

ESTIMATING AMMONIA EMISSIONS FROM ANTHROPOGENIC NONAGRICULTURAL SOURCES - DRAFT FINAL REPORT

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ACRONYMS AND ABBREVIATIONS

AAPFCO	American Association of Plant Food Control Officials
ABA	American Bakers Association
ADTP	air-dried ton of pulp
BACT	best available control technology
bbbl	barrel(s)
BLS	black liquor solids
°C	degree Celsius
CARB	California Air Resources Board
CEIDARS	CARB's Emission Inventory Data Acquisition and Retrieval System
CFC	chlorofluorocarbons
CH ₄	methane
CIWMB	California Integrated Waste Management Board
CO	carbon monoxide
CO ₂	carbon dioxide
CMU	Carnegie Mellon University
CO(NH ₂) ₂	urea
CWNS	Clean Water Needs Survey
EF	emission factor
EIIP	Emission Inventory Improvement Program
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPRI	Electric Power Research Institute
ESP	electrostatic precipitator
°F	degree Fahrenheit
FCC	fluid catalytic cracking
FIRE	Factors Information and REtrieval
ft ²	square feet
ft ³	cubic feet
FTP	Federal Test Procedure
H ₂ O	water
HCFC	hydrochlorofluorocarbons
kg	kilogram
LAER	lowest achievable emission rate
LandGEM	Landfill Gas Emissions Model
lb	pound(s)
LPG	liquefied petroleum gas
MACT	maximum achievable control technology
MANE-VU	Mid-Atlantic - Northeast Visibility Union
MCE	modified combustion efficiency
mg	milligram(s)
MGD	million gallons per day treated
mi	mile(s)

mpg	miles per gallon
mph	miles per hour
MSW	municipal solid waste
N	nitrogen
N ₂	molecular nitrogen
NAICS	North American Industrial Classification System
NAPAP	National Acid Precipitation Assessment Program
NCASI	National Council for Air and Stream Improvement
NEI	National Emission Inventory
NH ₃	ammonia
NH ₃ -N	ammonia-nitrogen
NH ₄ ⁺	ammonium ion
NH ₄ HCO ₃	ammonium bicarbonate
NO	nitric oxide
NO ₂	nitrogen dioxide
NO ₂ ⁻	nitrite
NO ₃ ⁻	nitrate
NO _x	oxides of nitrogen
NSSC	neutral sulfite semi-chemical pulping
NYMA	New York Metropolitan Area
OTAQ	Office of Transportation and Air Quality
OW	Office of Water
PM	particulate matter
POTWs	publicly-owned treatment works
ppmv	parts per million by volume
QA	quality assurance
RACT	reasonably available control technology
RBLC	RACT/BACT/LAER Clearinghouse
RMP	Risk Management Program
RPO	Regional Planning Organization
SCAQMD	South Coast Air Quality Management District
SCC	source classification code
SCR	selective catalytic reduction
SIC	Standard Industrial Classification
SNCR	selective noncatalytic reduction
TCC	Thermafor catalytic cracking
TNMHC	total nonmethane hydrocarbons
TRI	Toxics Release Inventory
U.S.	United States
VOC	volatile organic compound
WSPA	Western States Petroleum Association
yr	year

CHAPTER I. INTRODUCTION

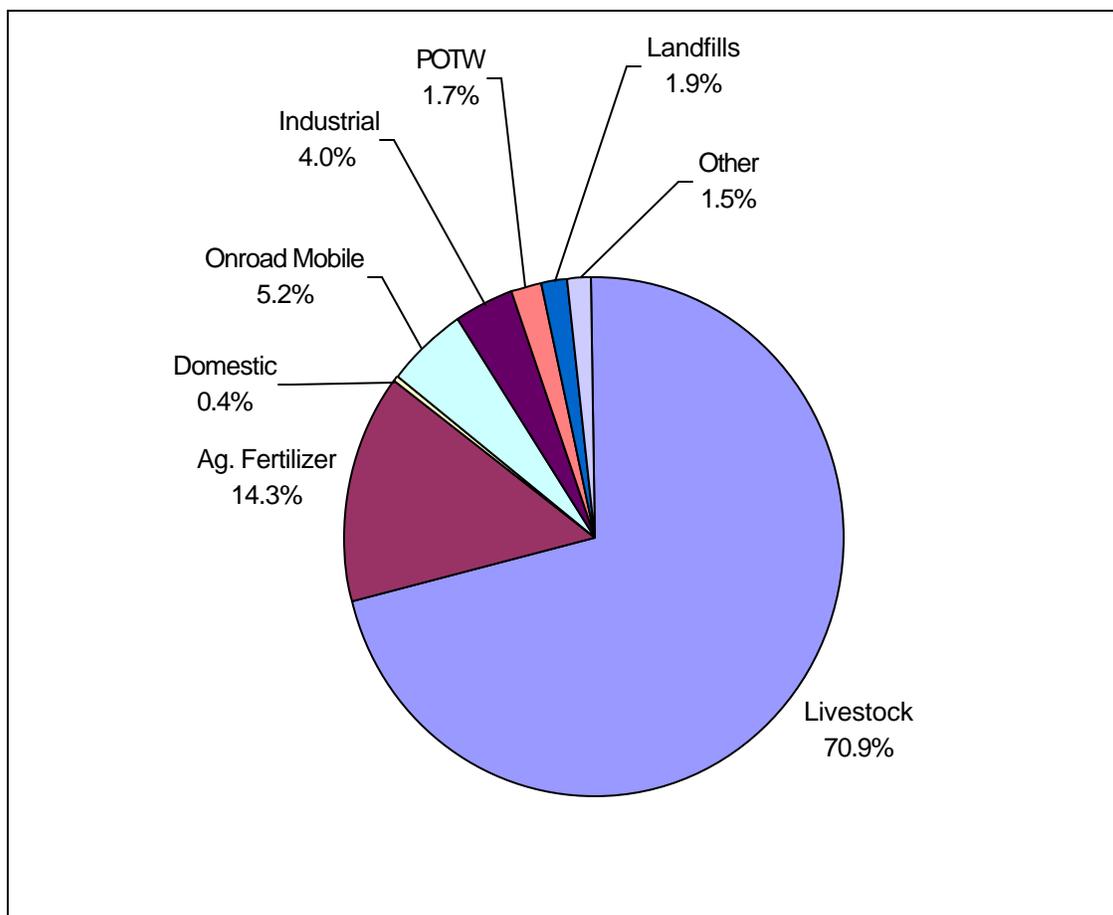
Ammonia (NH₃) emissions are an important contributor to fine particulate matter (PM) formation. Consequently, increased attention is being paid to accurate quantification and characterization of NH₃ emissions. A 1994 United States (U.S.) Environmental Protection Agency (EPA) report entitled *Development and Selection of Ammonia Emission Factors*,” hereafter referred to as the “1994 guidance,” contains the results of a literature review and compiled NH₃ emission factors (Battye et al., 1994). The purpose of this new emissions guidance for “anthropogenic sources” is to update the materials presented in Chapters 4 (Ammonia Emissions in Industry), 5 (Ammonia Emissions from Combustion), and portions of Chapter 6 (Miscellaneous Sources) of the 1994 guidance. For the purposes of this guidance, the term “anthropogenic sources,” excludes emissions from the agricultural sector (e.g., fertilizer application, livestock operations), as well as natural sources (e.g., soils, wild animal populations).

As compared to dominant NH₃ source sectors such as livestock operations, the anthropogenic sources covered in this guidance are estimated to contribute small amounts to national and regional annual inventories. On the other hand, as compared to natural sources and the agriculture sector, the categories covered here are often located in suburban and urban areas. Based on the current state of NH₃ emission inventories, emissions in urbanized areas are often under-represented. Figures I-1 through I-3 provide pie charts of ammonia source sector contributions to EPA’s National Emission Inventory (NEI), the Mid-Atlantic Northeast Visibility Union (MANE-VU) Regional Planning Organization (RPO), and the New York City Metropolitan Area (NYMA; six counties surrounding New York City, including northern New Jersey; Roe et al, 2004).

As shown in Figures I-1 through I-3, source contributions can vary substantially depending on the spatial scale involved as well as the general land use patterns in any given area. The NEI estimates in Figure I-1 were taken from the 2002 area source NEI estimates and the 1999 point, onroad, and nonroad estimates. These national estimates are dominated by the agricultural sector with about 85% contributed by livestock operations and agricultural fertilizer losses. Currently, the NEI does not include emission estimates for all categories included in this guidance, including composting and landfills (estimates were made for landfills and domestic sources for the purposes of constructing Figure I-1). In addition, the methods used by States to develop emission estimates for publicly-owned treatment works (POTWs) are probably different than the methods provided in this guidance. Given the uncertainty in natural soil emission estimates, these have been excluded from all three figures.

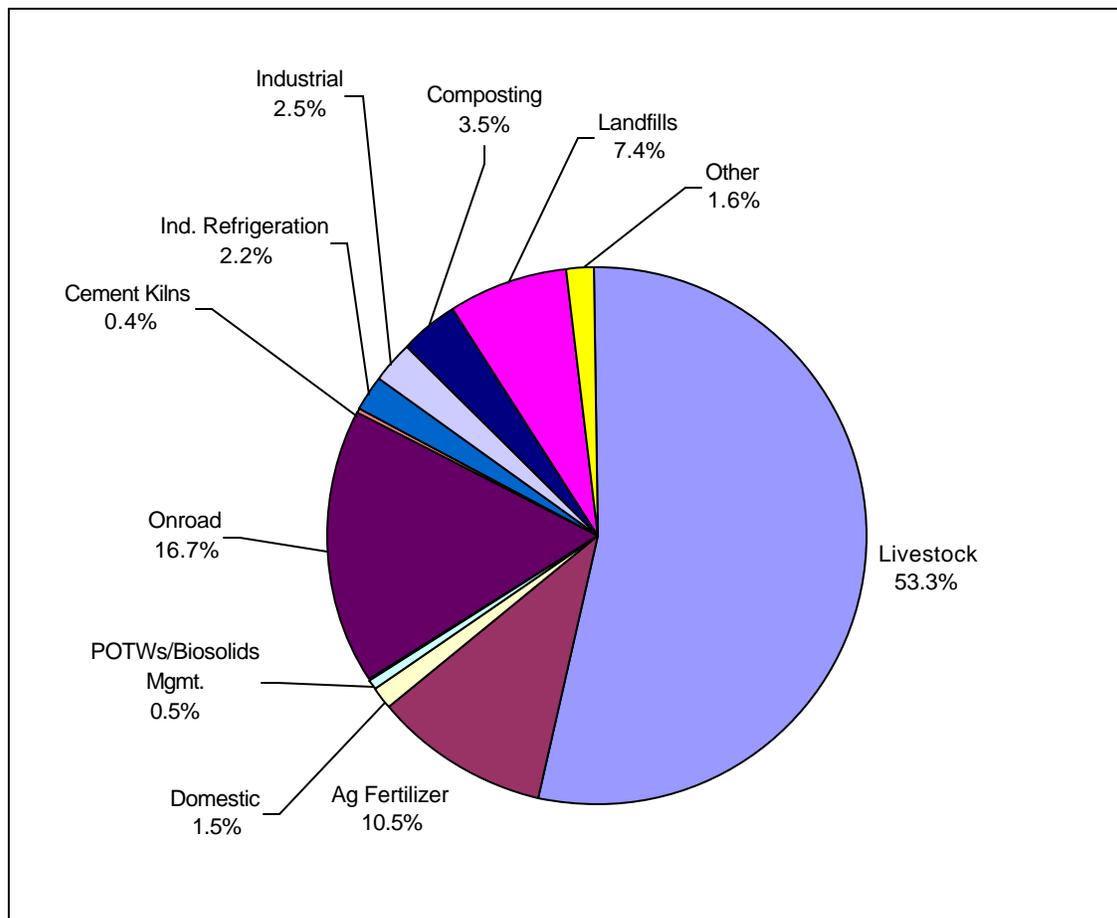
Compared to the national-scale estimates, the source sector contributions shown in Figure I-2 for the MANE-VU RPO are less dominated by the agricultural sector (about 64%). Notably, the onroad sector contributes nearly 17%. As one would expect in an urban domain, agricultural sector contributions are small. Figure I-3 for the NYMA shows these contributions to be less than 5%. In this example urban area, the onroad sector contributes nearly half of the inventory. Other source sectors that can take on significance in urban areas include composting, POTWs/biosolids management, industrial sources, and domestic sources. Therefore, emission estimation methods and data sources are needed to gain a better understanding of air pollutant formation in urban areas and a more comprehensive picture of all ammonia sources. The Emission Inventory Improvement Program (EIIP) has funded the development of this guidance with these needs in mind.

Figure I-1. Source Sector Ammonia Contributions to the NEI



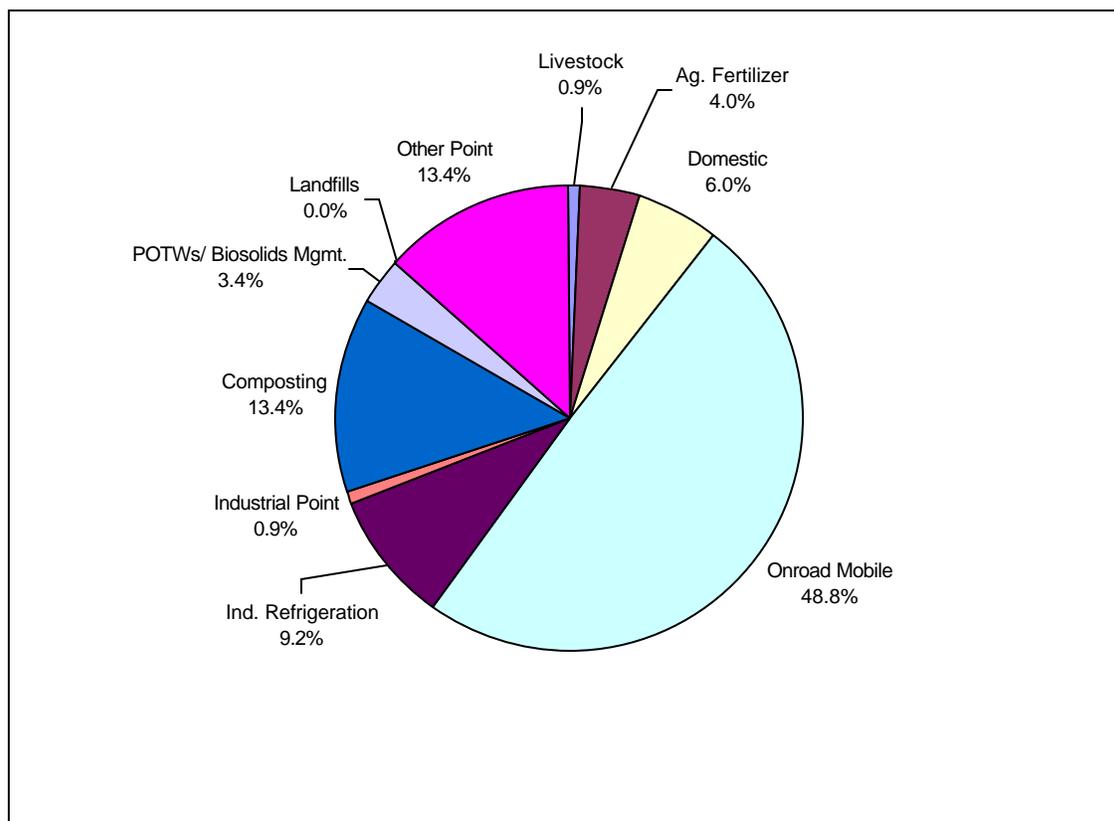
Note: NEI estimates were taken from the 2002 area source NEI and the 1999 point, onroad, and nonroad NEI. "Domestic" includes human perspiration/respiration, infant diapers, cigarette smoke, domestic fertilizer use, and household ammonia use (these estimates along with the landfill estimates are not currently in the NEI and were added to develop the figure). "Other Point" includes non-industrial point sources. "Other" includes: nonroad mobile, commercial and residential fuel combustion, forest fires and prescribed burning, storage and transport, incineration, and industrial waste water treatment. Note that most biomass combustion emission estimates (e.g., forest fires/prescribed burns) in the NEI probably do not include NH₃ estimates.

Figure I-2. Source Sector Ammonia Contributors in the MANE-VU RPO



Note: "Domestic" includes human perspiration/respiration, infant diapers, cigarette smoke, domestic fertilizer use, and household NH₃ use. "Domestic" includes human perspiration/respiration, infant diapers, cigarette smoke, domestic fertilizer use, and household ammonia use (these estimates along with the landfill estimates are not currently in the NEI and were added to develop the figure). "Other Point" includes non-industrial point sources. It is not clear the degree of overlap between the point source inventory and industrial refrigeration emission estimates. "Other" includes: nonroad mobile, commercial and residential fuel combustion, forest fires and prescribed burning, storage and transport, incineration, and industrial waste water treatment.

Figure I-3. Source Sector Ammonia Contributions in the New York Metropolitan Area



Note: "Domestic" includes human perspiration/respiration, infant diapers, cigarette smoke, domestic fertilizer use, and household ammonia use. "Domestic" includes human perspiration/respiration, infant diapers, cigarette smoke, domestic fertilizer use, and household ammonia use (these estimates along with the landfill estimates are not currently in the NEI and were added to develop the figure). "Other Point" includes non-industrial point sources. It is not clear the degree of overlap between the point source inventory and industrial refrigeration emission estimates. "Other" includes: nonroad mobile, commercial and residential fuel combustion, forest fires and prescribed burning, storage and transport, incineration, and industrial waste water treatment. Data were not available to estimate landfill emissions.

The scope of this project was limited to the identification and documentation of readily-available emissions data. A literature review was performed; however, no testing programs were conducted in support of this project. The objective of this guidance is to provide updated information to developers of regional NH_3 inventories. Hence, in some instances, other methods may be more appropriate for estimating emissions from individual facilities. Chapter II of this report provides guidance on estimating NH_3 emissions from industrial, commercial, and municipal sources. Chapter III contains guidance on estimating emissions from combustion sources. Recommendations for future work in estimating NH_3 emissions from anthropogenic sources are provided in Chapter IV.

Some useful information on NH_3 releases are reported through the Toxics Release Inventory (TRI). Under the Emergency Planning and Community Right-to-Know Act (EPCRA) Section 213, EPA and States are required to annually collect data on releases and transfers of certain toxic chemicals from

industries, including manufacturing, metal and coal mining, electric utilities, and commercial hazardous waste treatment facilities. The EPA makes this data available (via EPA's web site) to the public through the TRI, which contains information on releases of approximately 650 chemicals and chemical categories from various industries (<http://www.epa.gov/tri/>). Facilities that meet certain activity thresholds must annually report their releases of toxic chemicals to EPA and their State or tribal entity. Activity thresholds are specified amounts of a toxic chemical that a facility uses during a calendar year that trigger TRI reporting requirements. Note that these thresholds are different than the thresholds used in air quality programs (e.g., major source thresholds for criteria air pollutant releases).

A facility that manufactures or imports any of the TRI listed toxic chemicals will have a threshold quantity of 25,000 pounds (lbs) per toxic chemical or category during the calendar year. A facility that processes any of the TRI listed toxic chemicals will have a threshold quantity of 25,000 lbs per toxic chemical or category during the calendar year. Finally, a facility that uses any of the TRI listed toxic chemicals (without incorporating it into any product or producing it at the facility) will have a threshold quantity of 10,000 lbs per toxic chemical or category during the calendar year (EPA, 2000).

When a facility is determining threshold and releases of NH₃, anhydrous forms of NH₃ are 100 percent reportable while aqueous forms of NH₃ are limited to 10 percent of total aqueous NH₃. Evaporation of NH₃ from aqueous NH₃ solutions is considered anhydrous NH₃ and 100 percent of the evaporative losses must be counted towards the threshold and release determinations (EPA, 2003a).

As of the date of this report, the 2002 TRI data were not available. The annual emission estimates are provided as stack and fugitive releases. When the 2002 TRI data are release, these data may be useful as either a starting point in the development of State and regional point source inventories or in the quality assurance (QA) of existing point source inventories (e.g., identification of missing point sources).

Appendix A contains data on accidental releases of NH₃ during the 2002 calendar year as reported to the National Response Center (USCG, 2003). Under Section 302 of the Superfund Amendments and Reauthorization Act, all releases of NH₃ exceeding 100 lbs must be reported (<http://www.nrc.uscg.mil/foia.html>). The information in Appendix B can be used to identify large releases occurring on specific days within an area of interest. Depending on the method used to estimate emissions, it may be appropriate to subtract these reported accidental releases from emission estimates for certain source categories [e.g., NH₃ refrigeration, NH₃ injection for oxides of nitrogen (NO_x) control]. Additional information on accidental releases is provided in Section II.C.

Emission factors provided in this guidance are assigned a quality rating as is done for the emission factors presented in EPA's AP-42 document. In AP-42, emission factors are rated from A (highest quality) to E (lowest quality). These ratings are assigned during the development or revision of each AP-42 section. Among the criteria used in developing the ratings are the number of available tests, their representativeness of the source category, and the variability of the emissions data. Additional details on the methods used to develop emission factors and their quality ratings is provided by EPA (1997a). Details on how these ratings are assigned can be found in the AP-42 procedures document located at <http://www.epa.gov/ttn/chief/efdocs/procedur.pdf>.

CHAPTER II. INDUSTRIAL, COMMERCIAL, AND MUNICIPAL SOURCES

Table II-1 provides a summary of emission factors available through EPA's AP-42 document and the Factors Information and REtrieval (FIRE) data system. Also provided is a national annual emissions estimate for each source category from EPA's 1999 NEI Version 2. The NEI estimate provides a sense of the importance of each source category at a national scale. Some source categories may be more important in certain regions than indicated by their annual emissions in Table II-1 (see Chapter I). Table II-1 also provides the AP-42 emission factor rating.

A review of the available emissions information in AP-42/FIRE, the NEI, the TRI database, the California Air Resources Board's (CARB's) Emission Inventory Data Acquisition and Retrieval System (CEIDARS), and other recent NH₃ inventories (e.g., Corsi et al., 2000; Chitjian et al., 2000; Environ and Pechan, 2002) showed that there were many other important anthropogenic sources that were not covered in AP-42 or other available emissions guidance. A model was developed by Carnegie Mellon University (CMU) to develop regional and national NH₃ inventories; however, the model is primarily based on the methods used to construct the NEI (Strader et al., 2001). Available information gathered during a review of the available literature and the projects mentioned above is summarized by source category in the following sections.

Table II-2 provides additional emission factors extracted from the CEIDARS database. The reader is cautioned in the use of these emission factors since each is based on a single record from the CEIDARS database. Hence, the representativeness of these emission factors to other sources within the same source category is highly uncertain. Each emission factor is given an E rating. The CEIDARS data received from CARB originally contained a set of emission factors for petroleum refinery operations including wastewater treatment, valves, pumps, flanges, and process drains. As these emission factors seemed suspect, Pechan contacted the Western States Petroleum Association (WSPA) and requested a review of these data. WSPA reviewed and revised the list of emission factors. Many of the emission factors were removed (mainly those associated with fugitive VOC losses) and several were added (Buchan, 2003). These factors have been included in Table II-2. Quality ratings for these factors have also been given an E since the underlying source test data were not available for review.

Two emission factors for grain storage and handling were removed from the CEIDARS emission factors since these appeared to be unreasonably high (196 and 391 lb/ton of grain processed). Based on recent studies of composting operations (see Section IIB2), it seems plausible that ammonia emissions could occur from these processes. However, the magnitude of the CEIDARS emission factors seemed suspect.

Table II-1. Summary of AP-42 NH₃ Emission Factors

Source Category	Source Classification Code (SCC)	Emission Factor ^a (lb/unit)	Emission Factor Units	Emission Factor Rating	1999 NEI Emissions (tons/year)
Ammonium Nitrate Manufacture					
Neutralizer ^b	30102704	0.86 - 36.0	ton produced	A	6,921
High-density	30102711	0.86 - 36.0	ton produced	A	7,020
Low-density	30102721	0.86 - 36.0	ton produced	A	5,761
Evaporation/concentration					
High-density	30102717	0.54 - 33.4	ton produced	A	118
Low-density	30102727	0.54 - 33.4	ton produced	A	2
Solids Formation Operations					
High density prill towers	30102712	57.2	ton produced	A	10,419
Low density prill towers	30102722	0.26	ton produced	A	90
Rotary drum granulators	30102707	59.4	ton produced	A	n/a
Pan granulators	30102708	0.14	ton produced	A	n/a
Coolers and Dryers ^c					
High density prill coolers	30102714	0.04	ton produced	A	1
Low density prill coolers	30102724	0.30	ton produced	A	22
Low density prill dryers	30102725	0 - 3.18	ton produced	A	122
Petroleum Refineries					
Fluid catalytic cracking (FCC) units	30600201	54	10 ³ barrel (bbl) fresh feed	B	4,739
Moving bed Thermafor catalytic cracking (TCC) units	30600301	6	10 ³ bbl fresh feed	B	5
Reciprocating engine compressors	30602501	0.2	10 ft ³ gas burned	B	n/a
NH₃ Synthesis					
Carbon dioxide regeneration	30100308	2.0	ton produced	E	223
Condensate steam stripping	30100309	2.2	ton produced	E	1,790
Urea Manufacture					
Solution formation/concentration	30104002	18.46 ^d	ton produced	A	16
Solids formation					
Nonfluidized bed prilling					
Agricultural grade	30104008	0.87	ton produced	A	n/a
Fluidized bed prilling ^e					
Agricultural grade	30104010	2.91	ton produced	A	n/a
Feed grade	30104011	4.14	ton produced	A	n/a
Drum granulation	30104004	2.15 ^f	ton produced	A	53
Rotary drum cooler	30104012	0.051	ton produced	A	n/a
Coke Manufacture					
Wet coal oven charging (larry car)	30300302	0.02	ton coal charged	D	399
Oven door leaks	30300308	0.06	ton coal charged	D	13
Oven pushing	30300303	0.10	ton coal charged	D	66
Ammonium Phosphate Manufacture					
Ammonium Phosphate Manufacture (total plant)	30103000	0.14	ton produced	E	985

Source Category	Source Classification Code (SCC)	Emission Factor ^a (lb/unit)	Emission Factor Units	Emission Factor Rating	1999 NEI Emissions (tons/year)
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n/a = not available

^a Some emission factors provided as a range because of variation in data and plant operations.

^b Based on 95 percent recovery in a granulator recycle scrubber.

^c Factor for coolers represent combined pre-cooler and cooler emissions, and factors for dryers represent combined pre-dryer and dryer emissions.

^d The EPA test data indicated a range of 8.02 to 28.90 lb/ton [4.01 to 14.45 kilogram/milligram (kg/mg)].

^e Feed grade factors were determined at an ambient temperature of 29 degrees Celsius (°C) [85 degrees Fahrenheit (°F)] and agricultural grad factors at an ambient temperature of 27°C (80°F).

^f The EPA test data indicated a range of 1.90 to 2.45 lb/ton (0.955 to 1.20 kg/mg).

Table II-2. NH₃ Emission Factors from CEIDARS

Source Category	SCC	Emission Factor ^a (lb/unit)	Emission Factor Units
Adipic Acid Manufacturing: Refining	30100105	8.88E-08	ton product
Nitric Acid Manufacturing: Nitric Acid Concentration	30101303	8.36	ton product
Paint Manufacturing: Mixing/Blending Tanks	30101401	6.40E-03	ton product
Phosphoric Acid: Thermal Process	30101799	62.4	ton product
Plastics Production: Polyether Resins	30101872	1.20	ton product
Plastics Production: Synthetic Organic Fiber; Fiber Extrusion	30102423	41.3	ton product
Plastics Production: Synthetic Organic Fiber; Wash/Dry/Finish	30102424	0.43	ton product
Agricultural Chemicals: Normal Superphosphate; Ammonia Granulator	30102823	1.10E-03	ton product
Agricultural Chemicals: Ammonium Sulfate; Fluid Bed Dryer	30113005	0.137	ton product
Food/Agriculture: Vegetable Oil Processing; Oil Refining	30201913	1.65	ton oil produced
Mining Operations: Metal Ore Mining; Gold Mining; General Processes	30301301	0.347	ton ore
Primary Metals: Steel Foundry; Furnace Fugitives	30400745	310	ton processed
Secondary Metals: Heat Treating; Furnace; General	30402201	0.20	ton processed
Mineral Products: Fiberglass; Wool-Type Fiber; Forming - Rotary Spun	30501204	0.98	ton processed
Mineral Products: Fiberglass; Wool-Type Fiber; Curing - Rotary Spun	30501205	1.70	ton processed
Mineral Products: Fiberglass; Not Classified; Other	30501299	0.158	ton processed
Mineral Products: Glass Mfg.; Flat Glass; Melting Furnace	30501403	0.661	ton glass produced
Mineral Products: Gypsum Mfg.; Gypsum Ore; Storage Bins	30501509	6.0	ton crude gypsum processed
Petroleum Industry; Wastewater Treatment; Sour Water Treating - Valves ^b	30600523	1	valve in operation (annually)
Petroleum Industry; Wastewater Treatment; Sour Water Treating - Pumps ^b	30600524	35	pump in operation (annually)
Petroleum Industry; Wastewater Treatment; Sour Water Treating - Flanges ^b	30600525	1.16	flange in operation (annually)
Wood Products: Pressure Treating; Other Not Classified	30700598	5.40	10 ³ board feet
Fabricated Metals: Conversion Coating; Alkaline Cleaning Bath	30901101	22.8	ton processed
Printing/Publishing: General; Printing - Letter Press	40500212	0.056	gallon ink
Printing/Publishing: General; Printing - Flexographic Water-Based Ink	40500318	3.84	ton solvent in ink
Printing/Publishing: General; Lithographic	40500412	0.056	gallon ink
Printing/Publishing: General; Offset Lithography; Heatset Ink Mixing	40500421	25.0	ton solvent in ink
Printing/Publishing: General; Gravure	40500511	95.7	ton solvent in ink
Printing/Publishing: General; Screen Printing	40500811	3.78	ton solvent in ink

^a All emission factors are rated E.

^b Supplied by the WSPA (Buchan, 2003).

In developing regional emission inventories for certain source categories, a good start would be to identify and contact NH₃ suppliers in the region. Data on sales of NH₃ to specific end-users have been used to provide a good estimate of NH₃ releases within certain regions (Chitjian et al., 2000). For example, sales data broken out for the following end-users could be sought: industrial refrigeration; utilities (for NO_x control); fertilizer and chemical producers; publicly-owned treatment works (POTWs—for pH control); metal heat treating; and blueprinting. The NH₃ air releases reported into the TRI and accidental releases reported to the National Response Center (see Appendix A) should be reviewed and taken into consideration. With the exception of bakeries, TRI-reported releases from facilities in the food and beverage industry can be assumed to be associated with industrial refrigeration (see Section II.A below). TRI-reported releases from utilities can be assumed to be associated with NO_x control systems.

The NH₃ emissions for refrigeration and blueprinting should be assumed to equal 100 percent of NH₃ sales to these end-users. Emissions from POTWs are described in Section II.B. For fertilizer and chemical producers, most of the NH₃ becomes part of the product. Available emission factors for losses during the manufacturing processes are provided in Tables II-1 and II-2. Losses during the use of chemicals and fertilizers also occur. The NH₃ emissions from surface coatings are described in Section II.B. The reader should refer to the 1994 guidance (Battye et al., 1994), as well as new information being incorporated into the CMU model, to estimate fertilizer application losses (Strader et al., 2001). As of this writing, EPA is also conducting research to refine fertilizer application losses. Results of that effort should be available by early 2004.

A. INDUSTRIAL REFRIGERATION LOSSES

Ammonia is a widely used refrigerant in industrial refrigeration systems because it can be liquefied easily by compression or cooling and, when returned to its gaseous state, it absorbs large amounts of heat from its surroundings (RM Tech, 2003). Ammonia refrigeration systems are found in food, beverage, petrochemical, and cold storage industries. For example, the food processing industry operates with NH₃ as the refrigerant because it provides cooling efficiencies that are approximately four times greater than chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants (Hudson Tech, 2002).

When NH₃ gas (anhydrous NH₃) is dissolved in water, the resulting solution is called ammonium hydroxide or aqua NH₃. Aqua NH₃ is used in most applications instead of anhydrous NH₃ since it is much less hazardous (RM Tech, 2003). There are two types of refrigeration systems: vapor compression and absorption. Vapor compression systems use compressors to compress the NH₃ vapor, while absorption systems use a generator. Aqua NH₃ is used in conjunction with absorption-type refrigeration systems.

Refrigerant emissions to the atmosphere are referred to as “losses.” Losses are expressed as a fraction of the operating refrigerant quantity, or “charge.” There are four types of refrigerant losses:

- Initial;
- Operating;

- Intermittent; and
- Disposal.

Initial losses are associated with the manufacturing, performance and leak testing, transportation, installation, initial charging, and initial start up of refrigeration equipment. These losses are usually very small and occur once in the life the equipment. Operating losses are recurring and are associated with leakage and purge releases of the refrigerant. Intermittent losses from maintenance, accidents, failures, technician errors, and unintentional venting are also recurring. Disposal losses account for the refrigerant lost when the piece of equipment is retired (Calm, 2002).

To develop an emission factor for refrigeration losses, both bottom-up and top-down inventory methods were used. First, data underlying the South Coast Air Quality Management District's (SCAQMD) estimates were reviewed to develop a bottom-up estimate of emissions. These estimates were based on 1997 sales data from NH₃ suppliers (Chitjian et al., 2000). The amount of NH₃ supplied for several end-uses was included in these sales data (refrigeration, pH control, blue printing, metal heat treating, and NO_x control). The set of Standard Industrial Classification (SIC) codes that are believed to be most closely associated with facilities reporting refrigeration losses are shown in Table II-3. SIC codes have recently been replaced by North American Industrial Classification System (NAICS) codes. Information on NAICS codes and a crosswalk between the NAICS and SIC systems can be found at <http://www.census.gov/epcd/www/naics.html>.

Table II-3. SIC Codes Associated with Industrial Refrigeration Losses

SIC Code	Description	NAICS Code
2011	Meat Packing Plants	311611
2013	Sausages/Other Prepared Meats	311612, 311613
2015	Poultry Slaughtering/Processing ^a	311615
2021-2026	Dairy Products	311512-311514, 31152
2032-2038	Dried, Canned, Frozen Fruits/Vegetables	311411, 311412, 311421-311423
2051-2053	Bread and Bakery Product Mfg.	31181
2064, 2066	Chocolate and Confectionery Mfg.	31132, 31133
2082-2086	Malt Beverages, Wines, Liquors, Soft Drinks	31211-31213
2091-2092	Canned, Fresh or Frozen Seafood	31171
2097	Ice Manufacturing	312113
2099	Food Preparations, not elsewhere classified	311991, 311999
2821	Plastics Material and Resin Mfg.	325211
4222, 4226	Refrigerated Warehousing & Storage	49312
514x	Various Food Wholesalers	4224, 311612
518x	Various Beverage Wholesalers	42281,42282

^a Sometimes listed under 1123xx "Poultry & Egg Production."

Emission factors were developed for NH₃ refrigeration based on the 1997 Bureau of Census estimates of the number of facilities and number of employees in the five southern California counties assessed by Chitjian et al. (2000). National estimates were derived using similar 1997 statistics for the entire United States. These national estimates were compared to 1997 NH₃ sales data reported by the Bureau of Census and additional information from the Chemical Market Reporter (BOC, 1997, 1998; CMR, 2002). The Chemical Market Reporter provided an estimate that 6 percent of national consumption is associated with miscellaneous uses, including refrigeration (the bulk of NH₃ consumption is for fertilizer and chemical intermediate manufacturing). Unfortunately, there were no additional data found to further resolve the remaining miscellaneous uses.

Based on an extrapolation of the SCAQMD data to the national level, industrial refrigeration appears to consume about 1-2 percent of the miscellaneous use noted above (range is estimated to be 0.5 to 5 percent). Note that some of this usage is associated with the initial charging of new systems. No data were found to estimate this fraction. The employee-based emission factor derived from the SCAQMD data (30 lb/employee-year) is recommended (SIC codes to develop employment statistics are shown in Table II-3). The recommended SCC and description are provided in Table II-4.

Table II-4. Recommended NH₃ Emission Factor for Industrial Refrigeration Losses

SCC	Description	EF (lb/SCC unit)	SCC Unit	EF Rating; Notes
2399010000	Industrial Processes; Industrial Refrigeration; Refrigerant Losses; All Processes	30	employee-yr	D; use local survey data on NH ₃ charging and/or system capacity to improve estimates.

Analysts should consider subtracting certain accidental releases from the estimates derived from either surveys or the default emission factor in Table II-4 (see Appendix A). Review of the primary SIC and company name reported with the accidental release data and comparison with the SIC codes in Table II-3 should help to identify these releases.

Local surveys of facilities within the industry groups identified in Table II-3 can improve upon the emission estimates developed with the employment-based emission factor. Roe et al (2004) found that surveying ammonia suppliers to develop a regional inventory for the mid-Atlantic and northeast U.S. was not a viable option, as it was for the SCAQMD. Many more ammonia suppliers were involved, and few were willing to supply sales data. Instead, a facility database of operations likely to employ ammonia refrigeration was constructed from two sources. The first source was a database of facilities that reported ammonia storage obtained from EPA's Risk Management Program (RMP) office (EPA, 2003b). These RMP data did not contain data from the offsite consequence analysis sections of the RMP, which could have provided valuable information on system capacity. Surveys were conducted of a subset of the RMP facilities to gather capacity data and annual system charges.

From the RMP facility survey and additional data submitted by the State of Delaware, Pechan calculated a mean system capacity of 32,000 lb and an annual loss rate of 8% (Roe et al, 2004). Note that the RMP data only correspond to facilities that exceed the storage threshold of 10,000 lb of NH₃.

For facilities that have smaller refrigeration systems, another source of information comes from the Superfund Amendments and Reauthorization Act of 1986 (SARA) Tier II reporting requirements. Under these requirements, facilities subject to Section 311 of SARA must supply information on the type and amount of hazardous substances at their facilities each year. For NH_3 , the threshold quantity is 500 lb. Facilities reporting under this program within the SIC/NAICS codes listed in Table II-3 above, can be assumed to have ammonia refrigeration systems. As with the RMP data, the Tier II data are currently considered sensitive, so there can be difficulty obtaining these data. If the data from Tier II facilities can not be obtained, an area source estimate can be developed using the emission factor provided in Table II-4 from which the "point" source estimates (e.g. from the RMP database or other sources) can be subtracted.

B. EMISSIONS FOR SPECIFIC INDUSTRIAL, COMMERCIAL, AND MUNICIPAL PROCESSES

1. Sewage Treatment

The EPA's WATER9 program can be used to develop facility-level emission estimates for POTWs (EPA, 2001). Use of the WATER9 program requires process-level details for each facility, as well as information on influent chemistry. However, since most analysts are interested in developing regional emission estimates, other estimation methods are needed and are described below.

The 1994 guidance provided NH_3 emission factors based on a mass balance approach [i.e., from the 1985 National Acid Precipitation Assessment Program (NAPAP) inventory] or data reported into California's emission inventory system. Since the 1994 guidance was published, some work has been performed to better characterize NH_3 emissions from POTWs. Most of this work has been conducted in southern California by the Los Angeles and Orange County Sanitation Districts.

Use of a mass balance approach in the estimation of NH_3 emissions from wastewater treatment processes does not provide reliable estimates for the following reasons (Kogan and Torres, 1997):

- *Ammonia emissions are limited by the amount of free aqueous NH_3 available for volatilization:* in water treatment processes, nitrogen (N) will take a variety of forms. These include organic nitrogen, NH_3 , ammonium (NH_4^+), nitrite (NO_2^-) and nitrate (NO_3^-). Most of the nitrogen entering the POTW is in the form of organic nitrogen and NH_3 -nitrogen ($\text{NH}_3\text{-N}$). However, during the treatment process, organic nitrogen is converted to $\text{NH}_3\text{-N}$ and some of $\text{NH}_3\text{-N}$ is oxidized to NO_2^- and NO_3^- during the aeration process. The amount of nitrogen emitted in the gaseous form varies substantially depending upon numerous biological, chemical, technological, and meteorological factors.

Ammonia emissions occur through the stripping of free aqueous (unionized) NH_3 from the wastewater. The amount of NH_3 in this form is dependent on pH and temperature. For example, there is a factor of 10 increase in the concentration of aqueous NH_3 for each increasing value on the pH scale. At typical pH values of wastewater treatment processes

(6.5-8), over 90 percent of the $\text{NH}_3\text{-N}$ will be in the ammonium (ionized) form (NH_4^+) and will not be available for stripping; and

- *Some of the $\text{NH}_3\text{-N}$ in the wastewater influent is consumed in biological processes: $\text{NH}_3\text{-N}$ is assimilated by bacteria and accumulated in digested and raw sludge through adsorption to solids.*

Information submitted to SCAQMD by the County Sanitation Districts of Orange County, California (the Districts) indicate that NH_3 emissions from the wastewater treatment processes at southern California POTWs are on the order of 10 lbs/year/million gallons per day treated (lb/yr/MGD; Torres, 1995). Based on the information from Torres (1995), the range of emissions from wastewater treatment processes is estimated at 1.53 - 18.5 lb/yr/MGD. Another estimate reported by the Districts was from a POTW in Buffalo, New York at 15.2 lbs/year/MGD. These estimates are much lower than the values contained in the 1994 guidance and CEIDARS database, which range from about 2,920 to 43,800 lbs/yr/MGD. Additional information reported by Knapp et al. (1999) on emissions from secondary aeration processes, indicated that previous SCAQMD estimates were overestimated by 2.5 - 4 orders of magnitude. Given the review of the Districts' estimates by SCAQMD and the supporting test programs, recommended emission factors consistent with these newer data for wastewater treatment are provided in Table II-5.

Table II-5. Recommended NH_3 Emission Factors for POTWs

SCC	Description	EF (lb/SCC unit)	SCC Units	EF Rating; Notes
2630020000	Waste Disposal, Treatment and Recovery; Wastewater Treatment; Public Owned; Total	0.169	10 ⁶ gallons	D; range is 0.104 to 0.621; source is Torres (1995).
2630020010	Waste Disposal, Treatment and Recovery; Wastewater Treatment; Public Owned; Wastewater Treatment Processes Total	0.027 ¹	10 ⁶ gallons	D; range is 0.004 to 0.051; source is Torres (1995).
2630020020	Waste Disposal, Treatment and Recovery; Wastewater Treatment; Public Owned; Biosolids Processes Total	0.142 ²	10 ⁶ gallons	D; estimated range is 0.10 to 0.57; source Torres (1995).
2630040000	Waste Disposal, Treatment and Recovery; Wastewater Treatment; Public Owned; Ammonia pH Control	0.15	lb NH_3 added	E; source Chitjian et al. (2000).
2630050000	Waste Disposal, Treatment and Recovery; Wastewater Treatment; Public Owned; Land Application - Digested Sludge	0.109	ton wet digested sludge	E; derived from information provided by Torres (1995) and Sutton et al. (2000).

¹ Emission Factor derived from the mid-point of the range provided by Torres (1995) and divided by 365 days/year.

² Based on data provided by Torres (1995).

Note that the recommended emission factor above does not cover emissions that can occur at other points in the sewage system, such as pump stations. As mentioned in Chapter IV, no information was found to estimate emissions for these possible emission points, which require further study. Further, Corsi et al. (2000) used theoretical methods to conclude that emissions from residential septic systems were negligible (e.g., 185 lbs for Texas in 1996).

The best sources of local activity data are regional wastewater treatment agencies (e.g. sanitation districts). These sources will be able to provide the best details on wastewater and biosolids treatment processes, as well as biosolids management practices (biosolids management refers to the final disposition of biosolids from a POTW, such as land application, landfilling, and composting). Sources of data for regional to national level inventories include EPA's Clean Water Needs Survey (EPA, 2003c). This database includes facility-level information on flow rate, facility location, and water and biosolids treatment processes.

Publicly-owned treatment works NH_3 emissions are more important during sludge (biosolids) processing operations. Sonoma Technology, Inc. (STI, 1998) noted that the highest concentrations of NH_3 measured at a POTW were around some sludge drying beds. Kogan and Torres (1997) estimated the highest POTW emission rates at sludge dewatering processes. Biosolids processing can include various sludge dewatering processes (e.g., sludge presses, drying beds, and composting operations). Composting operations are covered in the next section of this report.

Table II-5 provides a recommended emission factor for biosolids processes at POTWs based on information provided by Torres (1995; 0.142 lbs/10⁶ gallon). Torres (1995) provided information to calculate an upper limit estimate of NH_3 emissions of 0.571 lbs/10⁶ gallon based on a nitrogen mass balance at one plant. Further, data from Kogan and Torres (1997) on two southern California plants yield an average emission rate for sludge dewatering processes of 0.088 lb/10⁶ gallon, suggesting that most of the emissions for biosolids processes came from dewatering. Until better information is available on NH_3 emissions from biosolids processes, composting emissions should be added to the emission estimates for biosolids processes, where composting is conducted (see Section B.2; Table II-7 emission factor for biosolids composting processes). The total NH_3 emission factor of 0.169 lbs/10⁶ (both wastewater and biosolids processing) is about 2 orders of magnitude lower than the recommended emission factor in the 1994 guidance.

Since sludge drying beds were not used at the southern California plants mentioned above, inventory preparers may want to consider using the biosolids composting emission factor provided in the next section for these operations, until better information are available.

As previously noted, NH_3 is also added during some wastewater treatment processes to control (raise) pH. Previous researchers have assumed 15 percent loss of the added NH_3 due to leaks, transfer losses, and process upsets (Chitjian et al., 2000). Therefore, in situations where NH_3 is added for pH control, researchers should consider adding these losses to the NH_3 emission estimates.

It should also be noted that NH_3 emissions occur at municipal solid waste (MSW) landfills when biosolids are disposed at these sites. Emissions from MSW landfills are described in Section B.6

below. Another disposal option for biosolids is land application. Little information has been published on NH_3 emissions from land application of POTW sludges. Sutton et al. (2000) used an estimate of 27 percent loss of applied nitrogen to estimate emissions in the United Kingdom. No other supporting data were provided as to the $\text{NH}_3\text{-N}$ content of the biosolids applied. Therefore, information supplied by Torres (1995) on the total nitrogen content, an assumed $\text{NH}_3\text{-N}$ content (2.25 percent of total nitrogen), and the 27 percent loss from Sutton et al. (2000) were used to derive an emission factor of 0.109 lbs/ton of digested sludge (wet basis).

CEIDARS contained three records relative to POTW emissions. One was for an entire plant (8.01 lbs/ 10^6 gallon); the second corresponded to the secondary settling process (0.085 lbs/ 10^6 gallon); and the third was for an aeration tank (13.0 lbs/ 10^6 gallon). Based on the above information, these emission factors appear to be based on older information when NH_3 emissions were thought to be much higher from wastewater treatment processes.

2. Composting

Composting refers to the use of both aerobic and anaerobic microbial processes to degrade waste materials for beneficial reuse. Compostable wastes include biosolids (sewage sludge), manure, green waste (e.g., landscape trimmings, grass clippings), and other biodegradable materials (e.g., food waste). The need to reduce the amount of waste placed into MSW landfills increased the number of composting operations during the 1990s. In California, for example, local jurisdictions were required to reduce the amount of landfilled waste by 50 percent from 1990 levels by the year 2000. According to the California Integrated Waste Management Board (CIWMB), approximately 40 percent of the waste stream in California is compostable material (CIWMB, 2002a). In a recent NH_3 inventory for the San Joaquin Valley of California (an agriculturally-intensive area), composting was estimated to contribute over 4 percent of the annual emissions (comparable to fertilizer application losses in this inventory; Environ and Pechan, 2002).

Compostable wastes with a high nitrogen content (e.g., biosolids, manure) are often mixed with green waste, wood waste, or other materials in order to achieve an optimum carbon to nitrogen ratio, porosity, and moisture content for the composting process. Green waste may be composted alone or in combination with higher nitrogen content wastes. Composting should be thought of as a combination of aerobic and anaerobic biological processes. The predominant product of aerobic decomposition is carbon dioxide. Anaerobic decomposition produces reduced compounds including methane (CH_4), NH_3 , reduced sulfur compounds, and volatile organic compounds (VOC). In order to minimize the amount of reduced compounds produced, composting operators try to minimize the anaerobic activity by turning the compost piles and/or forcing air through the piles. During the composting process, the internal temperature of an active compost pile typically reaches 120 - 150 degrees Fahrenheit ($^{\circ}\text{F}$). The high temperatures help to reduce pathogenic activity. Composting facilities must meet Federal pathogen reduction requirements and, in some cases, State reduction requirements (e.g., see California's requirements on the internet at <http://www.ciwmb.ca.gov/Regulations/Title14/ch31a5.htm#article6>).

Recent testing of several composting processes has been performed in southern California by SCAQMD and CIWMB. In most cases, testing was performed using EPA's surface emission isolation flux chamber method. Test results from four SCAQMD test programs are provided in Table II-6 (SCAQMD, 1996a-c, 2001a-b). EPA determined that this test method often produces a low bias on the order of 20 percent (SCAQMD, 1996c). Test results are provided in terms of mass of pollutant per mass of compost mix (prior to composting) and mass of pollutant per hour per 1,000 square feet (ft²) of compost pile area.

The SCAQMD (1996a) noted that temperature did not seem to have an impact on emission rates, however, moisture content did. The authors hypothesized that at higher moisture contents (e.g., >30 percent by weight), pore spaces became clogged and higher NH₃ emitting anaerobic processes began. The estimated emission rates may be biased low due to the potential low bias of flux chamber measurements, as well as potential NH₃ emissions occurring beyond the 50-day period encompassed by the test program (although typically most emissions occur within the first 3 weeks of a composting process). In the average emission rates shown in Table II-6, SCAQMD often attempted to account for higher emissions that occur during and immediately after pile turning.

The SCAQMD (1996c) performed testing at an enclosed composting operation that was vented to a biofilter. Both flux chamber sampling and sampling at the biofilter inlet were conducted. Due to facility constraints, only one of 12 compost rows could be sampled with the flux chamber compared to the entire building exhaust for the biofilter inlet. Table II-6 provides results for the biofilter inlet. Results for the flux chamber were only one-third to one-half that measured at the biofilter inlet. The most important reason for this is that only one of the 12 compost rows could be sampled. The results from this facility should be thought of as a best case (i.e., best management practices) for composting operations since the facility is outfitted with automatic forced-air aeration and low initial moisture content. Emission rates for NH₃ were only about 25 percent of the rates observed for other biosolids composting processes. Controlled emissions at the outlet of the biofilter were not measured.

The SCAQMD (2001a) also noted a low bias for both the NH₃ and VOC emission tests. The low bias is due to the known low bias of flux chamber sampling, as well as the inability to include likely emission spikes that occur during compost aeration activities (e.g., pile turning).

The CIWMB conducted source tests at two green waste composting facilities and one chipping and shredding facility (CIWMB, 2002a). Results of these tests are summarized in Table II-6. A chipping and shredding facility receives green waste and processes it for subsequent composting or other uses at another facility. After processing, the green waste is immediately shipped out for subsequent use (e.g., within a day). CIWMB found very low emission levels of NH₃ at the green waste chipping and shredding facility, even on piles of processed material that were allowed to decompose for up to 5 days. Out of 12 measurements, only 2 showed detectable levels of NH₃ (on day 3 following processing). However, during the testing program, high winds were present, which could have suppressed anaerobic activity and subsequent NH₃ formation (CIWMB, 2002a).

The emission rates for the CIWMB data shown in Table II-6 were developed as averages across all processes (e.g., raw green waste, day 3 pile, day 5 pile, etc.). Unlike the SCAQMD test data, the

CIWMB reports did not provide estimates of the area of each type of pile at each facility (or weight of material) so that the data could be weighted accordingly. Hence, the CIWMB and SCAQMD data are not directly comparable.

Table II-6. Source Test Data for Composting Operations

Material	NH ₃ Emissions		CH ₄ Emissions		VOC		Source/Notes
	lb/ton ^a	lb/hr-10 ³ ft ²	lb/ton	lb/hr-10 ³ ft ²	lb/ton	lb/hr-10 ³ ft ²	
20% Digested Biosolids: 80% Manure	3.28	0.175	2.23	0.119	1.70 ^b	0.090 ^b	SCAQMD, 1996a
50% Dewatered Biosolids: 50% Green Waste	2.81	0.107	33.5	1.23	3.12 ^b	0.110 ^b	SCAQMD, 1996b ^c
50% Dewatered Biosolids: 50% wood waste/rice hulls	0.70	0.036	0.50	0.025	0.76 ^b	0.038 ^b	SCAQMD, 1996c ^d
100% Green Waste	1.32	0.066	0.83	0.041	5.05 ^e	0.252 ^e	SCAQMD, 2001a.
Entire Facility	0.32	0.022	0.91	0.052	2.47	0.17	Represents summer conditions.
Tipping Pile		0.018		0.20		0.28	SCAQMD, 2001b.
Static Pile		0.048		0.048		0.21	Results by pile type.
Windrow		0.004		0.005		0.079	Winter cond.
100% Green Waste	n/a		n/a		n/a		CIWMB, 2002a. ^g Van Norman site. A chipping/grinding facility. Results by pile type.
Raw Green Pile		nd		0.0022		0.031 ^f	
Coarse Pile		0.00014		0.00083		0.48	
Fine Pile		nd		0.00043		0.27	
Super Fine Pile		0.00012		0.00043		0.43	
100% Green Waste	n/a	0.0017	n/a	n/a	n/a	3.2 ^f	CIWMB, 2002b. ^h Scholl Canyon site. A chipping/grinding facility.
100% Green Waste	n/a	0.0034	n/a	2.0	n/a	0.098 ^f	CIWMB, 2002a. Anchorage site.
100% Green Waste	n/a		n/a		n/a		CIWMB, 2002a. Inland Empire site. ⁱ
Tipping Pile		0.0056		nd		nd ^f	
17-Day Pile		0.0076		0.023		0.027	
45-Day Pile		0.0014		0.024		0.0012	
90-Day Pile		0.0028		0.48		0.30	
Fines		0.00052		0.00052		0.0013	

n/a = not available; nd = not detected.

^a lb/ton of compost mix refers to original mass prior to composting.

^b Measured as total nonmethane organic compounds.

^e Measured as total nonmethane, nonethane compounds.

^c A rain event prior to sampling appears to have resulted in much higher than expected methane (CH₄) and volatile organic compound (VOC) emissions (via increased anaerobic activity).

^d This composting facility is an enclosed facility venting to a biofilter. Compost piles are aerated by both turning and forced-air. Testing was performed by both flux chamber on one compost row and at the biofilter inlet for a composite of all rows. Results in this table are for the biofilter inlet.

^f Measured as total nonmethane hydrocarbons (TNMHC).

^g High winds during testing may have suppressed anaerobic activity and may have increased the TNMHC values. Mulch was aged up to 5 days at this chipping/shredding operation for this test program (normally shipped out in 1 day).

^h Testing conducted by the Los Angeles County Sanitation Districts. This was another chipping/shredding operation, where mulch was aged up to 5 days. Values reported are for the highest emitting piles (e.g., day 1 mulch).

ⁱ Emission rates represent averages of detected values for 5 processes: raw green waste, static pile (17 days old), 45 day old compost, 90 day compost, and fines pile.

Table II-7 provides recommended source classification codes (SCCs) for composting operations. Table II-8 provides recommended emission factors for composting operations. Emission factors for the composting of biosolids, mixed waste, and green waste are given a D based on the small number of tests conducted and the possible low bias of measurements. The emission factors for chipping and shredding operations are given an E for similar reasons, plus there was not enough process information available to accurately assess the emissions contributions from the different composting piles tested.

The CIWMB and SCAQMD test programs showed that NH₃ and CH₄ emissions from biosolids or mixed waste composting processes are higher than green waste composting processes. VOC emissions are higher at green waste composting operations than at biosolids/mixed waste composting operations. In addition to the compost materials, the configuration of compost piles is thought to play a role in NH₃ emission rates. Large and deep compost piles will yield higher emission rates of NH₃ and CH₄ than long windrows, which have a higher surface area and allow for greater air infiltration.

Table II-7. SCCs for Composting Operations

SCC	SCC Descriptors				Comments
	1	2	3	4	
2680010000	Waste Disposal, Treatment and Recovery	Composting	Biosolids	All Processes	For composting of 100% biosolids (e.g., sewage sludge, manure, or mixtures of these materials).
2680020000	Waste Disposal, Treatment and Recovery	Composting	Mixed Waste	All Processes	For composting mixtures of biosolids and green wastes (e.g., a 50:50 mixture by weight).
2680030000	Waste Disposal, Treatment and Recovery	Composting	Green Waste	All Processes	For composting of 100% green wastes (e.g., residential or municipal yard wastes).
2680030010	Waste Disposal, Treatment and Recovery	Composting	Green Waste	Chipping and Shredding Operations	For green waste chipping and shredding operations, where the processed material is shipped out within 1 day.

Table II-8. Recommended NH₃ Emission Factors for Composting Operations

SCC	NH ₃ EF		CH ₄ EF		VOC EF		EF Rating; Notes
	lb/ton	lb/10 ³ ft ² -hr	lb/ton	lb/10 ³ ft ² -hr	lb/ton	lb/10 ³ ft ² -hr	
2680010000 ^a	3.28	0.175	2.23	0.119	1.70	0.090	D; Source: SCAQMD, 1996a.
2680020000 ^b	2.81	0.107	33.5	1.23	3.12	0.110	D; Source: SCAQMD, 1996b. If the facility is well-designed and employs state-of-the-art operations (e.g., automatic forced-air aeration), then the emission factors shown in Table II-6 from SCAQMD, 1996c are more appropriate.
2680030000 ^c	0.82	0.044	0.87	0.047	3.76	0.211	D; Source: SCAQMD, 2001a, b. Emission factors are averages from the two test programs.
2680030010 ^d	n/a	6.50E-05	n/a	9.70E-04	n/a	0.303	E: Source: CIWMB, 2002a. Values from the Van Norman site were used (average of 4 processes), since they are believed to be the most representative of chipping and shredding facilities.

3. Bakeries

Ammonium bicarbonate (NH_4HCO_3) is used in the baking industry as a leavening agent. The function of a leavening agent is to aerate the dough or batter which renders it light and porous. When heated, NH_4HCO_3 yields NH_3 and carbon dioxide (Pylar, 1988). The use of NH_4HCO_3 is restricted to baked products with a very low moisture content and porous structure, such as cookies and crackers, which allows the NH_4HCO_3 to dissipate. In higher moisture baked products, the water retains the NH_3 , which in turn gives the product an undesirable flavor and odor (Kuntz, 1995).

During the baking process, NH_3 is emitted from the bakery oven stack. Air control equipment, such as a catalytic oxidizer, is often installed at bakeries to convert the NH_3 to nitrogen and NO_x . The American Bakers Association (ABA) provided information that can be used to estimate the amount of NH_3 emitted from the bakery oven stack. The amount of NH_4HCO_3 used in a cookie or cracker recipe may be 0.5 - 3.0 percent (by weight or "baker's percent") based on 100 lbs of flour. The baker's percent of an ingredient in a recipe refers to the weight of that particular ingredient per 100 lbs of flour in the recipe. In a given recipe, the baker's percent of all ingredients will total more than 100 percent as the flour alone equals 100 baker's percent (Giesecke, 2003; Hosenev, 1998).

An example of a baker's percent cookie recipe is as follows:

Ingredient	Parts by Weight
Flour	100
Sugar	20
Shortening	25
Ammonium bicarbonate (NH_4HCO_3)	1.5
Misc. ingredients	14.4
Water (variable)	10

Therefore, uncontrolled emissions can be calculated directly from the amount of NH_4HCO_3 consumed by the facility as follows:

$$\text{NH}_3 \text{ emissions} = (17/79) M_{\text{NH}_4\text{CO}_3}$$

where: $17/79$ = ratio of the molecular weights of NH_3 and NH_4HCO_3 ; and
 $M_{\text{NH}_4\text{CO}_3}$ = mass of NH_4HCO_3 (e.g., lb).

According to the ABA, not all bakeries use NH_4CO_3 as a leavening agent and those that do should be represented in the data reported into the TRI (Giesecke, 2003). Bakery emissions are reported under the SCCs below. Since NH_3 emissions are only associated with baking of crackers and cookies, emissions should be reported under the new SCC 30203205:

30203201	Industrial Processes	Food and Agriculture	Bakeries	Bread Baking: Sponge-Dough Process
30203202	Industrial Processes	Food and Agriculture	Bakeries	Bread Baking: Straight-Dough Process
30203203	Industrial Processes	Food and Agriculture	Bakeries	Material Handling and Transferring
30203204	Industrial Processes	Food and Agriculture	Bakeries	Flour Storage
30203205	Industrial Processes	Food and Agriculture	Bakeries	Cracker and Cookie Baking
30203299	Industrial Processes	Food and Agriculture	Bakeries	Other Not Classified

Table II-9 contains the recommended emission factor for bakeries. Since it is based on mass balance procedures, it is rated A. Note that the emission factor does not account for emission reductions associated with any stack controls.

Table II-9. Recommended NH₃ Emission Factor for Bakeries

SCC	Description	EF (lb/unit)	Units	EF Rating; Notes
30203205	Industrial Processes; Food and Agriculture; Bakeries; Cracker and Cookie Baking	0.22	lb ammonium bicarbonate	A; EF is for uncontrolled emissions (does not account for possible stack controls).

4. Pulp and Paper

Chemical pulping of wood involves “cooking” wood chips in a chemical solution to dissolve the lignin that binds the cellulose fibers together. There are three main types of chemical pulping in use today: kraft; sulfite; and semi-chemical. Because of advantages in chemical recovery and pulp strength, kraft pulping accounts for the majority of chemical pulp produced in the United States (over 80 percent).

In the kraft pulping process, wood is digested under elevated temperature and pressure in a cooking solution of sodium hydroxide and sodium sulfide, called “white liquor.” After cooking, the digester contents are separated by the pulp washing system into a pulp slurry and spent cooking liquor. The pulp slurry is sent to subsequent processing and conditioning equipment, and the spent cooking liquor, called “black liquor,” is concentrated in the evaporator system. The black liquor is then combined with pulp wash water and fired in the chemical recovery boiler. The inorganic cooking chemicals, recovered as smelt from the boiler furnace floor, are dissolved in water to form “green liquor.” The green liquor is sent to a causticizing tank where calcium oxide is added to convert the solution back to white liquor. The solution is then returned to the digester system.

Ammonia is produced during kraft pulping through the alkaline hydrolysis of amino acids. Ammonia has been detected in vent gases from smelt dissolving tanks, lime slakers, and green liquor causticizers. In 1995, the National Council for Air and Stream Improvement (NCASI) compiled NH₃ emissions data measured in vent gases at several kraft pulp mills. Tarpey et al. (1996) also detected NH₃ in a kraft pulp mill’s smelt dissolving tank vent. The results from the most recent study conducted by NCASI, however, exhibit less variability than earlier studies (NCASI, 1999). The NCASI measured NH₃ emissions from smelt dissolving tanks, lime shakers, and green liquor causticizers at five kraft mills.

Emissions data from this study are shown in Table II-10. Emissions are presented in terms of lb per ton black liquor solids (BLS) and lb per air-dried ton of pulp (ADTP).

Table II-10. NH₃ Emissions Data from Kraft Pulping Processes

Mill	Source Description	Range, ppmv	Average, ppmv ^a	lb/ton BLS ^b	lb/ADTP ^c
A	Smelt dissolving tank	300-398	349	0.226	0.357
B	Smelt dissolving tank	236-278	257	0.169	0.270
C	Smelt dissolving tank	1,607-1,944	1,795	0.371	0.593
D	Smelt dissolving tank	780-1120	907	0.257	0.405
E	Smelt dissolving tank	248-315	282	0.153	0.246
Average Smelt Dissolving Tank Emission Factor				0.235	0.374
Standard Deviation				0.087	0.138
A	Slaker	154-1,092	623	0.148	0.040
B	Slaker	1,856-2,320	2,033	0.304	0.084
C	Slaker/Causticizer	3,141-6,539	4,531	0.114	0.031
D	Slaker	1,462-1,488	1,485	0.108	0.111
E	Slaker	453-4,281	1,843	0.093	0.025
Average Slaker Emission Factor				0.153	0.058
Standard Deviation				0.087	0.038
A	Causticizer	--	14,315	0.093	0.026
B	Causticizer	4,605-6,673	5,639	0.126	0.034
C	Slaker/Causticizer	3,141-6,539	4,531	0.114	0.031
Average Causticizer Emission Factor				0.111	0.030
Standard Deviation				0.017	0.004

Source: NCASI, 1999.

^a ppmv - parts per million by volume

^b BLS - black liquor solids.

^c ADTP - air-dried ton of pulp.

Sulfite pulping is similar to kraft pulping, except that instead of a caustic solution, the cooking solution consists of sulfurous acid buffered with a bisulfite of sodium, magnesium, calcium, or ammonium. In neutral sulfite semi-chemical (NSSC) pulping, wood chips are cooked in a neutral solution of sodium sulfite and sodium carbonate. Only a portion of the lignin is removed during cooking in semi-chemical pulping. After cooking, the pulp is reduced further using mechanical pulping. No NH₃ emissions data for sulfite pulping or semi-chemical pulping are currently available.

Table II-11 provides emission factors for pulp and paper processes. The average emission factors from the NCASI data are recommended and are given a B rating. In addition to emission factors based on the NCASI information described above, two related emission factors extracted from CEIDARS are included. These emission factors are given a D rating. Although they are based on testing or other sound methods, it is not known how representative they are to other pulp plants. Note that NH₃ emissions data for a number of pulp and paper plants are reported into the TRI.

Table II-11. Recommended NH₃ Emission Factors for Pulp and Paper Processes

SCC	Description	EF (lb/unit)	Units	EF Rating; Notes
30700105	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Smelt Dissolving Tank	0.374	ADTP ^a	B; source - NCASI, 1999.
30700121	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Wastewater: General	7.78E-03	10 ³ gallons wastewater	E; source - CEIDARS
30700122	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Causticizing: General	0.030	ADTP ^a	B; source - NCASI, 1999.
30700123	Industrial Processes; Pulp and Paper and Wood Products; Sulfate (Kraft) Pulping; Lime Slaker	0.058	ADTP ^a	B; source - NCASI, 1999.
30700401	Industrial Processes; Pulp and Paper and Wood Products; Pulpboard manufacture; Paperboard: General	0.0633	Ton finished product	E; source - CEIDARS

^a air-dried ton of pulp.

5. Surface Coatings

During a review of the NEI and CEIDARS databases, point source surface coating records were identified with reported NH₃ emissions. Ammonia is added to some water-based (e.g., latex) paints for pH adjustment. Very little information was found on the NH₃ content of water-based paints; however, one national manufacturer provided information on NH₃ usage (the manufacturer is not cited here to protect potentially sensitive business information). Ammonia usage was estimated to be 3.16 lb/ton of latex paint (0.017 lb/gallon). This emission factor is most applicable to water-based architectural and industrial maintenance coatings. Given that this value is derived from information from only one manufacturer, it should be considered highly uncertain (i.e., E rated).

As mentioned above, both the NEI and CEIDARS contained records for NH₃ emissions from surface coatings. The source categories included surface coatings of cans, drums, wood and metal furniture, automobiles, aircraft, fabrics, and general solvent- and water-based coatings. The NEI does not provide sufficient information to develop emission factors. Emission factor information from CEIDARS is summarized in Table II-12. Generic emission factors were derived from the CEIDARS data to estimate emissions for all industrial surface coatings.

While the CEIDARS records contained data for both water- and solvent-based coatings, it is not clear if the solvent-based records were mis-coded. Ammonia is not believed to be a component of solvent-borne coating systems. Hence, the emission factors below should be applied only to water-based formulations. Given the small number of data points, the range in reported values, and the inability to review the underlying information, all emission factors are given an E rating.

Table II-12. Recommended NH₃ Emission Factors for Surface Coatings

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
40202402	Petroleum and Solvent Evaporation; Surface Coating Operation; Large Aircraft; Cleaning/Pretreatment	80.5	ton coating solvent	E; source CEIDARS; these emission factors should only be applied to water-based coating operations.
40202406	Petroleum and Solvent Evaporation; Surface Coating Operation; Large Aircraft; Topcoat Operation	0.462	ton coating solvent	
40202501	Petroleum and Solvent Evaporation; Surface Coating Operation; Miscellaneous Metal Parts; Coating Operation	1.17	ton coating solvent	
40202599	Petroleum and Solvent Evaporation; Surface Coating Operation; Miscellaneous Metal Parts; Other Not Classified	14.7	ton coating solvent	
40202607	Petroleum and Solvent Evaporation; Surface Coating Operation; Steel Drums; Exterior Coating	5.02 x 10 ³	gallon coating	
40201101	Petroleum and Solvent Evaporation; Surface Coating Operation; Fabric Coating/Printing; Coating Operation	47.2	ton coating solvent	
40201104	Petroleum and Solvent Evaporation; Surface Coating Operation; Fabric Coating; Coating Storage	0.359	ton coating solvent	
40201201	Petroleum and Solvent Evaporation; Surface Coating Operation; Fabric Dyeing; Dye Application: General	33.4	ton dye	
30800724	Industrial Processes; Rubber and Miscellaneous Plastics Products; Fiberglass Resin; Resin: General - Spray-On	10.5	ton coating	
40200501	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Enamel	20.0	ton coating	
40200710	Petroleum and Solvent Evaporation; Surface Coating Operations; Surface Coating Application - General; Adhesive: General	0.024	gallon coating	
2401090000	Solvent Utilization; Surface Coating; Miscellaneous Manufacturing; Total: All Solvent Types	0.029 ^a	gallon coating	E; source - confidential major U.S. manufacturer; apply to water-based coatings only.
2401090000	Solvent Utilization; Surface Coating; Miscellaneous Manufacturing; Total: All Solvent Types	8.87 ^b	ton coating	
2401003000	Solvent Utilization; Surface Coating; Architectural Coatings - Water-based; Total: All Solvent Types	0.017	gallon coating	
2401100000	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings; Total: All Solvent Types	0.017	gallon coating	

^a Range = 0.0001 - 0.121.

^b Range = 0.287 - 20.0.

6. Municipal Solid Waste Landfills

Little information exists on NH₃ emissions from MSW landfills. Yet most emission inventories prepared in the United States and abroad contain an emission estimate for landfills. All of the known estimates stem from the work of Munday (1990) who concluded that nitrogenous emissions equate to 7.3 percent of CH₄ emissions, and that 10 percent of the nitrogenous emissions are in the form of NH₃ (Sutton et al., 2000). Given the discussions above on emissions from biosolids (which are often disposed of in landfills or used as cover materials) and composting, there is little doubt that landfills are a source of NH₃. However, no measurements in the U.S. have been identified.

Until better information becomes available, the NH₃:CH₄ mass ratio of 0.0073 can be used along with an estimate of CH₄ emissions to estimate NH₃ emissions. As shown in Table II-13, this emission factor is given an E rating. The EPA's Landfill Gas Emissions Model (LandGEM) can be used to develop the CH₄ estimates (Pelt et al., 1998). LandGEM and the associated documentation can be found at: <http://www.epa.gov/ttn/catc/products.html#software>.

Table II-13. Recommended NH₃ Emission Factor for MSW Landfills

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
2620030000	Waste Disposal Treatment and Recovery; Landfills; Municipal; Total	7.30E-03	lb methane	E; source - Munday (1990).

7. Portland Cement Kilns

Portland cement is a fine powder, gray or white in color, that consists of a mixture of hydraulic cement materials comprising primarily calcium silicates. More than 30 raw materials are known to be used in the manufacture of portland cement, and these materials can be divided into four distinct categories: calcareous, siliceous, argillaceous, and ferriferous. These materials are chemically combined via pyroprocessing and subjected to subsequent mechanical processing operations to form gray and white portland cement. Gray portland cement is used for structural applications and is the more common type of cement produced. White portland cement has lower iron and manganese contents than gray portland cement and is used primarily for decorative purposes (MRI, 1994).

Portland cement manufacturing plants are included under SIC 3241, hydraulic cement manufacturing, which also includes natural, masonry, and pozzolanic cement. The portland and masonry cement manufacturing process can be divided into the following primary components: raw materials acquisition and handling; kiln feed preparation; pyroprocessing; and finished cement grinding. More than 30 raw materials are known to be used to manufacture portland cement. Calcium, the element of highest concentration in portland cement, is obtained from a variety of calcareous raw materials, including limestone, chalk, marl, sea shells, aragonite, and an impure limestone known as "natural cement rock" (MRI, 1994). Ammonia emissions occur from the kilns during the pyroprocessing step.

The six-digit SCC for portland cement plants with wet process kilns is 3-05-006, and the six-digit SCC for plants with dry process kilns is 3-05-007. In a wet process kiln, the kiln feed is in the form of a slurry (around 65 percent solids), while dry process kilns use dry materials. Emission factors from kilns are usually reported on the basis of mass of raw material feed or mass of kiln product (clinker).

AP-42 contains little information on NH₃ emissions from portland cement kilns. An emission factor for NH₃ of 0.010 lb/ton clinker is provided for a dry kiln outfitted with a fabric filter. This emission factor is based on one test using an inappropriate method (AP-42 rating is an E; MRI, 1994). Another emission factor is provided for ammonium (NH₄⁺) from wet kilns controlled by an electrostatic precipitator (ESP; 0.10 lb/ton clinker). This emission factor is based on 6 different tests; however they are all from the same plant (EF is rated D).

Test data from a facility in New York indicate that NH₃ emissions can be much higher than the test data provided in the AP-42 background document (Kent, 2003). Dilution sampling conducted on a dry kiln controlled by an ESP showed an emission rate of approximately 1.31 lb/ton clinker (yielding an annual emission rate of over 350 tons for this facility). The TRI contains reported stack releases of NH₃ from a handful of cement plants (reported under SIC 3241). The range of emissions reported in the TRI is 13 to over 150 tons/year.

The Portland Cement Association (PCA) provided a summary of emission test results for 16 plants covering wet and dry kilns (including preheater and precalciner kilns; Hawkins, 2003). Regardless of kiln type, enormous variability is shown in these test data (i.e. 3 orders of magnitude). Follow-up discussions with PCA indicated that the main source of variation is thought to be with the nitrogen content of the raw materials. A secondary source of variation could be process design. Based on the available data, a single emission factor was developed from the PCA data (shown in Table II-14 below); however state agencies are encouraged to base their emission estimates on facility-specific test data.

Table II-14. Recommended NH₃ Emission Factor for Portland Cement Kilns

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
30500606	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Kilns	0.145	ton clinker	D; the EF rating is low due to the high degree of variability in measured emissions; source: Hawkins, 2003.
30500622	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater Kiln			
30500623	Industrial Processes; Mineral Products; Cement Manufacturing (Dry Process); Preheater/Precalciner Kiln			
30500706	Industrial Processes; Mineral Products; Cement Manufacturing (Wet Process); Kilns			

C. ACCIDENTAL RELEASES

Accidental releases of NH₃ reported to the National Response Center at the U.S. Coast Guard for the 2002 calendar year are summarized in Appendix A (USCG, 2003). Information on the date, location, and facility reporting the release are included. Also included are reported amounts of release. The reported release amounts range from a few lbs to many tons. Hence, a significant NH₃ release that occurs within the time frame of a regional air quality modeling scenario could have a significant impact on the modeling results. Therefore, the data in Appendix A can be used to construct detailed inventories for regional modeling purposes or to back out certain accidental releases from inventory estimates developed for other source categories (e.g., industrial refrigeration).

Applicable area source SCCs for accidental releases are: 2830000000 (all catastrophic/accidental releases; 2830001000 (industrial accidents); and 2830010000 (transportation accidents). Emission factors are summarized in Table II-15.

Table II-15. Recommended NH₃ Emission Factors for Accidental Releases

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
2830000000	Miscellaneous Area Sources; Catastrophic/Accidental Releases; All Catastrophic/Accidental Releases; Total	2000	ton material released	A; based on reported releases of 100 lbs or more to the National Response Center.
2830001000	Miscellaneous Area Sources; Catastrophic/Accidental Releases; Industrial Accidents; Total	2000	ton material released	
2830010000	Miscellaneous Area Sources; Catastrophic/Accidental Releases; Transportation Accidents; Total	2000	ton material released	

D. MISCELLANEOUS SOURCES

The miscellaneous sources covered here are generally referred to as “domestic” sources. These sources include human breath and sweat, pet animal waste, and household uses. Emission factors are taken from a recent review of the available emissions data by Sutton et al (2000). Much of the data reviewed by Sutton came from European studies. However, the emission factors are thought to be reasonable for application in the U.S., until additional data are available. These emission factors are shown in Table II-16. The emission factors have C and D ratings based on the wide range of the supporting data (often an order of magnitude).

For domestic fertilizer use, data were obtained for 2002 non-farm commercial fertilizer sales from the American Association of Plant Food Control Officials (AAPFCO; Terry, 2004). According to AAPFCO, the states that provided a good break-out of farm versus non-farm sales were California and Florida. When combined with the 2.5% nitrogen loss for domestic fertilizer use provided by Sutton et al (2000) and 2002 population data, the AAPFCO data yielded annual ammonia emission factors of 0.108 lb/person in Florida and 0.047 lb/person in California. The emission factor provided below

(0.067 lb/person) is derived from sales and population data for both states combined. The emission factor is rated D due to the uncertainty in the loss estimate from Sutton et al (2000) as well as uncertainties in the representativeness of the non-farm sales data for other states.

Table II-16. Recommended NH₃ Emission Factors for Miscellaneous Sources

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
2810010000	Miscellaneous Area Sources; Other Combustion; Perspiration and Respiration; Total	0.037	person-yr	D; Source: Sutton et al (2000).
2870000002	Miscellaneous Area Sources; Infant Diapered Waste; Total	0.030	infant-yr	D; Source: Sutton et al (2000). Applied to infants 0 to 3 years old.
2870000011	Miscellaneous Area Sources; Domestic Activity; Household Products; Total	0.031	person-yr	D; derived from data reported by Sutton et al (2000) for household product use in the United Kingdom.
2870000015	Miscellaneous Area Sources; Domestic Activity; Non-agricultural Fertilizers; Total	0.067	person-yr	D; Source: Terry (2004) and Sutton et al (2000)
2810003000	Miscellaneous Area Sources; Other Combustion; Cigarette Smoke; Total	0.039	smoker-yr	C; Source: Sutton et al (2000)

CHAPTER III. COMBUSTION SOURCES

A. EMISSIONS FROM STATIONARY COMBUSTION SOURCES

Little has changed since the 1994 guidance was prepared on the availability of NH₃ emissions data from fossil fuel-fired boilers and other stationary combustion sources. Recommended emission factors are presented in Table III-1 and are largely taken from the 1994 guidance. The reported emission factors for coal combustion cover a range of four orders of magnitude (0.000565 to 2.0 lbs/ton). The emission factor recommended for utility, industrial, commercial, and institutional coal combustion in the 1994 guidance is the low end of this range and is taken from the 1985 NAPAP (Battye et al, 1994). That value was based on a single source test (Warn et al., 1990), and is consistent with the emission factors used in recent European inventories (e.g., AEA, 2001).

Table III-1. Recommended NH₃ Emission Factors for Stationary Combustion Sources

SCC	Description	EF (lb/unit)	EF Unit	Rating; Notes
101001xx, 101002xx, 101003xx, 102001xx, 102002xx, 102003xx, 103001xx, 103002xx, 103003xx, 10500102, 10500202, 2101001000, 2101002000, 2101003000, 2102001000, 2102002000, 2103001000, 2103002000, 2199001000, 2199002000, 2199003000	External Combustion: Utility, Industrial, Commercial and Institutional Coal	0.030	ton coal	D; sources - CEIDARS; Warn et al., 1990
101008xx, 102008xx, 2101009000, 2102009000, 2199009000	External Combustion: Utility, Industrial, Commercial and Institutional Coke	0.397	ton coke	E; source -CEIDARS
101004xx, 101005xx, 102004xx, 102005xx, 103004xx, 103005xx, 10301302, 10500105, 10500113, 10500114, 2101004001, 2101005000, 2102004000, 2102005000, 2103004000, 2103005000, 2103011005, 2103011010, 2199004000, 2199005000, 2199011000	External Combustion: Utility, Industrial, Commercial and Institutional Oil	0.80	10 ³ gallons oil	E; source - EC/R, 1994
101006xx, 102006xx, 10500106, 10500206, 2101006001, 2102006001, 2199006000	External Combustion: Utility and Industrial Natural Gas	3.20	10 ⁶ ft ³ gas	D; source - EC/R, 1994
103006xx, 2103006000	External Combustion: Commercial and Institutional Natural Gas	0.49	10 ⁶ ft ³ gas	D; source - EC/R, 1994
101007xx, 102007xx, 103007xx, 2101010000, 2102010000, 2199010000	External Combustion: Utility, Industrial, Commercial and Institutional Process Gas	1.20	10 ⁶ ft ³ gas	E; source - CEIDARS
101009xx, 102009xx, 103009xx, 10500209, 2101008000, 2102008000, 2103008000, 2199008000	External Combustion: Utility, Industrial, Commercial and Institutional Wood/Wood Waste	0.086	ton wood	E; source - CEIDARS
101012xx, 102012xx, 103012xx, 2601010000, 2601020000	External Combustion: MSW Incineration	1.19	ton waste	E; sources - CEIDARS; Geadah, 1985
50200515, 50200516, 50200516, 50200517, 50200518, 50200519, 50200520	Solid Waste Disposal, Commercial/Institutional, Incineration: Special Purpose, Sewage Sludge	0.30	ton sludge	E; source - Geadah, 1985

Table III-1 (continued)

SCC	Description	EF (lb/unit)	EF Unit	Rating; Notes
20100101, 20100102, 20100105, 20100107, 20100209, 20200101, 20200102, 20200103, 20200104, 20200105, 20200107, 20200109, 20200401, 20200402, 20200403, 20200405, 20200407, 20200501, 20200505, 20200507, 20200901, 20200902, 20200905, 20200907, 20200909, 20300101, 20300102, 20300105, 20300107, 20300109, 20300901, 20300909, 204001xx, 20400302, 20400303, 20400305, 20400402, 20400403, 20400406, 20400407, 20400408, 210100402	Internal Combustion: Utility, Industrial, Commercial and Institutional Oil-Fired Equipment	6.62	10 ³ gallons	E; source - CEIDARS
20100202, 20100205, 20100207, 20200202, 20200204, 20200205, 20200207, 20200252, 20200253, 20200254, 20300201, 20300204, 20300205, 20300207	Internal Combustion: Utility, Industrial, Commercial and Institutional Natural Gas-Fired Reciprocating Engines	0.60	10 ⁶ ft ³ gas	E; source - CEIDARS
20100201, 20100209, 20200201, 20200203, 20200209, 20300202, 20300203, 20300209, 2101006002, 2102006002, 2199006002	Internal Combustion: Utility, Industrial, Commercial and Institutional Natural Gas-Fired Turbines	6.56	10 ⁶ ft ³ gas	D; source - CEIDARS
2104001000, 2104002000	Residential Coal Combustion	2.0	ton coal	E; Geadah, 1985
2104004000, 2104005000	Residential Oil Combustion	1.0	10 ³ gallons oil	E; source - Geadah, 1985
2104006000	Residential Natural Gas Combustion	20	10 ⁶ ft ³ gas	E; source - EC/R, 1994

The only other data points identified for utility/industrial/commercial/institutional coal combustion are two values from the CEIDARS database. One is for bituminous coal combustion in a fluidized bed utility boiler listed as 0.060 lbs/ton. The other emission factor is for coke combustion in a utility boiler listed as 0.397 lbs/ton. These data suggest that emissions may be somewhat higher than the low end of the reported range for coal. To develop a recommended emission factor, the coal combustion value from CEIDARS was averaged with the value from Warn et al. (1990). The coke combustion value from CEIDARS was also selected for use in estimating emissions from coke combustion. Note that none of the records from CEIDARS listed NH₃ injection as a control; therefore, all emissions are assumed to be uncontrolled.

The emission factor for fuel oil combustion is also taken from the 1985 NAPAP inventory. This emission factor is the mid-point of a range of values (0.19 to 1.5 lbs/10³ gallon) reported by the Electric Power Research Institute (EPRI) in the 1970's (EPRI, 1976). The CEIDARS database has one record for distillate oil-fired reciprocating engines (6.62 lbs/10³ gallon). This value was selected for all oil-fired internal combustion engines.

The 1994 guidance reported that NH₃ emissions for natural gas combustion ranged from 0.3 to 20 lbs/10⁶ ft³. Three records for utility/industrial boilers from the CEIDARS database are in general agreement with this range (0.013, 10.5, and 13.6 lb/10⁶ ft³; average = 8.04 lbs/10⁶ ft³). Although none of these sources had a listed NO_x control featuring ammonia injection in the CEIDARS database, there is a concern that the two highest values may have involved ammonia slip from such control devices (see the next section for a discussion of ammonia slip emissions). For this reason, the data were not used to update the emission factor for utility/industrial natural gas

record for distillate oil-fired reciprocating engines (6.62 lbs/10³ gallon). This value was selected for all oil-fired internal combustion engines.

The 1994 guidance reported that NH₃ emissions for natural gas combustion ranged from 0.3 to 20 lbs/10⁶ ft³. Three records for utility/industrial boilers from the CEIDARS database are in general agreement with this range (0.013, 10.5, and 13.6 lb/10⁶ ft³; average = 8.04 lbs/10⁶ ft³). Although none of these sources had a listed NO_x control featuring ammonia injection in the CEIDARS database, there is a concern that the two highest values may have involved ammonia slip from such control devices (see the next section for a discussion of ammonia slip emissions). For this reason, the data were not used to update the emission factor for utility/industrial natural gas combustion. The emission factor of 3.2 lb/10⁶ ft³ from the 1994 guidance remains unchanged. For commercial boilers, the recommended emission factor (0.49 lb/10⁶ ft³) is from the 1985 NAPAP inventory.

The CEIDARS database also contained four records for internal natural gas combustion. One of these records was for an industrial reciprocating engine (0.60 lbs/10⁶ ft³). The other three were for utility and industrial turbines (6.84, 10.2, and 2.64 lbs/10⁶ ft³). The record for the reciprocating engine was selected as an emission factor for these types of engines, while the average of the three turbine records was used to derive an emission factor for turbines.

The CEIDARS database contained two records for process gas (2.24 and 0.155 lbs/10⁶ ft³). No additional information was provided on the type of process. The average of these values was selected as the recommended emission factor for process gas combustion. Another CEIDARS record was for emissions from petroleum refining process heaters fired on process gas (15.0 lbs/10⁶ ft³). According to WSPA, this value corresponds to a process heater controlled by selective catalytic reduction (SCR; Buchan, 2003); therefore it was excluded from Table III-1. Additional emission factors reported into CEIDARS are provided for process gas incineration and liquefied petroleum gas (LPG) incineration. Based on comments from WSPA (Buchan, 2003), these emission factors were also excluded from Table III-1. Note also that Table II-1 contains an emission factor from AP-42 for refinery gas-fired reciprocating engines.

For utility and industrial wood combustion, CEIDARS contains two records for industrial wood combustion (0.00992 and 0.076 lbs/ton wood). The average of these values was selected as the recommended emission factor (see Table III-1).

The CEIDARS database contained two records for solid waste combustion. One of these was for refuse derived fuel (3.125 lbs/ton) and the other for an unknown waste type (0.052 lbs/ton). The only other known value was provided by Geadah (1985) at 0.4 lbs/ton MSW. The average of these three values was selected as the emission factor for MSW combustion. The emission factor for sewage sludge incineration shown in Table III-1 is taken from Geadah (1985).

For residential coal combustion, an emission factor at the high end of the range reported for coal combustion above is recommended due to the combustion conditions in domestic coal burning equipment. The recommended emission factor in Table III-1 is consistent with values used in European inventories (AEA, 2001; Sutton et al., 2000; Geadah, 1985). Similar logic was applied in the selection

of emission factors for residential oil and natural gas combustion. For residential oil, the emission factor is taken from Geadah (1985). All of the emission factors are rated E, however, due to a lack of recent test data for these equipment. Emission estimation methods for residential wood combustion are provided in Section III.D (Biomass Burning).

B. AMMONIA SLIP EMISSIONS FROM NO_x-CONTROLLED COMBUSTION SOURCES

Oxides of nitrogen are gaseous pollutants primarily formed during combustion processes. Selective noncatalytic reduction (SNCR) and SCR are post-combustion control technologies based on the chemical reduction of NO_x. In both SCR and SNCR, a nitrogen-based reducing agent, such as NH₃ or urea [CO(NH₂)₂], is injected into the post-combustion flue gas. The reagent reacts selectively with NO_x in the presence of oxygen to reduce the NO_x into molecular nitrogen (N₂) and water vapor (H₂O). The predominant form of NO_x in the flue gas is nitric oxide (NO); therefore, the main chemical reaction for an NH₃-based control system is:



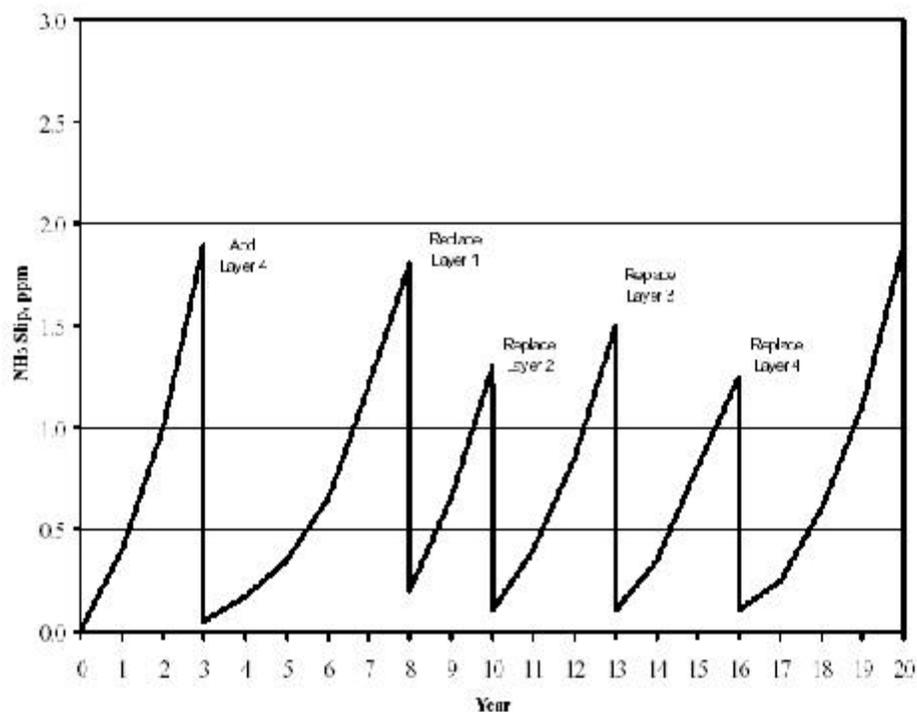
The reaction for the urea-based system is:



The primary difference between the two technologies is that SCR utilizes a catalyst to increase the NO_x removal efficiency, which allows the process to occur at lower temperatures. Most SCR systems operate at efficiencies in the range of 70 percent to 90 percent, while SNCR systems typically reduce NO_x by 30 percent to 50 percent.

As shown in the reactions above, the theoretical NH₃:NO_x ratio for the reduction reaction with NH₃ is 1, and the theoretical ratio for urea is 0.5. However, due to the portion of NO_x that is in the form of nitrogen dioxide (NO₂) rather than NO and reaction rate limitations, more than the theoretical amount of NH₃ is generally required for high levels of NO_x removal. In addition to excess NH₃ being added, generally less than 100 percent of the NO_x is reduced. This leaves a portion of the injected reagent in the flue gas. Most of the excess reagent used in the process is destroyed through other chemical reactions. However, a small portion remains in the flue gas as NH₃ slip. A number of factors affect NH₃ slip in SCR and SNCR systems. These factors include reaction temperature range, residence time at the optimum temperature, degree of mixing of NH₃ in the flue gas, and the molar ratio of NH₃ added to uncontrolled NO_x.

The main factor affecting NH₃ slip in SCR systems is catalyst activity. Catalysts are composed of active metals or ceramics with a highly porous structure. Within the pores of the catalyst are activated sites, which have an acid group on the end of the compound structure where the reduction reaction occurs. After the reduction reaction takes place, the site reactivates via rehydration or oxidation. Over time, the active sites lose activity due to irreversible binding to flue gas components, thermal sintering, erosion, or plugging. As the catalyst activity decreases, the NO_x reduction reaction rate decreases and

Figure III-1. Typical SCR Catalyst Management Plan

NH₃ slip increases. When the NH₃ slip level reaches the design limit, the catalyst must be replaced or new catalyst must be added. An example of a catalyst management plan is shown in Figure III-1.

Table III-2 shows emission factors recommended in the 1994 guidance. Advances in SCR catalyst technology in recent years have resulted in greatly reduced NH₃ slip levels. Permit data obtained from EPA's RACT/BACT/LAER Clearinghouse (RBLC) database show that SCR units on natural gas turbines and boilers permitted between 1999 and 2001 are permitted for 5 to 10 parts per million by volume (ppmv) of NH₃ slip. Units in California have been permitted at 5 ppmv or less since 1999. Actual slip values are usually below these levels, because the permitted level is typically the expected slip at the end of the catalyst life. Most SCR systems currently being installed on coal-fired boilers are guaranteed for 2 or 5 ppmv of NH₃ slip. However, a 1997 study of SCR units on coal-fired boilers, conducted by EPA's Office of Air and Radiation, found that actual slip values are often below 1 ppmv, and in some cases as low as 0.02 ppmv (EPA, 1997b).

Source: EPA, 2002

Table III-2. NH₃ Slip Emission Factors for SCR and SNCR Applications^a

System (Control Code)	Fuel/Source	Applicable SCCs	Emission Factor ^a (lb/SCC unit)	SCC Units	EF Rating; Notes
<i>1997 and Later Applications</i>					
SCR (139)	Coal-fired boilers	101001xx, 101002xx, 101003xx, 102001xx, 102002xx, 102003xx, 103001xx, 103002xx, 103003xx, 10500102, 10500202	0.032	ton coal	C; EF based on 2 ppmv NH ₃ slip (range is <0.1 - 5)
	Oil-fired boilers, turbines, and engines	101004xx, 101005xx, 102004xx, 102005xx, 103004xx, 103005xx, 10500105, 10500205, 201001xx, 201009xx, 202001xx, 202003xx, 20200401, 20200501, 202009xx, 203001xx, 20300301	0.17	10 ³ gallons oil	C; EF based on 2 ppmv NH ₃ slip (range is <2 - 5)
	Natural gas-fired boilers, turbines, and engines	101006xx, 102006xx, 103006xx, 10500106, 10500206, 201002xx, 202002xx, 203002xx	7.4	10 ⁶ ft ³ gas	C; EF based on 5 ppmv NH ₃ slip (range is <5 - 10)
	Wood-Fired Boilers	101009xx, 102009xx, 103009x	n/a	ton wood	No data available; SCR not commonly-applied to these sources.
	Refinery gas-fired process heaters	30600102, 30600104, 30600106	14.6	10 ⁶ ft ³ gas	E; source: Buchan, 2003.
	Refinery fluid catalytic cracker	30600201	7.5 ^b	10 ³ barrels of feed	E; source: Buchan, 2003.
	Refinery gas turbine cogeneration unit	20200705	0.58	10 ⁶ ft ³ gas	E; source: Buchan, 2003.
SNCR (107)	Coal-fired boilers	101001xx, 101002xx, 101003xx, 102001xx, 102002xx, 102003xx, 103001xx, 103002xx, 103003xx, 10500102, 10500202	0.16	ton coal	C; EF based on 10 ppmv NH ₃ slip (range is 5 - 15 ppmv)
	Oil-fired boilers, turbines, and engines	101004xx, 101005xx, 102004xx, 102005xx, 103004xx, 103005xx, 10500105, 10500205, 201001xx, 201009xx, 202001xx, 202003xx, 20200401, 20200501, 202009xx, 203001xx, 20300301	0.87	10 ³ gallons oil	C; EF based on 10 ppmv NH ₃ slip (range is 5 - 20 ppmv)
	Wood-fired boilers	101009xx, 102009xx, 103009x	0.10	ton wood	C; EF based on 10 ppmv NH ₃ slip (range is 5 - 20 ppmv)
<i>Pre-1997 Applications</i>					
SCR (139)	Coal-fired boilers	101001xx, 101002xx, 101003xx, 102001xx, 102002xx, 102003xx, 103001xx, 103002xx, 103003xx, 10500102, 10500202	0.31	ton coal	C; All SCR emission factors based on 15 ppmv NH ₃ slip; Source - Battye et al., 1994.
	Oil-fired boilers, turbines, and engines	101004xx, 101005xx, 102004xx, 102005xx, 103004xx, 103005xx, 10500105, 10500205, 201001xx, 201009xx, 202001xx, 202003xx, 20200401, 20200501, 202009xx, 203001xx, 20300301	1.4	10 ³ gallons oil	
	Gas-fired boilers, turbines, and engines	101006xx, 102006xx, 103006xx, 10500106, 10500206, 201002xx, 202002xx, 203002xx	9.1	10 ⁶ ft ³ gas	
	Wood-fired boilers	101009xx, 102009xx, 103009x	0.31	ton wood	
SNCR (107)	Coal-fired boilers	101001xx, 101002xx, 101003xx, 102001xx, 102002xx, 102003xx, 103001xx, 102003xx, 103003xx, 10500102, 10500202	0.63	ton coal	C; All SNCR emission factors based on 30 ppmv NH ₃ slip; Source - Battye et al., 1994.

^a New applications are those installed in 1997 and later. Emission factors include any NH₃ from the combustion process.

^b EF for an SCR-controlled FCC unit without a carbon monoxide (CO) boiler; those with CO boilers should have lower NH₃ emissions (Buchan, 2003).

Table III-2 also shows emission factors for newer SCR systems estimated from EPA permit data (natural gas turbines and boilers) and a 1997 EPA report on coal-fired boilers (EPA, 2003d; EPA, 1997b). The data for natural gas turbines and boilers are based on permitted slip levels, which range from 5 to 10 ppmv. Since, actual levels are usually below permitted levels, the minimum value (5 ppmv) was used to calculate the emission factor. The data for coal-fired boilers are based on actual NH₃ slip levels; therefore, the average slip value of 1 ppmv was used to estimate the recommended emission factor.

Table also provide the 3-digit EPA control equipment codes for SCR and SNCR. Although these NH₃ injection systems can be thought of as the source of emissions, the emissions should be reported in association with the combustion unit. Use of the appropriate control equipment code allows for the identification of NH₃ slip emissions in reported emissions data (NH₃ emissions from the combustion process are assumed to be included with the NH₃ slip emissions in this case).

Only one SNCR permit was found in the RBLC database for the years 1998-2001. This unit was on a coal-fired boiler and was permitted to emit NH₃ at 10 ppmv. Literature sources indicate that current SNCR systems on coal-fired boilers have NH₃ slip levels from below 5 ppmv to 15 ppmv (ICAC, 1997; ICAC, 2000; Babcock & Wilcox, 1999). Because SNCR systems have lower NO_x removal efficiencies and higher NH₃ slip levels, these systems are rarely used on sources such as natural gas turbines (which have lower uncontrolled NO_x levels).

No recent permit data were available for wood-fired sources, and only one permit (with incomplete data) was identified for an oil-fired source. Therefore, typical fuel factors and fuel heat contents were used to estimate emission factors for typical emission concentrations (e.g., 10 ppmv for SNCR).

Because actual NH₃ emissions vary by site, site-specific data should be used, where available, to calculate NH₃ emission factors. NH₃ slip emissions are usually reported as a concentration, but sometimes they are expressed as an emission rate (e.g., lb/hour). If emissions are reported as an emission rate, emissions can be calculated from the hours of operation or fuel throughput. Or, if the controlled NO_x concentration and emission rate are known, the NH₃ emission rate can be calculated from the NH₃ concentration, as follows:

$$Q_{NH_3} = \frac{C_{NH_3}}{C_{NO_2}} \times \frac{17}{46} \times Q_{NO_2}$$

where:

- Q_{NH_3} = emission rate of NH₃ (lb/hour);
- C_{NH_3} = concentration of NH₃ in flue gas (ppmv);
- C_{NO_2} = post control concentration of NO_x as NO₂ in flue gas (ppmv);
- 17 = molecular weight of NH₃ in flue gas (grams/mole);
- 46 = molecular weight of NO_x as NO₂ in flue gas (grams/mole); and
- Q_{NO_x} = controlled emission rate of NO_x as NO₂ (lb/hour).

If only the NH₃ slip level is known, the emission factors provided in Tables III-2 and III-3 can be scaled to provide a reasonable estimate of NH₃ emissions. For example, if a natural gas-fired boiler had SCR installed in 2001 and had a measured NH₃ slip value of 2 ppmv, the scaled emission factor could be calculated as follows:

$$\text{Scaled EF} = \frac{2\text{ppmv}}{5\text{ppmv}} \times \frac{7.4 \text{ lb}}{10^6 \text{ ft}^3}$$

C. MOBILE SOURCES

1. Onroad Mobile Sources

The NH₃ emission factors currently built into EPA's MOBILE6.2 vehicle emissions modeling software were taken from a 1981 EPA report (Garbe, 1981). EPA conducted a literature search to verify that the emission factors are still representative of current vehicles, and found that recent measurements are in the same general range. However, NH₃ measurements vary substantially by vehicle class. Also, the level of NH₃ emissions appears to be a function of sulfur level, test cycle, and catalyst technology. Fleet-average NH₃ emissions are thought to be increasing as advanced catalyst-equipped vehicles (e.g., 3-way catalysts) make up a larger fraction of the fleet. Advanced catalysts have higher NH₃ emission rates stemming from an over-reduction of NO_x to NH₃.

The Garbe emission factors used in MOBILE6.2 are shown in Table III-3. The emissions data for light-duty vehicles came from 306 vehicles tested in various programs by EPA. The NH₃ emissions data were all obtained using the Federal Test Procedure (FTP), which is a three-phase cycle designed to simulate cold-start conditions, hot operating conditions over an urban route [average speed of 19.6 miles per hour (mph)], and hot-start conditions. The emissions data for heavy-duty engines came from EPA-sponsored tests of 11 engines at Southwest Research Institute, which included 13-mode steady speed tests and the EPA heavy-duty transient test procedure. To give a more realistic picture of what could occur on the road, a weighted average was taken of data from normal operation (75 percent) and data from malfunctioning vehicles (25 percent).

The emission factors in Table III-3 are all given a C rating, with the exception of 3-way catalyst-equipped vehicles. While all of the emission factors show reasonable agreement with other available test data (as described below), more testing has been conducted for this vehicle type than for others (including tests under real world conditions). Additional information on EPA's MOBILE6.2 model can be found at: <http://www.epa.gov/otaq/mobile.htm>.

Table III-3. Recommended NH₃ Emission Factors from MOBILE6.2

SCC	Description	EF (mg/mi)	Rating; Notes
2201001xx, 2201020xx, 2201040xx, 2201060xx,	Light-duty gasoline, noncatalyst	7.0 ^a	C
2201001xx, 2201020xx, 2201040xx, 2201060xx,	Light-duty gasoline, oxidation catalyst	15.128	C
2201001xx, 2201020xx, 2201040xx, 2201060xx,	Light-duty gasoline, 3-way catalyst	101.711	B; rating based on the agreement with a number of other tests.
2201080xx	Motorcycle	11.265	C
2201070xx	Heavy-duty gasoline	45.062	C
2230001xx, 2230060xx	Light-duty diesel	6.759	C
2230070xx	Heavy-duty diesel	27.037	C

^a As of September, 2003, the emission factor in MOBILE6.2 is actually 11.265 milligrams per mile (mg/mi), but this has been found to be a mistake and will be updated in a future version of the model.

The NH₃ emission factors found in the literature are shown in Table III-4. Only one other emission factor for light-duty noncatalyst vehicles was found, 2.9 milligrams (mg) per mile (mi) from a 1989 Volkswagen study (Sutton et al., 2000). A fleet-average emission factor of 4.6 mg/mi for noncatalyst vehicles was reported by Gharib and Cass (and cited by Dickson et al., 1991). These emission factors are lower than the 7.0 mg/mi reported by Garbe et al. (1981); however, they are in the same general range. The emission factors reported in the literature for light-duty gasoline oxidation catalyst and light-duty diesel vehicles are also in the same range as the factors in MOBILE6.2. Cadle and Mulawa (1980) estimated a range of emission factors from 0.6 to 14.8 mg/mi compared to 15.1 mg/mi in MOBILE6.2. The Volkswagen study estimated 1.6 mg/mi compared to 6.8 mg/mi in MOBILE6.2.

The 1989 Volkswagen study estimated an emission factor of 113 mg/mi for light-duty catalyst-equipped gasoline vehicles, similar to the 102 mg/mi for 3-way catalyst vehicles in MOBILE6.2. Fraser and Cass (1998) reported a comparable value based on measured NH₃ levels in the Van Nuys tunnel in Los Angeles during morning rush hour traffic in 1993. These authors estimated the NH₃ emissions from three-way dual-bed (3-way+oxidation) catalyst-equipped vehicles to be 116 mg/mi. Kean et al. (2000) estimated an emission factor of 78 mg/mi for light-duty catalyst-equipped gasoline vehicles (>94 percent 3-way catalyst) from measurements taken in the Caldecott Tunnel in the San Francisco Bay area. Finally, Becker et al. (1999) estimated an emission factor of 63 mg/mi from dynamometer tests on 1996 and 1997 Tier 1 catalyst-equipped vehicles.

Tier 0 standards, which applied to light-duty gasoline vehicles, took effect in the 1980's. Oxides of nitrogen standards were generally met using early three-way catalysts. Tier 1 standards set more stringent emission limits for light-duty vehicles, and were phased in between 1994 and 1997. Tier 1 NO_x standards generally have been met using advanced 3-way catalysts. Tier 1 emission limits for diesel vehicles are higher than those for gasoline vehicles. Also, higher emissions are allowed for heavier light-duty vehicles. Tier 2 standards, which will be phased in between 2004 and 2009, set emission limits more stringent than Tier 1. Under the Tier 2 standards, the same limits apply to all light-duty vehicle weight categories and fuel types. In

Table III-4. Other NH₃ Emission Factors Available in the Literature

Vehicle Type ¹	Fuel	Location	NH ₃ Emission Factor (mg/mi)	Notes	Reference
Light duty, catalyst	Gasoline	US - CA	78	Tunnel measurements, >94% with 3-way catalyst, vehicles using CA phase 2 reformulated gasoline (~10 ppm sulfur)	Kean et al., 2000
Light duty, catalyst	Gasoline	Europe	113 (40.7 to 185.5)	From 1989 Volkswagen AG study, FTP, 330 ppm fuel sulfur	Sutton et al., 2000
Light duty, catalyst	Gasoline	US - PA	15.1 (+/- 4.3)		Gertler et al., 2002 (as cited in Durbin et al., 2002)
Light duty, catalyst	Gasoline	US - CA	116	Tunnel measurements, 3-way or dual-bed catalysts (3-way+oxidation catalysts)	Fraser and Cass, 1998
Light duty, catalyst	Gasoline	US - CA	119	Dynamometer test, 1992 Tier 0 vehicle, FTP cycle, 30 ppm fuel sulfur level	Durbin et al., 2002
Light duty, catalyst	Gasoline	US - CA	86	Dynamometer tests, 1992 Tier 0 vehicle, FTP cycle, 330 ppm fuel sulfur level	Durbin et al., 2002
Light duty, catalyst	Gasoline	US - CA	210	Dynamometer tests, 1992 Tier 0 vehicle, US06 cycle, 30 ppm fuel sulfur level	Durbin et al., 2002
Light duty, catalyst	Gasoline	US - CA	161	Dynamometer tests, 1992 Tier 0 vehicle, US06 cycle, 330 ppm fuel sulfur level	Durbin et al., 2002
Fleet, catalyst	Gasoline	US - CA	33		Dickson et al., 1991 (from Gharib and Cass, 1984)
Light duty, oxidation catalyst	Gasoline	US	0.6 to 14.8	Chassis dynamometer tests, FTP	Cadle and Mulawa, 1980
Light duty, 3-way catalyst	Gasoline	US	63	Dynamometer tests, FTP, 1996-1997 Tier 1 vehicles,	Becker et al., 1999
Light duty, catalyst and noncatalyst	Gasoline	US - PA	2.1 (+/- 5.6)	Tunnel measurements, measured NH ₃ +NH ₄ ⁺ , 70% catalyst (mostly oxidation catalyst)	Pierson and Brachaczek, 1983
Light duty, noncatalyst	Gasoline	Europe	2.9 (1.9 to 4.4)	From 1989 Volkswagen AG study	Sutton et al., 2000
Fleet, noncatalyst	Gasoline	US - CA	4.6		Dickson et al., 1991 (from Gharib and Cass, 1984)
Light duty	Diesel	Europe	1.6 (0.5 to 2.7)	From 1989 Volkswagen AG study	Sutton et al., 2000
Heavy duty	Diesel	US - PA	8.4 +/- 2.4		Gertler et al., 2002
Heavy duty	Diesel	US - PA	40 +/- 9.6	Tunnel measurements, measured NH ₃ +NH ₄ ⁺ , some NH ₃ measured probably from livestock cargo	Pierson and Brachaczek, 1983
Fleet	Diesel	US - CA	3.1		Dickson et al., 1991 (from Gharib and

addition, standards were extended to cover vehicles in the new medium-duty passenger vehicle category.

Durbin et al. (2002) estimated a range of emission factors from dynamometer tests on a 1992 Tier 0 vehicle (86-210 mg/mi). These measurements show the variability of NH₃ emissions with fuel sulfur level and test cycle. Ammonia emissions were measured for fuel sulfur levels of 30 and 330 ppmv and for the FTP and US06 test cycles. The US06 test cycle is designed to represent more aggressive, high-speed driving than the FTP. These tests showed that NH₃ emissions increase with decreasing fuel sulfur and that higher-speed driving results in greater NH₃ emissions.

The MOBILE6.2 emission factor for heavy-duty diesel vehicles (27 mg/mi) is between the two other emission factors found in the literature. Gertler et al. (2002) estimated an emission factor of 8.4 mg/mi. Pierson and Brachaczek (1983) measured an emission factor of 40 mg/mi from measurements in the Allegheny Mountain Tunnel in Pennsylvania. However, these measurements include both NH₃ and NH₄⁺, and the authors suggested that some of the NH₃ emissions came from livestock, which was one of the chief cargos hauled by heavy-duty trucks in the area.

The NH₃ emission factors in MOBILE6.2 are recommended, because they are in the same range as other values reported in the literature. While emission factors from different studies vary, these variations are likely caused by variations in vehicle model, catalyst technology, test cycle, and fuel type.

2. Nonroad Mobile Sources

Nonroad mobile sources include exhaust emissions from a wide range of nonroad engines. These include construction equipment, agricultural equipment, lawn and garden equipment, commercial and recreational marine vessels, and locomotives. The EPA's NONROAD model is used to develop emission estimates for a large number of these engines (except commercial marine, aircraft, and locomotives); however it does not include emission factors to calculate NH₃ emissions (additional information on the NONROAD model can be found at: <http://www.epa.gov/otaq/nonrdmdl.htm>).

Available emission factors for nonroad engines have been derived from onroad vehicle testing (e.g., Garbe, 1981). Unlike highway vehicles, nonroad gasoline engines are typically not equipped with catalysts, so only results for noncatalyst vehicles are used in the development of emission factors. Most of the available emissions data for non-catalyst engines were published in the 1980's (EPA, 1981; Harvey, 1983; Volkswagen, 1989).

The EPA's Office of Transportation and Air Quality (OTAQ) recently reviewed the basis of NH₃ data summarized in a report entitled, "A Study of the Potential Impact of Some Unregulated Motor Vehicle Emissions" (Harvey, 1983). In conducting this review, OTAQ performed an analysis of the available light-duty noncatalyst engine data to develop defensible gasoline nonroad emission factors on a mg/gallon basis (Harvey, 2003). For gasoline noncatalyst engines, an emission factor value of 8.2 mg/mi was derived by averaging multiple tests with the worst malfunction conditions and weighting this average 25 percent, while average test data for non-malfunctioning engines were weighted 75 percent. Since the available activity data for nonroad engines is typically expressed as fuel consumption in

gallons, an emission factor on a mg/gallon basis was developed in a similar manner (i.e., weighting the nonmalfunction and malfunction results), by accounting for the reported fuel economy of each tested engine. This resulted in a value of 111 mg/gallon, which can be applied to fuel consumption estimates for 2-stroke and 4-stroke gasoline engines, as well as LPG engines. See Table III-5 for a summary of the engine data used to derive these weighted emission factors.

Table III-5 also contains the test information used to derive an average diesel nonroad engine emission factor. For the diesel emission factor no malfunctioning engine data were available to factor in to the average (Harvey, 2003).

Table III-5. Nonroad Gasoline and Diesel NH₃ Emission Factors Derived from Light-Duty Gasoline Noncatalyst Engines

Car #	FTP (without malfunctions)			FTP (malfunctions)			Weighted Emission Factor ^a	
	Fuel Economy, mpg	NH ₃ , mpg	NH ₃ , mpg	Fuel Economy, mpg	NH ₃ , mg/mi	NH ₃ , mg/gal	mg/mi	mg/gal
<i>Gasoline Engines</i>								
71	11.36	6.15	69.85	9.96	7.69	76.60	6.53	71.54
72	18.82	4.67	87.81	17.82	6.03	106.64	5.01	92.52
73	13.22	9.20	121.63	12.31	7.58	93.51	8.80	114.60
74	14.43	7.69	111.00	12.31	26.71	328.92	12.45	165.48
Avg	14.46	6.93	97.57	13.10	12.00	151.42	8.20	111.03
<i>Diesel Engines^b</i>								
12	40.0	1.70	68.00	-	-	-	1.70	68.00
13	36.0	5.14	185.04	-	-	-	5.14	185.04
14	43.0	1.47	63.21	-	-	-	1.47	63.21
15	41.0	1.79	73.39	-	-	-	1.79	73.39
16	26.0	0.88	22.88	-	-	-	0.88	22.88
17	26.0	3.75	97.50	-	-	-	3.75	97.50
18	27.0	2.70	72.90	-	-	-	2.70	72.90
Avg	34.1	2.49	83.27	-	-	-	2.49	83.27

Source: Harvey, 2003.

^a Value is weighted as 75 percent of the nonmalfunction value, and 25 percent of the malfunction value.

^b Fuel consumption data were not reported in the underlying report (Volkswagen, 1989), so the diesel miles per gallon (mpg) values are from the certification test results (unadjusted city) for these specific light-duty model year vehicles.

Recommended emission factors for nonroad engines are provided in Table III-6. The emission factors are the weighted average emission factors from Table III-5. These emission factors are assigned an E rating, since they are derived from test data for onroad vehicles and are applied to a wide range of

nonroad engine types (e.g., construction equipment, farming equipment, marine vessels, railroad engines).

Table III-6. Recommended NH₃ Emission Factors for Nonroad Engines

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
2260xxxxxx, 2265xxxxxx, 2280004xxx, 2282005xxx, 2282010xxx	Mobile Sources; Off Highway Vehicle Gasoline	2.44E-04	gallon fuel	E; source - Harvey, 2003.
2270xxxxxx, 2280002xxx, 2280003xxx, 2282020xxx, 2285002xxx	Mobile Sources; Off Highway Vehicle Oil	1.83E-04	gallon fuel	

D. BIOMASS COMBUSTION

Ammonia emissions from biomass combustion are dependent on the type of fuel and the type of combustion. There are several categories of biomass burning, including prescribed burning, wildfires, agricultural burning, land clearing, brush and leaf burning, and residential wood combustion. Prescribed burning involves the intentional burning of outdoor vegetation under controlled conditions to accomplish natural resource management objectives. A wildfire is a large-scale naturally occurring fire that consumes various ages, sizes, and types of vegetation. Open burning is the purposeful burning of materials in outdoor areas. Open burning subcategories include open burning of residential MSW, land clearing wastes, and yard (brush and leaf) wastes. Residential wood combustion is defined as wood burning that takes place primarily in woodstoves and fireplaces.

There are two main types of combustion: flaming and smoldering. Flaming combustion is the luminous, rapid reaction of oxygen with gases evolving from the solid biomass fuel. The heat of the flames cause more gases to evolve. Dry, small-diameter above-ground biomass tends to burn mostly by flaming. Smoldering combustion is a combination of surface oxidation (or gasification, commonly known as “glowing”) and pyrolysis (the thermal breakdown of solid fuel into gases), with a little bit of distillation mixed in. Large-diameter above-ground biomass and below-ground biomass tends to burn mostly by smoldering. Both types of combustion occur during a typical fire with a smoldering phase of combustion often dominating at the end of the fire episode.

Ammonia emissions from tests of wildfires and prescribed burns are primarily associated with smoldering combustion. However, it is not clear how much of the total NH₃ emissions are contributed from the degradation of nitrogen-containing compounds in the underlying soil versus nitrogen-containing compounds in the burning biomass. Emissions of NH₃ have been shown to be dependent on combustion efficiency, as well as fuel consumption. Combustion efficiency is defined as the fraction of carbon released from combustion in the form of carbon dioxide (CO₂):

$$CE = \frac{\Delta C_{CO_2}}{\Delta C_{CO_2} + \Delta C_{CO} + \Delta C_{CH_4} + \Delta C_{other}}$$

where: CE = combustion efficiency
 ΔC = the concentration of each compound in the fire off-gas minus the concentration in clean air (moles/m³); and
 other = total nonmethane hydrocarbons and particulate carbon (moles of carbon).

Combustion efficiency is higher under the flaming phase than during the smoldering phase of combustion. The higher combustion efficiency during the flaming phase leads to lower emission rates of NH₃ during this phase. Table III-7 provides a summary of emissions data from a recent report published by EPA (EC/R, 2002). The emission factor for forest fuels can be used to develop emission estimates for wildfires and prescribed burns in forested areas. This emission factor is an average of several measurements primarily carried out in coniferous forests. The “grasses and sage” average emission factor is also presented in Table III-7 for application to biomass burning of grasslands and shrublands.

Table III-7. Summary of NH₃ Emissions Data for Biomass Combustion

Source Description		MCE ^a	Ratio of NH ₃ to CO (mole-%)	Emission Factor (g/kg)
Forest fuels	Flaming	0.96		0.36 ± 0.39
	Smoldering	0.86		1.63 ± 1.48
	Overall	0.93	1.2 ± 0.9	0.63 ± 0.50
Grasses and sage	Flaming	0.97		0.078 ± 0.063
	Smoldering	0.90		0.61 ± 0.39
	Overall	0.93	2.6 ± 2.0	0.56 ± 0.60
All measurements			1.5 ± 1.2	0.70 ± 0.59

Source: EC/R, 2002.

^a Modified combustion efficiency (the ratio of the concentrations of CO₂ emitted by the fire to the total of CO₂ and CO).

Until more specific emissions data become available, the emission factor for forest fuels could be used to develop emission estimates for residential wood combustion and open burning of brush. Similarly, the emission factor for grasses and sage could be applied to generate emission estimates for agricultural burning. In situations where CO emissions have been estimated, but the underlying activity data are not available, NH₃ emissions can be estimated with the molar ratios provided in Table III-8:

$$E_{NH_3} = E_{CO} \times M \times \frac{17}{28}$$

where: E_{NH_3} = NH₃ emissions (tons/year);
 E_{CO} = CO emissions (tons/year);
 M = molar ratio of NH₃ to CO (unitless); and
 17/28 = molecular weight of NH₃ over the molecular weight of CO (gram/mole).

Table III-8 provides the recommended emission factors for biomass combustion. For application to wildfires and prescribed burns, the emission factors are given a D rating (due to the high degree of variability and the modest number of tests that have been performed). For application to other biomass combustion source categories, the emission factors are rated E.

For residential wood combustion, Pechan (2004) used information on CO:NH₃ ratios from EC/R (2002) to derive NH₃ emission factors for different types of equipment.

Table III-8. Recommended NH₃ Emission Factors for Biomass Combustion

SCC	Description	EF (lb/unit)	EF Unit	EF Rating; Notes
2810001xxx, 2810005xxx, 2810015xxx	Miscellaneous Area Sources; Other Combustion; Forested Areas	1.20E-03	lb fuel	D; source - EC/R, 2002.
2810001xxx, 2810005xxx, 2810015xxx	Miscellaneous Area Sources; Other Combustion; Grass- and Sage-lands	2.60E-03	lb fuel	
2104008001	Stationary Source Fuel Combustion; Residential; Wood; Fireplaces	1.80	ton wood	E; source - Pechan, 2004.
2104008051	Stationary Source Fuel Combustion; Residential; Wood; Non-catalytic Woodstoves: Conventional	1.70	ton wood	
2104008052	Stationary Source Fuel Combustion; Residential; Wood; Non-catalytic Woodstoves: Low Emitting	0.90	ton wood	
2104008053	Stationary Source Fuel Combustion; Residential; Wood; Non-catalytic Woodstoves: Pellet Fired	0.30	ton wood	
2104008060	Stationary Source Fuel Combustion; Residential; Wood; Boilers and Furnaces	1.80	ton wood	
2104008070	Stationary Source Fuel Combustion; Residential; Wood; Outdoor Equipment ^a	1.80	ton wood	
2610000xxx	Waste Disposal, Treatment, and Recovery; Open Burning; All Categories	1.20E-03	lb fuel	E; source - EC/R, 2002.
2801500xxx	Miscellaneous Area Sources; Agriculture Production - Crops; Agricultural Field Burning; Orchards, Forest Fuel Categories	1.20E-03	lb fuel	E; source - EC/R, 2002.
2801500xxx	Miscellaneous Area Sources; Agriculture Production - Crops; Agricultural Field Burning; Field Crop Categories	2.60E-03	lb fuel	E; source - EC/R, 2002.

^a Outdoor equipment includes - outdoor fireplaces, fire pits, wood-fired barbecues, and chimineas.

CHAPTER IV. RECOMMENDATIONS FOR FUTURE WORK

As shown in the preceding chapters, anthropogenic nonagricultural sources are generally small, in terms of annual emissions, yet numerous and cover a wide range of source sectors. This differs from natural and agricultural sources, which are characterized by relatively few source sectors and produce significant levels of emissions. Intuitively, it is the anthropogenic source sector that is the most important to characterize in situations where air quality in urbanized areas is evaluated (e.g., fine PM formation). For the most part, available emission factors for anthropogenic nonagricultural sources are based on few measurements and have a high degree of uncertainty. Research in the following areas would help in filling data gaps or in reducing the uncertainties in these NH₃ emission estimates:

- *Additional characterization of emissions from biosolids processes at POTWs and biosolids management activities:* additional measurements (e.g., through remote sensing or other techniques) are needed to provide a better understanding of emissions for various biosolids dewatering processes (e.g., sludge presses, sludge drying beds), and biosolids composting and land application;
- *Studies to identify and characterize additional emission sources in municipal sewage treatment systems:* specifically, identification and measurements of potential emission points outside of the POTW (e.g., pump/lift stations, vents);
- *Further evaluation of potentially important industrial, commercial, and municipal source categories:* for example, emissions from active MSW landfills are highly uncertain and potentially important at regional scales. Measurements are needed for landfills using varying daily cover materials (e.g. green waste, sewage sludge). Additional measurements are needed for cement kilns. These measurements need to be paired with process data to develop better estimation methods. Specifically, information on the nitrogen content of kiln feed materials is needed, so that this information can be incorporated within the emission estimation method;
- *Continued study and refinement of methods for estimating emissions from industrial refrigeration:* While direct surveys of sources that use ammonia-based refrigeration systems will continue to be the most accurate method for estimating emissions, this method is difficult to perform for large States or regions. The default employment-based emission factor provided in this guidance is based on a study in the South Coast Air Quality Management District of California, and its applicability to other areas of the U.S. is uncertain. This emission factor is thought to provide emission estimates accurate within an order of magnitude of the real value;
- *Additional information on the ammonia content of water-based surface coatings (especially architectural coatings):* very little information is available for the amount of ammonia used for pH adjustment in water-based coatings. The available information suggests

that ammonia emissions might not be significant from surface coatings; however more survey data are needed for verification; and

- *Additional study of biomass combustion:* currently, available information is taken from studies on wildfires and prescribed burns. Additional measurements for agricultural burns and residential wood combustion are needed.

CHAPTER V. REFERENCES

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**APPENDIX A. 2002 AMMONIA ACCIDENTAL RELEASE DATA
FROM THE NATIONAL RESPONSE CENTER**

DATE	STATE	COUNTY	COMPANY	TYPE OF FACILITY	ADDRESS	ZIP CODE	MATERIAL RELEASED	AMOUNT OF MATERIAL RELEASED	AMOUNT RELEASED UNITS
02/19/02	AK	ALEUTIAN ISLANDS	WESTWARD SEAFOODS	MANUFACTURING		996920608	AMMONIA, ANHYDROUS	6	POUND(S)
03/01/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	MANUFACTURING	KENAI PLANT		AMMONIA	100	POUND(S)
10/12/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	OTHER	KENAI PLANT	99611	AMMONIA, ANHYDROUS	0	UNKNOWN
12/26/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	OTHER	KENAI PLANT		AMMONIA, ANHYDROUS	100	POUND(S)
02/01/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	MANUFACTURING	KENAI PLANT	99611	AMMONIA, ANHYDROUS	4	BARREL(S)
02/18/02	AK	UNKNOWN	TRIDENT SEAFOOD	UNKNOWN	AKUTAN SHORE PLANT	99593	AMMONIA, ANHYDROUS	500	POUND(S)
02/19/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	UNKNOWN	KENAI PLANT	99611	AMMONIA, ANHYDROUS	100	BARREL(S)
03/01/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	OTHER	KENAI PLANT	99611	AMMONIA, ANHYDROUS	0	UNKNOWN
10/05/02	AK	ANCHORAGE	AGRIUM ALASKA DIV.	CHEMICAL	KENAI PLANT	99611	AMMONIA, ANHYDROUS	100	POUND(S)
08/04/02	AL	CALHOUN		UNKNOWN	BEAR BLVD		AMMONIA, ANHYDROUS	2,000	POUND(S)
06/23/02	AL	CLAY	TYSON FOODS	MANUFACTURING	515 TYSON ROAD	36251	AMMONIA, ANHYDROUS	100	POUND(S)
06/03/02	AL	COLBERT	CHEROKEE NITROGEN	MANUFACTURING	1080 INDUSTRIAL DRIVE	35616	AMMONIA, ANHYDROUS	2,000	POUND(S)
01/31/02	AL	ETOWAH	TYSON FOODS AND COMPANY	OTHER	501 PADDEN ROAD		AMMONIA, ANHYDROUS	100	POUND(S)
02/01/02	AL	ETOWAH	TYSON FOODS AND COMPANY	OTHER	501 PADDEN ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
05/07/02	AL	ETOWAH	TYSON FOODS AND COMPANY	OTHER	501 PADDEN ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
10/28/02	AL	ETOWAH	TYSON FOODS AND COMPANY	OTHER	501 PADDEN ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
11/10/02	AL	ETOWAH	TYSON FOODS	OTHER	501 PADEN ROAD	35903	AMMONIA, ANHYDROUS	0	UNKNOWN
01/22/02	AL	HOUSTON	TRI-STATE PLANT FOOD CO	MANUFACTURING	E. BURDESHAW STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
01/24/02	AL	HOUSTON	TRI STATE PLANT FOOD	MANUFACTURING	BURDESHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
01/31/02	AL	HOUSTON	TRISTATE PLANT FOOD COMPANY	MANUFACTURING	BURDESHAW ST		MIXTURE OF SULFUR AND AMMONIA	0	UNKNOWN
01/31/02	AL	HOUSTON	TRISTATE	CHEMICAL	BURDESHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
01/31/02	AL	HOUSTON	TRI-STATE PLANT FOOD CO	MANUFACTURING	BURDESHAW STREET		AMMONIA FUMES	0	UNKNOWN
02/09/02	AL	HOUSTON	TRI-STATE PLANT FOOD CO.	OTHER	805 EAGLE ROAD	36303	AMMONIA, ANHYDROUS	0	UNKNOWN
02/16/02	AL	HOUSTON	TRI STATE PLANT FOOD CO	UNKNOWN	1614 BURDESHAW STEET		AMMONIA, ANHYDROUS	0	UNKNOWN
02/20/02	AL	HOUSTON	TRI STATE PLANT FOOD CO	OTHER	1614 E. BIRDY SHAW ST.		SULPHUR AMMONIA	0	UNKNOWN
02/20/02	AL	HOUSTON	TRI STATE PLANT FOODS	FLARE STACK	BURDESHAW ST	36303	AMMONIA, ANHYDROUS	0	UNKNOWN
03/04/02	AL	HOUSTON	TRI STATE PLANT FOOD CO	MANUFACTURING	1615 EAST BURDUSHAW ST		AMMONIA FUMES	0	UNKNOWN
03/08/02	AL	HOUSTON	TRI STATE PLANT FOOD CO	MANUFACTURING	1614 E. BURDESHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
03/23/02	AL	HOUSTON	TRI-STATE PLANT FOOD CO.	OTHER	1614 E. BURDESHAW ST.		AMMONIA, ANHYDROUS	0	UNKNOWN
03/24/02	AL	HOUSTON	TRI STATE CHEMICAL PLANT FOOD	CHEMICAL	BUTTERSHAW STREET		AMMONIA	0	UNKNOWN
03/24/02	AL	HOUSTON	TRI STATE PLANT FOOD CO.	OTHER	1614 EAST BIRDESHAW ST.		AMMONIA, ANHYDROUS	0	UNKNOWN
05/02/02	AL	HOUSTON	TRI-STATE FOOD PLANT	OTHER	1400 BLOCK OF EAST BURDY SHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
05/08/02	AL	HOUSTON	TRI STATE FOOD PLANT	MANUFACTURING	805 EAGLE ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
06/04/02	AL	HOUSTON	TRI-STATE FOOD PLANT	MANUFACTURING	805 EAGLE ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
09/10/02	AL	HOUSTON	TRISTATE	CHEMICAL	BUDDYSHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
10/04/02	AL	HOUSTON	TRI-STATE FERTILIZER PLANT	MANUFACTURING	1615 BURDERSHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN

DATE	STATE	COUNTY	COMPANY	TYPE OF FACILITY	ADDRESS	ZIP CODE	MATERIAL RELEASED	AMOUNT OF MATERIAL RELEASED	AMOUNT RELEASED UNITS
10/04/02	AL	HOUSTON	TRI-STATE FOOD PLANT	OTHER	203 EMMONS DR		AMMONIA, ANHYDROUS	0	UNKNOWN
12/19/02	AL	HOUSTON	TRISTATE PLANT FOOD CO	OTHER	1315 EAST BURDESHAW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
05/07/02	AL	JEFFERSON	MRS STRATTONS SALADS	MANUFACTURING	380 INDUSTRIAL LANE		AMMONIA, ANHYDROUS	200	POUND(S)
11/12/02	AL	JEFFERSON	AMERICOLD LOGISTICS	OTHER	600 WEST 25TH AVE.	35204	AMMONIA, ANHYDROUS	0	UNKNOWN
06/11/02	AL	MARSHALL	ROBERTS ENGINEERING	UNKNOWN	655 4TH AVE NW	35016	AMMONIA, ANHYDROUS	0	UNKNOWN
01/11/02	AL	MOBILE	METAL-TEC HEAT TREATING INC	UNKNOWN	4723 WEST STATION ST	36613	AMMONIA, ANHYDROUS	300	GALLON(S)
02/11/02	AL	MOBILE	CELANESE	MANUFACTURING	14086 HWY 43 NORTH	36512	AMMONIA, ANHYDROUS	180	POUND(S)
07/24/02	AL	MOBILE	CS INTERGRATED LLC.	OTHER	2201 PERIMETER RD		AMMONIA, ANHYDROUS	100	POUND(S)
08/07/02	AL	MOBILE	DEGUSSA CORP.	OTHER	4201 DEGUSSA RD		AMMONIA, ANHYDROUS	339	POUND(S)
08/17/02	AL	MOBILE	DEGUSSA	CHEMICAL	4201 DEGUSSA RD.	36582	AMMONIA, ANHYDROUS	0	UNKNOWN
12/23/02	AL	MOBILE		MANUFACTURING	5213 HAMILTON BLVD		AMMONIA, ANHYDROUS	3,800	POUND(S)
09/19/02	AL	MONTGOMERY	WINN DIXIE LOGISTICS	OTHER	1550 JACKSON FERRY RD	36104	AMMONIA, ANHYDROUS (RELEASED IN LUBE OIL)	10	POUND(S)
02/25/02	AL	TUSCALOOSA	ALABAMA FOOD GROUP	UNKNOWN	2373 39TH STREET	35401	AMMONIA, ANHYDROUS	150	GALLON(S)
04/11/02	AL	WASHINGTON	CIBA SPECIALTY CHEM CORP	CHEMICAL	CIBA RD OFF HWY 43	36553	AMMONIA, ANHYDROUS	3,000	POUND(S)
04/25/02	AL	WILCOX	WEYERHAEUSER COMPANY	MANUFACTURING	7616 HWY 10 WEST	36769	AMMONIA	1,398	POUND(S)
02/07/02	AR	CALHOUNE	KOCH PIPELINE CO.	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
07/28/02	AR	CARROLL	TYSON FOODS	OTHER	601 TYSON DRIVE	72638	AMMONIA, ANHYDROUS	122	POUND(S)
08/03/02	AR	CARROLL	TYSON FOOD	MANUFACTURING	110 WEST FREEMAN		AMMONIA, ANHYDROUS	0	UNKNOWN
12/25/02	AR	CRAWFORD	SIMONS FOODS	OTHER	5 MAIN ST.	72957	AMMONIA, ANHYDROUS	0	UNKNOWN
09/07/02	AR	GARLAND	ARKANSAS MIDLAND RAILROAD	UNKNOWN	4285 MALVERN ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
09/07/02	AR	GARLAND	ARKANSAS MIDLAND RAILROAD	UNKNOWN	4285 MALVERN RD.		AMMONIA, ANHYDROUS	0	UNKNOWN
03/26/02	AR	HEMPSTEAD	TYSON FOODS	OTHER	275 COUNTY ROAD 278		AMMONIA, ANHYDROUS	0	UNKNOWN
09/11/02	AR	HEMPSTEAD	TYSON FOODS	OTHER	275 COUNTY ROAD 278	71801	AMMONIA, ANHYDROUS	0	UNKNOWN
01/22/02	AR	JEFFERSON	REDDY ICE CORP.	MANUFACTURING	2601 W. 6TH AVE		AMMONIA, ANHYDROUS	100	OTHER
02/19/02	AR	MISSISSIPPI	TERRA NITROGEN	UNKNOWN	6054 STATE HWY 18 EAST	75126	AMMONIA, ANHYDROUS	200	POUND(S)
08/11/02	AR	PULASKI	CMT, INC.	OTHER	4701 ASHER AVE.	72204	AMMONIA, ANHYDROUS	1,169	POUND(S)
10/16/02	AR	PULASKI	NE KEITH	OTHER	6109 LINDSEY ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
02/19/02	AR	SEBASTIAN	OK FOODS INC.	MANUFACTURING	N. 6TH STREET AND REED	72904	AMMONIA, ANHYDROUS	100	POUND(S)
02/28/02	AR	SEBASTIAN	ARKANSAS REFRIGERATED SER	OTHER	24 N. D ST		AMMONIA, ANHYDROUS	1,200	POUND(S)
06/30/02	AR	SEBASTIAN	OK FOODS INC.	OTHER	N. 6TH STREET AND REED	72904	AMMONIA, ANHYDROUS	1,000	POUND(S)
08/16/02	AR	SEBASTIAN	OWINS CORNING	UNKNOWN	5520 PLANTERS RD		AMMONIA, ANHYDROUS	823	POUND(S)
09/12/02	AS	UNKNOWN	STARKIST SAMOA INC.	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
06/17/02	AZ	LA PAZ		WAREHOUSE	44376 VICKSBURG RD		AMMONIA, ANHYDROUS	0	UNKNOWN
03/23/02	AZ	MARICOPA	SALT RIVER PROJECT	OTHER			AMMONIA, ANHYDROUS	500	POUND(S)
04/08/02	AZ	MARICOPA	UNITED DAIRY MEN OF ARIZONA	OTHER	2008 SOUTH HARDY DR		AMMONIA, ANHYDROUS	0	UNKNOWN

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06/03/02	AZ	MARICOPA		UNKNOWN	1301 EAST HARRISON ST		AMMONIA, ANHYDROUS	0	UNKNOWN
05/23/02	AZ	PIMA	FARMLAND INDUSTRIES	UNKNOWN	1255 SOUTH CAMPBELL		AMMONIA, ANHYDROUS	0	UNKNOWN
06/24/02	AZ	PIMA		UNKNOWN	PFE RAIL YARD		AMMONIA, ANHYDROUS	0	UNKNOWN
10/21/02	AZ	PINAL	HUERTA RANCH COOLING	OTHER	3990 ALSDORF ROAD	85231	AMMONIA, ANHYDROUS	40	POUND(S)
06/20/02	AZ	YUMA	PROBEDORA	UNKNOWN			AMMONIA, ANHYDROUS	80	POUND(S)
06/20/02	CA	ALAMEDA	UNITED STATES COLD STORAGE	WAREHOUSE	3300 400 DOWE AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
01/21/02	CA	CONTRA COSTA	BOC GASES	CHEMICAL	731 WEST CUTTING BLVD	94804	AMMONIA, ANHYDROUS	0	OTHER
06/01/02	CA	CONTRA COSTA	CHEVRON	FLARE STACK	841 CHEVRON WAY	94801	AMMONIA, ANHYDROUS	0	UNKNOWN
06/12/02	CA	CONTRA COSTA	CHEVRON	MANUFACTURING	841 CHEVRON WAY		AMMONIA, ANHYDROUS	0	UNKNOWN
04/13/02	CA	IMPERIAL	SIX STREET COOLING	OTHER	521 OLIVE STREET		AMMONIA, ANHYDROUS	100	GALLON(S)
01/15/02	CA	KINGS	MARQUEZ BROTHERS INTERNATIONAL	MANUFACTURING	612 6TH STREET		AMMONIA, ANHYDROUS	500	GALLON(S)
10/14/02	CA	LOS ANGELES	CHEVRON EL SEGUNDO	FLARE STACK	324 WEST EL SEGUNDO		AMMONIA, ANHYDROUS	0	UNKNOWN
05/26/02	CA	MONTEREY	MONTEREY FISH CO	OTHER	840 FIR AVE		AMMONIA, ANHYDROUS	1,500	POUND(S)
07/05/02	CA	MONTEREY	JM SMUCKER COMPANY	OTHER	423 SALINAS ROAD	95076	AMMONIA, ANHYDROUS	0	UNKNOWN
06/26/02	CA	ORANGE	LAROCHE INDUSTRIES	UNKNOWN	MICRO SEMI CORP		AMMONIA, ANHYDROUS	0	UNKNOWN
11/01/02	CA	PLACER	CALFIRON ANMONIA	OTHER	1600 VERNOR		AMMONIA, ANHYDROUS	0	UNKNOWN
12/01/02	CA	SACRAMENTO	CAPITAL STATION 65 COLD STORAGE	WAREHOUSE	424 N. 7TH STREET	95814	AMMONIA, ANHYDROUS	403	POUND(S)
03/17/02	CA	SAN BENITO	TELCO FOOD PRODUCTS INC.	OTHER	2111 WEST VALLEY BLVD		AMMONIA, ANHYDROUS	500	POUND(S)
07/29/02	CA	SAN DIEGO	MARINE CORP. RECRUIT DEPOT	UNKNOWN	MCRD SAN DIEGO		AMMONIA, ANHYDROUS	0	UNKNOWN
07/29/02	CA	SAN DIEGO	SITHE ENERGY	UNKNOWN	BUILDING 566 MCRD		AMMONIA, ANHYDROUS	400	POUND(S)
07/20/02	CA	SAN JOAQUIN	DELICATO VINEYARDS	MANUFACTURING	12001 SOUTH HWY 99	95336	AMMONIA, ANHYDROUS	100	POUND(S)
07/20/02	CA	SAN JOAQUIN	CAMPBELL SOUP SUPPLY CO	OTHER	760 INDUSTRIAL DR		AMMONIA, ANHYDROUS	350	POUND(S)
11/11/02	CA	SAN JOAQUIN		UNKNOWN	833 E. 8TH		AMMONIA, ANHYDROUS ODOR	0	UNKNOWN
05/07/02	CA	SONOMA	GEYSERS POWER CO LLC	OTHER			AMMONIA, ANHYDROUS	100	POUND(S)
10/13/02	CA	STANISLAUS	SIGNATURE FRUIT	OTHER	555 MARIPOSA RD		AMMONIA, ANHYDROUS	250	GALLON(S)
02/01/02	CA	SUTTER	YUBA CITY WATER RECLAMATION	UNKNOWN	302 BURNES DRIVE		AMMONIA SOLUTION	4,000	GALLON(S)
05/12/02	CA	TULARE	EXETER IVANHOE / MT WHITNEY COLD STORAGE	OTHER	121 1ST STREET	93221	AMMONIA, ANHYDROUS	40	GALLON(S)
04/22/02	CA	YOLO	AGRIUM COMPANY	UNKNOWN	3961 CHANNEL DR	95691	AMMONIA, ANHYDROUS	100	POUND(S)
01/22/02	CA	YUBA	EMMPAK	OTHER	1109 CHESNUT STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
01/30/02	CO	DENVER	KING SOOPERS	MANUFACTURING	60 YUMA STREET		AMMONIA, ANHYDROUS	4,200	POUND(S)
07/31/02	CO	DENVER	COMMERICAL REFRIGERATION	OTHER	1700 EAST FIRST AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
12/07/02	CO	DENVER	SAFEWAY	OTHER	4301 FOREST ST.	80216	AMMONIA, ANHYDROUS	2,500	POUND(S)
06/28/02	CO	JEFFERSON	COORS BREWING CO	MANUFACTURING	12TH AND FORD	80401	AMMONIA, ANHYDROUS	170	POUND(S)
06/08/02	CO	LA PLATA	BP	OTHER	2906 COUNTY RD 307		AMMONIA, ANHYDROUS	2,000	POUND(S)

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06/15/02	CO	MONTROSE		UNKNOWN	6600 ROAD		AMMONIA, ANHYDROUS	3,610	POUND(S)
03/29/02	CO	PROWERS	SOUTHEASTERN COLORADO COOP	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
05/15/02	CO	RIO BLANCO	AMERICAN SODA	OTHER	27989 COUNTY ROAD 5		AMMONIA, ANHYDROUS	2,000	POUND(S)
04/24/02	CO	WASHINGTON	MEARS FERTILIZER	MANUFACTURING	202 SOUTH WASHINGTON	80743	AMMONIA, ANHYDROUS	30	POUND(S)
08/01/02	CO	WELD	AMERICAN PRIDE CO OP	UNKNOWN	3600 STRASBURG MILE RD		AMMONIA, ANHYDROUS	4,000	POUND(S)
05/02/02	CT	HARTFORD	HP HOOD	UNKNOWN	1250 EAST ST.	6078	AMMONIA, ANHYDROUS	0	UNKNOWN
12/10/02	CT	LITCHFIELD	EBNER ASSOCIATES	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
08/29/02	CT	NEW LONDON	PFIZER	MANUFACTURING	445 EASTERN POINT ROAD		AMMONIA, ANHYDROUS	200	POUND(S)
10/29/02	DE	KENT	DOW REICHOLD SPECIALTY LATEX	MANUFACTURING	144 FORK BRANCH ROAD	19936	AMMONIA, ANHYDROUS	100	POUND(S)
12/05/02	DE	KENT	US COAL STORAGE	OTHER	419 MILFORD HARRINGTON HWY	19963	AMMONIA, ANHYDROUS	100	POUND(S)
01/02/02	DE	NEW CASTLE	MOTIVA	REFINERY	2000 WRANGLE HILL RD	19709	AMMONIA, ANHYDROUS	0	UNKNOWN
09/03/02	DE	NEW CASTLE	MOTIVA ENTERPRISES	REFINERY	2000 WRANGLER HILL RD	19709	AMMONIA	0	UNKNOWN
10/28/02	DE	NEW CASTLE	MOTIVA ENTERPRISES	MANUFACTURING	2000 WRANGLER HILL RD		AMMONIA, ANHYDROUS	0	UNKNOWN
06/29/02	DE	SUSSEX	MOUNTAIR FARMS INC.	MANUFACTURING	RAIL ROAD AVE	19975	AMMONIA, ANHYDROUS	100	POUND(S)
08/10/02	DE	SUSSEX	PERDUE FARMS	MANUFACTURING	200 SAVANNAH RD	19947	AMMONIA, ANHYDROUS	0	UNKNOWN
08/12/02	FL	ALACHUA		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/10/02	FL	BAY	ADMIRAL ICE	OTHER	1614 MCKENZIE ROAD		AMMONIA, ANHYDROUS	1,000	POUND(S)
03/14/02	FL	BREVARD	NASSAU	OTHER	NASSAU TA-C3	32899	AMMONIA, ANHYDROUS	140	POUND(S)
05/05/02	FL	BROWARD	PUBLIC SUPERMARKETS	OTHER	777 SW 12TH AVENUE	33442	AMMONIA, ANHYDROUS	0	UNKNOWN
06/03/02	FL	BROWARD	SERVICE COLD STORAGE	UNKNOWN	3220 S.W. 2ND AVE	33315	AMMONIA, ANHYDROUS	1,200	POUND(S)
11/06/02	FL	DADE	ASSOC GROCERIES OF FL INC	WAREHOUSE	7000 NW 32 AVENUE		AMMONIA, ANHYDROUS	200	POUND(S)
11/21/02	FL	DADE	SUPER BRAND DAIRY	OTHER	3000 NW 123 ST		AMMONIA, ANHYDROUS	50	POUND(S)
06/13/02	FL	DUVAL	PUBLIX SUPERMARKETS INC.	WAREHOUSE	9800 WEST BEAVER ST	32220	AMMONIA, ANHYDROUS	0	UNKNOWN
07/16/02	FL	DUVAL	TYSON FOODS	OTHER	5421 W. BEAVER STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
08/16/02	FL	DUVAL	PRIDE OF FLORIDA AND/OR 200 COLD STORAGE	UNKNOWN	1429 W. 16TH STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
08/15/02	FL	DUVAL	PRIDE	OTHER	1429 WEST 16TH ST		AMMONIA, ANHYDROUS	0	UNKNOWN
05/15/02	FL	GILCHRIST		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/14/02	FL	HAMILTON	PCS PHOSPHATE	UNKNOWN	COUNTY RD 137		AMMONIA, ANHYDROUS	2,000	POUND(S)
02/21/02	FL	HILLSBOROUGH	NITRAM	OTHER	36 AVE SOUTH AND 58 ST		AMMONIA, ANHYDROUS	0	UNKNOWN
02/27/02	FL	HILLSBOROUGH	LYKES BROTHERS	UNKNOWN	BOX 518	33564	AMMONIA, ANHYDROUS	100	POUND(S)
04/01/02	FL	HILLSBOROUGH	FARMLAND HYDRO-LP	UNKNOWN	3421 PORT SUTTON RD		AMMONIA, ANHYDROUS	0	UNKNOWN
08/12/02	FL	HILLSBOROUGH	IMC PHOSPHATES	UNKNOWN	4801 PORT SUTTON RD		AMMONIA, ANHYDROUS	0	UNKNOWN
10/18/02	FL	HILLSBOROUGH	CARGILL FERTILIZER	UNKNOWN	8813 HWY 41 S	33569	AMMONIA, ANHYDROUS	0	UNKNOWN
12/08/02	FL	HILLSBOROUGH	PERFORMANCE FOOD GROUP OF FLORIDA	OTHER	3150 NORTH GALLAGHER RD	33527	AMMONIA, ANHYDROUS	650	POUND(S)
05/08/02	FL	LAKE	CUTRALE CITRUS	OTHER	11 CLOUD ST.	34748	AMMONIA, ANHYDROUS	0	UNKNOWN

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09/11/02	FL	LAKE	SILVER SPRING CITRUS INC	MANUFACTURING	25411 MARE AVE		AMMONIA, ANHYDROUS	600	POUND(S)
06/01/02	FL	MADISON	DIXIE PACKERS	MANUFACTURING	STATE ROUTE 53 SOUTH	32340	AMMONIA, ANHYDROUS	0	UNKNOWN
02/25/02	FL	MANATEE	TROPICANA PRODUCTS	UNKNOWN	1001 13TH AVE EAST	34208	AMMONIA, ANHYDROUS	100	POUND(S)
07/04/02	FL	MANATEE	TROPICANA PRODUCTS INC	MANUFACTURING	1001 13TH AVE EAST	34208	AMMONIA, ANHYDROUS	0	UNKNOWN
08/22/02	FL	MANATEE	TROPICANA PRODUCTS	MANUFACTURING	1001 13TH AVE EAST	34208	AMMONIA, ANHYDROUS	0	UNKNOWN
09/01/02	FL	MANATEE	TROPICANA PRODUCTS	MANUFACTURING	1001 13TH AVE EAST		AMMONIA, ANHYDROUS	180	POUND(S)
09/01/02	FL	MANATEE	TROPICANA PRODUCTS	OTHER	1001 13TH AVE EAST		AMMONIA, ANHYDROUS	180	POUND(S)
09/19/02	FL	MANATEE	TROPICANA PRODUCTS	UNKNOWN	1001 13TH AVE EAST		AMMONIA, ANHYDROUS	103	POUND(S)
09/19/02	FL	MANATEE	TROPICANA PLANT	OTHER	1001 13TH AVE. EAST		AMMONIA, ANHYDROUS	0	UNKNOWN
09/12/02	FL	MONROE	POLAR ICE CORP	OTHER	3770 OVERSEAS HWY		AMMONIA, ANHYDROUS	0	UNKNOWN
11/22/02	FL	NASSAU	JEFFERSON-SMURFITT CORP.	MANUFACTURING	NORTH EIGHTH ST	32035	AMMONIA	162,046	POUND(S)
05/03/02	FL	ORANGE	US COLD STORAGE	OTHER	2540 SHADER RD.		AMMONIA, ANHYDROUS	0	UNKNOWN
05/03/02	FL	ORANGE	UNITED STATES COLD STORAGE	OTHER	2540 SHADER ROAD		AMMONIA, ANHYDROUS	825	POUND(S)
02/22/02	FL	PALM BEACH		UNKNOWN	UNKNOWN		AMMONIA (UNKNOWN TYPE)	0	UNKNOWN
04/25/02	FL	PINELLAS		OTHER	15TH AVE SOUTH EAST		AMMONIA, ANHYDROUS	0	UNKNOWN
04/25/02	FL	PINELLAS	BAMA SEA PRODUCTS	OTHER	1301 BAY STREET SE	33701	AMMONIA, ANHYDROUS	60	POUND(S)
11/29/02	FL	PINELLAS		OTHER	300 PINELLAS STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
12/03/02	FL	PINELLAS	BAMA SEA PRODUCTS	OTHER	756 28TH STREET SOUTH	33712	AMMONIA, ANHYDROUS	3	POUND(S)
04/14/02	FL	POLK	PUBLIX SUPERMARKETS	MANUFACTURING	BUILDING 25		AMMONIA, ANHYDROUS	0	UNKNOWN
07/03/02	FL	POLK	PUBLIX SUPERMARKETS	OTHER	3045 NEW TAMPA HWY	33802	AMMONIA, ANHYDROUS	20	POUND(S)
08/14/02	FL	POLK	LAKELAND ELECTRIC	UNKNOWN	2002 E. HWY 92	33801	AMMONIA, ANHYDROUS	141	POUND(S)
09/12/02	FL	POLK	FARMLAND HYRO, L.P.	UNKNOWN	CO RD 640	33830	AMMONIA, ANHYDROUS	100	POUND(S)
11/18/02	FL	POLK	CUTRALE CITRUS	OTHER	602 MCKEAN ST	33823	AMMONIA, ANHYDROUS	0	UNKNOWN
12/18/02	FL	POLK	CARGILL		4390 COUNTY RD 640	33830	AMMONIA, ANHYDROUS	0	UNKNOWN
12/18/02	FL	POLK	CARGILL FERTILIZER	MANUFACTURING	4390 COUNTY ROAD 640	33830	AMMONIA, ANHYDROUS	105	POUND(S)
02/26/02	FL	SANTA ROSA	AIR PRODUCTS AND CHEMICALS	CHEMICAL	4575 HWY 90 E	32571	AMMONIA, ANHYDROUS	0	UNKNOWN
05/21/02	FL	SANTA ROSA	AIR PRODUCTS AND CHEMICALS	CHEMICAL	4575 HWY 90 E	32571	AMMONIA, ANHYDROUS	0	UNKNOWN
08/27/02	FL	SANTA ROSA	AIR PRODUCTS AND CHEMICALS	CHEMICAL	4575 HWY 90 E	32571	AMMONIA	0	UNKNOWN
05/10/02	FL	WALTON	CSX	UNKNOWN	89 WEST MOSSEYHEAD	32434	AMMONIA, ANHYDROUS	0	UNKNOWN
09/04/02	FL	WASHINGTON		OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
09/11/02	GA	BARTOW	ANHEISER-BUSCH	FLARE STACK	100 BUSCH DR	30120	AMMONIA, ANHYDROUS	0	UNKNOWN
04/14/02	GA	BIBB		WAREHOUSE	235 NORTH WEST INDUSTRIAL BLVD		AMMONIA, ANHYDROUS	500	POUND(S)
07/25/02	GA	CHEROKEE	CONAGRA	OTHER	654 UNIVETER		AMMONIA, ANHYDROUS	0	UNKNOWN
07/25/02	GA	CHEROKEE	CONAGRA POULTRY	OTHER	654 UNIVERTA	30115	AMMONIA, ANHYDROUS	2,170	POUND(S)
01/07/02	GA	COFFEE	WAYNE FARMS-DUTCH HOUSE	MANUFACTURING	601 EAST JOHNSON ST	31533	AMMONIA, ANHYDROUS	0	UNKNOWN

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02/09/02	GA	FULTON	SUNDOR BRANDS	CHEMICAL	7000 LAGRANGE BLVD.	30336	AMMONIA, ANHYDROUS	0	UNKNOWN
07/24/02	GA	FULTON	REDDY ICE CORP.	OTHER	1578 E TAYLOR AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
07/24/02	GA	FULTON	REDDY ICE CORP	MANUFACTURING	1586 E TAYLOR AVE		AMMONIA, ANHYDROUS	10,000	POUND(S)
11/29/02	GA	FULTON	WAYNE FARMS	OTHER	5550 MALLORY RD.	30349	AMMONIA, ANHYDROUS	300	POUND(S)
06/25/02	GA	GWINNETT	BIRCHWOOD FOODS	OTHER	6009 GOSHEN SPRINGS RD	30071	AMMONIA, ANHYDROUS	0	UNKNOWN
10/30/02	GA	GWINNETT	PUBLIX SUPERMARKETS	OTHER	445 HURICANE TRAIL	30019	AMMONIA, ANHYDROUS	2	POUND(S)
08/19/02	GA	HALL	FIELDALE FARMS CORP.	OTHER	1540 MONROE DRIVE	30501	AMMONIA, ANHYDROUS	318	POUND(S)
08/20/02	GA	HALL	FIELDALE FARMS CORP.	MANUFACTURING	MONROE DR		AMMONIA, ANHYDROUS	40	POUND(S)
09/05/02	GA	HALL	FIELDALE FARMS CORP.	OTHER	956 DORSEY ST		AMMONIA, ANHYDROUS	40	POUND(S)
09/14/02	GA	HALL	PRIME PAK FOODS INCE	MANUFACTURING	2076 MEMORIAL PARK RD		AMMONIA, ANHYDROUS	1,500	POUND(S)
02/25/02	GA	LOWNDES	ARCHER DANIELS MIDLAND	OTHER	647 CLAY RD.		AMMONIA, ANHYDROUS	0	UNKNOWN
09/27/02	GA	LOWNDES	ARCHER DANIELS MIDLAND	MANUFACTURING	1841 CLAY ROAD		AMMONIA	100	POUND(S)
03/15/02	GA	MUSCOGEE	GEORGIA COLD STORAGE	OTHER	600 ANDREWS RD		AMMONIA, ANHYDROUS	600	POUND(S)
07/03/02	GA	RICHMOND	PCS NITROGEN	CHEMICAL	NO. 23 COLUMBIA NITROGEN		AMMONIA, ANHYDROUS	0	UNKNOWN
07/07/02	GA	RICHMOND	DFM CHEMICALS N. AMERICA	UNKNOWN	1 COLUMBIA NITROGEN	30903	AMMONIA, ANHYDROUS	210	GALLON(S)
07/09/02	GA	RICHMOND	DSM CHEMICALS	OTHER	1 COLUMBIA NITROGEN	30901	AMMONIA, ANHYDROUS	0	UNKNOWN
08/19/02	GA	RICHMOND	DSN CHEMICALS	OTHER	1 COLUMBIA NITROGEN		AMMONIA, ANHYDROUS	200	POUND(S)
07/15/02	GA	TERRELL	TYSON'S FOOD CORP	MANUFACTURING	514 INDUSTRIAL PARK	31742	AMMONIA, ANHYDROUS	0	UNKNOWN
04/08/02	GA	WARE	CSX TRANSPORTATION	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
12/03/02	GA	WASHINGTON			514 EAST MCCARTY		AMMONIA, ANHYDROUS	150	POUND(S)
02/01/02	GA	WHITFIELD	VULCAN PERFORMANCE CHEMICAL	UNKNOWN	134 PHELPS RD. SE		AMMONIA, ANHYDROUS	0	UNKNOWN
08/22/02	GU	GUAM	UNITED FISHERIES CORP	WAREHOUSE			AMMONIA, ANHYDROUS	80	POUND(S)
11/08/02	HI	HAWAII	MATSON	UNKNOWN			AMMONIA SOLUTION CLASS 8 UN 2672 PACKING GROUP THREE	0	UNKNOWN
04/17/02	IA	ALLAMAKEE		UNKNOWN	13593 160TH STREET		AMMONIA, ANHYDROUS	775	POUND(S)
11/12/02	IA	AUDUBON		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
05/10/02	IA	BLACK HAWK	CONAGRA	MANUFACTURING	2701 MIDPORT BLVD	50704	AMMONIA, ANHYDROUS	0	UNKNOWN
04/15/02	IA	BUCHANAN		UNKNOWN	UNION AVE		AMMONIA, ANHYDROUS	2,500	POUND(S)
04/18/02	IA	BUENA VISTA		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/18/02	IA	BUENA VISTA		UNKNOWN	570TH & 120TH		AMMONIA, ANHYDROUS	700	GALLON(S)
11/19/02	IA	BUENA VISTA	AG-PARTNERS	UNKNOWN	OFF OF M-36		AMMONIA, ANHYDROUS	0	UNKNOWN
02/06/02	IA	BUTLER	FARMERS CORP.	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/12/02	IA	CALHOUN		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/15/02	IA	CARROLL		UNKNOWN			AMMONIA, ANHYDROUS	3,500	POUND(S)
04/16/02	IA	CARROLL		UNKNOWN	22016 OLYMPIC AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
11/01/02	IA	CARROLL	FARMLAND FOODS	OTHER	401 N GRANT RD		AMMONIA, ANHYDROUS	16,088	POUND(S)
04/20/02	IA	CLAYTON		UNKNOWN	HWY 18 & 52		AMMONIA, ANHYDROUS	0	UNKNOWN
04/01/02	IA	DAVIS	NEW ALLIANCE FS	UNKNOWN			AMMONIA, ANHYDROUS	100	GALLON(S)

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04/12/02	IA	DECATUR		UNKNOWN			AMMONIA, ANHYDROUS	2,000	POUND(S)
11/19/02	IA	EMMET	STATELINE COOPERATIVE	UNKNOWN	4702 40TH AVE		AMMONIA, ANHYDROUS	100	POUND(S)
06/05/02	IA	FRANKLIN	KOCH PIPELINE	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/02/02	IA	GUTHRIE	SELF EMPLOYED FARMER	UNKNOWN	FIELD AREA		AMMONIA, ANHYDROUS	800	GALLON(S)
11/21/02	IA	HAMILTON	UNITED COOPERATIVE	UNKNOWN	1324 STREET	50595	AMMONIA, ANHYDROUS	0	UNKNOWN
11/21/02	IA	HAMILTON	HI VIEW UNITED CO-OP	UNKNOWN	D20 & HIGHWAY 17	50595	AMMONIA, ANHYDROUS	0	UNKNOWN
06/03/02	IA	HANCOCK	KOCH PIPELINE	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
06/17/02	IA	HANCOCK	KOCH PIPELINE CO LP	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
05/28/02	IA	HOWARD	ADVANTANGE FS INC.	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
02/06/02	IA	IDA	WILLIAMS ENERGY SERVICE	UNKNOWN	4876 260TH ST		AMMONIA, ANHYDROUS	2	BARREL(S)
05/15/02	IA	IDA	WILLIAMS ENERGY	FLARE STACK	4876 260TH STREET		AMMONIA, ANHYDROUS	2	BARREL(S)
05/07/02	IA	IOWA		UNKNOWN	1838 L AVENUE		AMMONIA, ANHYDROUS	2	TON(S)
06/17/02	IA	JONES	SWISS VALLEY FARMS	UNKNOWN	12202 150TH AVE.		AMMONIA, ANHYDROUS	0	UNKNOWN
11/18/02	IA	KOSSUTH	GOLD-EAGLE COOP	UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)
01/10/02	IA	LOUISE	IVP	OTHER	HWY 70 NORTH	52738	AMMONIA, ANHYDROUS	0	UNKNOWN
09/08/02	IA	LOUISE	IBP (IOWA BEEF PACKERS)	OTHER	HWY 70 N	52638	AMMONIA, ANHYDROUS	100	POUND(S)
04/11/02	IA	MILLS	FARM SERVICE COMPANY	UNKNOWN	808 DEPOT AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
04/11/02	IA	MILLS	FARM SERVICE CO.	UNKNOWN	808 DEPOT AVE		AMMONIA, ANHYDROUS	1,400	POUND(S)
04/11/02	IA	MILLS	FARM SERVICE CO.	UNKNOWN	808 DEPOT AVE		AMMONIA, ANHYDROUS	7,800	POUND(S)
03/28/02	IA	MONONA	WILLIAMS	OTHER	16653 HWY K45	51063	AMMONIA, ANHYDROUS	2	BARREL(S)
05/29/02	IA	MONONA	WILLIAMS	UNKNOWN	16653 HWY K45	51063	AMMONIA, ANHYDROUS	88	GALLON(S)
08/07/02	IA	MONROE	AJINOMOTO HEARTLAND INC.	MANUFACTURING	1 HEARTLAND DR.	52553	AMMONIATED WATER 4% SOLUTION.	100	GALLON(S)
09/09/02	IA	MONROE	NEW ALLIANCE FS	UNKNOWN	6281 160TH ST		AMMONIA, ANHYDROUS	0	UNKNOWN
09/11/02	IA	PALO ALTO	KOCH PIPELINE	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
12/13/02	IA	PLYMOUTH	WELLS DAIRY	OTHER	1191 18TH STREET		AMMONIA	0	UNKNOWN
07/15/02	IA	POCAHONTAS	WILLIAMS ENERGY SERVICES	OTHER	25224 530TH ST.	50574	AMMONIA, ANHYDROUS	2	BARREL(S)
12/03/02	IA	POCAHONTAS	WILLIAMS		25224 530TH ST		AMMONIA, ANHYDROUS	2	BARREL(S)
12/12/02	IA	POLK	IOWA PACKING COMPANY	OTHER	1801 SE MAURY		AMMONIA, ANHYDROUS	0	UNKNOWN
07/22/02	IA	SAC	EARLY'S FARMER CO	UNKNOWN	2217 230TH ST		AMMONIA, ANHYDROUS	300	POUND(S)
03/27/02	IA	SCOTT	BENSON FARMS INC	UNKNOWN	235TH ST		AMMONIA, ANHYDROUS	0	UNKNOWN
07/25/02	IA	STORY	HEART OF IOWA CO-OP	UNKNOWN			AMMONIA, ANHYDROUS	5	GALLON(S)
04/08/02	IA	VAN BURREN	CHEM GRO OF HOUGHTON	OTHER			AMMONIA, ANHYDROUS	18,000	POUND(S)
02/07/02	IA	WAPELLO	EXCEL CORP.	UNKNOWN	6000 SOUTH IOWA	52501	AMMONIA, ANHYDROUS	220	POUND(S)
09/28/02	IA	WAPELLO	EXCEL	OTHER	600 S IOWA AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
03/15/02	IA	WEBSTER		UNKNOWN	116 4TH ST. NW		AMMONIA, ANHYDROUS	0	UNKNOWN
04/10/02	IA	WEBSTER	FARMLAND INDUSTRIES	MANUFACTURING	3162 200TH STREET		AMMONIA, ANHYDROUS	400	POUND(S)
04/11/02	IA	WEBSTER		UNKNOWN	DAKOTA AVE & 360TH ST		AMMONIA, ANHYDROUS	0	UNKNOWN
05/07/02	IA	WEBSTER	FARMLAND INDUSTRIES	UNKNOWN	3162 200TH STREET	50501	AMMONIA, ANHYDROUS	200	POUND(S)

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06/19/02	IA	WEBSTER	FARMLAND INDUSTRIES	CHEMICAL	3162 200TH STREET	50501	AMMONIA, ANHYDROUS	1,000	POUND(S)
11/09/02	IA	WEBSTER	FARMERS CO-OP	UNKNOWN			AMMONIA, ANHYDROUS	650	GALLON(S)
11/12/02	IA	WEBSTER	FARMLAND INDUSTRIES	OTHER	3162 200TH STREET		AMMONIA, ANHYDROUS	1,000	POUND(S)
01/11/02	IA	WOODBURY	TERRA NITROGEN	CHEMICAL	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	100	POUND(S)
03/07/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	2,605	POUND(S)
04/10/02	IA	WOODBURY	TERRA NITROGEN	OTHER	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	100	POUND(S)
04/29/02	IA	WOODBURY	TERRA NITROGEN CO.	MANUFACTURING	1182 260TH ST.	51054	AMMONIA, ANHYDROUS	262	POUND(S)
04/30/02	IA	WOODBURY	TERRA NITROGEN	OTHER	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	50	POUND(S)
04/30/02	IA	WOODBURY	TERRA NITROGEN CO.	MANUFACTURING	1182 260TH ST.		AMMONIA, ANHYDROUS	264	POUND(S)
05/02/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	100	POUND(S)
05/07/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	1,600	POUND(S)
06/25/02	IA	WOODBURY	WILLAIMS ENERGY SERVICES	UNKNOWN	270TH ST & PORT NEAL		AMMONIA, ANHYDROUS	38	GALLON(S)
06/28/02	IA	WOODBURY	TERRA NITROGEN	FLARE STACK	1182 260TH ST	51054	AMMONIA, ANHYDROUS	100	POUND(S)
06/28/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH ST	51054	AMMONIA, ANHYDROUS	18,676	POUND(S)
07/10/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	1,000	POUND(S)
07/24/02	IA	WOODBURY	KOCH PIPELINE	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
08/04/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH STREET	51054	AMMONIA, ANHYDROUS	100	POUND(S)
08/08/02	IA	WOODBURY	TERRA NITROGEN	MANUFACTURING	1182 260TH ST	51054	AMMONIA, ANHYDROUS	0	POUND(S)
08/25/02	IA	WOODBURY	TERRA NITROGEN	CHEMICAL	1182 260TH ST	51054	AMMONIA, ANHYDROUS	3,000	POUND(S)
08/26/02	IA	WOODBURY	TERRA NITROGEN	CHEMICAL	1182 260TH ST		AMMONIA, ANHYDROUS	0	UNKNOWN
11/18/02	IA	WORTH	DAVIDSON FARMS INC.	UNKNOWN	2137 500TH ST		AMMONIA, ANHYDROUS	600	GALLON(S)
09/21/02	ID	MINIDOKA	JR SIMLOT CO	OTHER	HWY 30 N	83336	AMMONIA, ANHYDROUS	0	UNKNOWN
04/01/02	IL	BROWN	CROP PRODUCTION SERVICES	UNKNOWN			AMMONIA, ANHYDROUS	500	GALLON(S)
08/25/02	IL	BUREAU	MIDWEST TROPHY MANUFACTURING	UNKNOWN	615 SOUTH 6TH STREET	61356	AMMONIA, ANHYDROUS	250	POUND(S)
08/01/02	IL	CHAMPAIGN	ILLINI FS INCORPORATED	UNKNOWN	2470 COUNTY ROAD F 2700E		AMMONIA, ANHYDROUS	0	UNKNOWN
08/26/02	IL	CHRISTIAN	CHRISTAIN COUNTY FARMER SUPPLY	UNKNOWN		62546	AMMONIA, ANHYDROUS	0	UNKNOWN
08/30/02	IL	CHRISTIAN		UNKNOWN	294 NORTH 1700 EAST RD		AMMONIA, ANHYDROUS	50	POUND(S)
06/06/02	IL	CLARK		UNKNOWN			AMMONIA, ANHYDROUS	5,820	POUND(S)
06/25/02	IL	CLAY	GEORGE SMITH AG. SERV. INC	UNKNOWN	CO RD 300 E		AMMONIA, ANHYDROUS	0	UNKNOWN
11/14/02	IL	COLES	KOCH	OTHER	5051 EAST COUNTY 000 NORTH		AMMONIA, ANHYDROUS	100	POUND(S)
01/02/02	IL	COOK	PASCO BEVERAGE COMP.	UNKNOWN	1821 S. KILBOURN AVE	60623	AMMONIA, ANHYDROUS	0	UNKNOWN
01/29/02	IL	COOK	CISCO FOOD SVCS CHICAGO	OTHER	250 WIEBOLDT DR	60016	AMMONIA, ANHYDROUS	0	UNKNOWN
06/29/02	IL	COOK	ROGER BERMAN REALESTATE	OTHER	832 WEST FULTON MARKET ST	60607	AMMONIA, ANHYDROUS	0	UNKNOWN
11/29/02	IL	COOK	GONNELLA FROZEN PRODUCTS	OTHER	1117 EAST WILLIE RD		AMMONIA, ANHYDROUS	2,500	POUND(S)
11/29/02	IL	COOK	GONNELLA FROZEN PRODUCTS	OTHER	1117 EAST WILLIE RD		AMMONIA, ANHYDROUS	2,500	POUND(S)

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06/10/02	IL	CRAWFORD		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/17/02	IL	FULTON	RIVERLAND FS INC.	UNKNOWN	FULTON COUNTY HWY 26		AMMONIA, ANHYDROUS	850	GALLON(S)
04/13/02	IL	GREENE		UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)
09/08/02	IL	HANCOCK	WEST CENTRAL FS	UNKNOWN	WEST POINT		AMMONIA, ANHYDROUS	4,200	POUND(S)
11/24/02	IL	HANCOCK	CHEMGRO INC.	UNKNOWN			AMMONIA, ANHYDROUS	2,500	POUND(S)
04/22/02	IL	IROQUOIS	HERITAGE FS	OTHER			AMMONIA, ANHYDROUS	150	POUND(S)
06/23/02	IL	JEFFERSON	AGRIPRIDE FS INC	UNKNOWN	5815 E. ILLINOIS HWY 15		AMMONIA, ANHYDROUS	1,900	POUND(S)
12/23/02	IL	JEFFERSON			ROUTE 142		AMMONIA, ANHYDROUS	1,500	POUND(S)
09/01/02	IL	JO DAVIESS	PRIMERA FOODS	UNKNOWN	2125 ILLINOIS ROUTE 78 SOUTH	61085	AMMONIA, ANHYDROUS	0	UNKNOWN
02/08/02	IL	KANE	CONAGRA FOODS	OTHER	410 KIRK RD.	60174	AMMONIA, ANHYDROUS	0	UNKNOWN
06/04/02	IL	KANKAKEE		UNKNOWN	A FARM ON HWY 13		AMMONIA, ANHYDROUS	0	UNKNOWN
07/09/02	IL	LA SALLE	IBP INC	OTHER	621 EAST STEVENSON	61350	AMMONIA, ANHYDROUS	0	UNKNOWN
06/10/02	IL	LOGAN		UNKNOWN			AMMONIA, ANHYDROUS	275	GALLON(S)
05/08/02	IL	MACON	ARCHER DANIELS MIDLAND CO	MANUFACTURING	3883 FARIES PARKWAY	62525	AMMONIA, ANHYDROUS	0	UNKNOWN
06/27/02	IL	MARION	EFFINGHAM EQUITY	UNKNOWN	3533 TONTI ROAD	62881	AMMONIA, ANHYDROUS	375	GALLON(S)
04/09/02	IL	MCDONOUGH		UNKNOWN	1055 NORTH 500 RD	62367	AMMONIA, ANHYDROUS	0	UNKNOWN
07/24/02	IL	MORGAN	A.C. HUMKO	OTHER	1201 EAST MORTON RD		AMMONIA, ANHYDROUS	150	GALLON(S)
08/18/02	IL	MORGAN	SOUTHERN TOWING	UNKNOWN			AMMONIA, ANHYDROUS	25	POUND(S)
08/03/02	IL	MOULTRIE	LAKELAND FS INCORPORATED	UNKNOWN			AMMONIA, ANHYDROUS	370	POUND(S)
03/19/02	IL	OGLE	BLACKHAWK FS	UNKNOWN	CRESTON		AMMONIA, ANHYDROUS	20	POUND(S)
02/11/02	IL	ROCK ISLAND	CF INDUSTRIES	UNKNOWN	23300 RIVER ROAD		AMMONIA, ANHYDROUS	500	POUND(S)
04/16/02	IL	ROCK ISLAND		UNKNOWN			AMMONIA, ANHYDROUS	100	GALLON(S)
05/20/02	IL	ROCK ISLAND	IBP INCORPORATED	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
02/23/02	IL	SALINE	TWIN COUNTY SERVICE CO	UNKNOWN	55 BORLAND RD.		AMMONIA, ANHYDROUS	970	POUND(S)
07/14/02	IL	SANGAMON		UNKNOWN	13974 WATTS RD		AMMONIA, ANHYDROUS	4,000	POUND(S)
10/21/02	IL	SANGAMON	LINCOLN LAND FS INC.	UNKNOWN	FARMINGTON CEMETARY RD		AMMONIA, ANHYDROUS	4,200	POUND(S)
11/07/02	IL	STEPHENSON		UNKNOWN	7446 NORTH WADDAMS GROVE RD	61048	AMMONIA, ANHYDROUS	1,500	POUND(S)
06/08/02	IL	WASHINGTON	AGRIPRIDE FS INC	UNKNOWN	14443 ASPEN ROAD		AMMONIA, ANHYDROUS	3,500	POUND(S)
04/10/02	IL	WHITE	POSEY COUNTY CO-OP	UNKNOWN	HWY 1		AMMONIA, ANHYDROUS	1,800	POUND(S)
06/12/02	IL	WHITE	POSEY COUNTY CO-OP	UNKNOWN	2333 ILLINOIS HWY 1	62844	AMMONIA, ANHYDROUS	190	POUND(S)
06/29/02	IL	WILL	APOLO COLORS INC	MANUFACTURING	1550 MOUND ROAD	60436	AMMONIA, ANHYDROUS	5,000	POUND(S)
04/24/02	IL	WINNEBAGO	LANDMARK AGRONOMY	UNKNOWN	8411 FREEPORT RD	61024	AMMONIA, ANHYDROUS	10	POUND(S)
11/14/02	IN	BENTON	JASPER COUNTY COOP.	UNKNOWN	2802 WEST STATE RD 352		AMMONIA, ANHYDROUS	160	POUND(S)
04/12/02	IN	DAVISS	FARMER	UNKNOWN			AMMONIA, ANHYDROUS	200	GALLON(S)
06/14/02	IN	DE KALB		UNKNOWN			AMMONIA, ANHYDROUS	400	GALLON(S)
06/15/02	IN	DECATUR		UNKNOWN	5700 BLOCK OF NORTH COUNTY ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
06/21/02	IN	DECATUR		UNKNOWN	6652 WEST BASE ROAD		AMMONIA, ANHYDROUS	150	GALLON(S)

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10/09/02	IN	DECATUR	PREMERE AG	UNKNOWN	RURAL RT 5	47274	AMMONIA, ANHYDROUS	150	POUND(S)
09/11/02	IN	DELAWARE	FARMERS ELEVATOR	UNKNOWN	500 OAKVILLE ROAD	47367	AMMONIA, ANHYDROUS	100	POUND(S)
05/22/02	IN	DUBOIS		UNKNOWN	5688 S 245 E		AMMONIA, ANHYDROUS	900	GALLON(S)
05/28/02	IN	DUBOIS		UNKNOWN			AMMONIA, ANHYDROUS	650	GALLON(S)
06/22/02	IN	HENDRICKS		UNKNOWN	8758 NORTH STATE RD 75	46165	AMMONIA, ANHYDROUS	2,000	POUND(S)
05/21/02	IN	HUNTINGTON		UNKNOWN	8745 SOUTH 300 WEST		AMMONIA, ANHYDROUS	0	UNKNOWN
07/19/02	IN	HUNTINGTON	KOCH FERTILIZER STORAGE & TERMINAL	UNKNOWN	502 EAST HOSLER ST	46750	AMMONIA, ANHYDROUS	0	UNKNOWN
06/21/02	IN	JACKSON		UNKNOWN	104 NORTH FARMS BUREAU	47220	AMMONIA, ANHYDROUS	62	GALLON(S)
06/22/02	IN	JACKSON		UNKNOWN			AMMONIA, ANHYDROUS	2,500	POUND(S)
06/24/02	IN	JAY	AGBEST LLC	UNKNOWN	11191 WEST COUNTY ROAD 450 SOUTH		AMMONIA, ANHYDROUS	1,000	POUND(S)
05/01/02	IN	LA PORTE		OTHER			AMMONIA, ANHYDROUS	2,100	POUND(S)
05/31/02	IN	LA PORTE	ALEXANDER CHEMICAL CORP	UNKNOWN	KINGSBURY INDUSTRIAL PARK		AMMONIA, ANHYDROUS	140	POUND(S)
05/22/02	IN	LAKE		UNKNOWN	6413 WEST 101ST AVE	46307	AMMONIA, ANHYDROUS	850	GALLON(S)
06/19/02	IN	LAKE		UNKNOWN			AMMONIA, ANHYDROUS	1,000	POUND(S)
12/28/02	IN	LAKE					AMMONIA, ANHYDROUS	0	UNKNOWN
03/11/00	IN	MARION	MERCHANDISE WAREHOUSE	MANUFACTURING	1414 S WEST STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
05/13/02	IN	MARION	CONAGRA DAIRY FOODS	MANUFACTURING	4300 WEST 62ND STREET		AMMONIA, ANHYDROUS	200	POUND(S)
07/12/02	IN	MARION	KROGER INDIANAPOLIS BAKERY	UNKNOWN	6801 ENGLISH AVE		AMMONIA, ANHYDROUS	200	GALLON(S)
08/02/02	IN	MARION	ROYAL FOOD PRODUCTS	OTHER	2322 EAST MINNESOTA ST	46203	AMMONIA, ANHYDROUS	500	POUND(S)
10/26/02	IN	MARION	REILEY INDUSTRY	OTHER	1500 SOUTH TIBBS AVE		AMMONIA, ANHYDROUS	253	POUND(S)
06/10/02	IN	MIAMI	CON AGRA FOODS	OTHER	3311 SOUTH ST RD 19	46970	WASTE WATER CONTAINING AMMONIA	0	UNKNOWN
01/29/02	IN	MONTGOMERY	WESTLAND CO-OP	UNKNOWN	136 WEST	47968	AMMONIA, ANHYDROUS	200	POUND(S)
06/19/02	IN	MORGAN	GORE GRAIN CO	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
01/02/02	IN	NEWTON	ELWOOD LINE	UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)
05/29/02	IN	PIKE		UNKNOWN	HWY 56		AMMONIA, ANHYDROUS	1,000	POUND(S)
01/23/02	IN	POSEY	POSEY COUNTY COOP	UNKNOWN			AMMONIA, ANHYDROUS	10	GALLON(S)
04/01/02	IN	POSEY	POSEY COUNTY COOP	OTHER			AMMONIA, ANHYDROUS	875	POUND(S)
03/19/02	IN	RIPLEY	LAUGHERY VALLEY AG CO-OP	UNKNOWN	3994 SOUTH US 421	47042	AMMONIA, ANHYDROUS	500	POUND(S)
06/21/02	IN	RUSH	PREMIER AG	UNKNOWN	10820 SOUTH 1000 COUNTY RD WEST	46182	AMMONIA, ANHYDROUS	500	POUND(S)
04/10/02	IN	VERMILLION	ELI LILLY AND COMPANY	UNKNOWN	CLINTON LABORATORIES		AMMONIA, ANHYDROUS	100	POUND(S)
06/20/02	IN	VERMILLION		UNKNOWN			AMMONIA, ANHYDROUS	386	POUND(S)
10/30/02	KS	ALLEN	RUSSELL STOVER CANDIES	MANUFACTURING	1995 MARSHMELLOW LANE	66749	AMMONIA, ANHYDROUS	100	POUND(S)
06/27/02	KS	BARTON	GREAT BEND PACKING	UNKNOWN	30 SOUTHEAST 10 RD		AMMONIA, ANHYDROUS	100	POUND(S)
05/13/02	KS	BUTLER		OTHER	223 SOUTH ASH		AMMONIA, ANHYDROUS	2,500	POUND(S)
04/26/02	KS	DONIPHAN	AGRILANCE	OTHER	708 SOUTH 10TH ST		AMMONIA, ANHYDROUS	950	POUND(S)

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06/12/02	KS	DOUGLAS	FARMLAND INDUSTRIES	UNKNOWN	1608 N. 1400 RD	660469258	AMMONIA, ANHYDROUS	1,000	POUND(S)
09/30/02	KS	DOUGLAS	OTTAWA ASC.	UNKNOWN	1941 DIAGONAL RD		AMMONIA, ANHYDROUS	0	UNKNOWN
08/12/02	KS	FORD	FARMLAND INDUSTRY	OTHER	EAST HWY 50	67801	AMMONIA, ANHYDROUS	3,600	POUND(S)
08/27/02	KS	FORD	FARMLAND INDUSTRY	UNKNOWN	EAST HWY 50	67801	AMMONIA, ANHYDROUS	600	POUND(S)
10/24/02	KS	FORD	FARMLAND INDUSTRY	OTHER	EAST HWY 50		AMMONIA, ANHYDROUS	100	POUND(S)
11/15/02	KS	FORD	FARMLAND INDUSTRY	OTHER	EAST HWY 50	67801	AMMONIA, ANHYDROUS	500	POUND(S)
12/02/02	KS	FORD	FARMLAND INDUSTRY	MANUFACTURING	EAST HWY 50	67801	AMMONIA, ANHYDROUS	0	UNKNOWN
12/09/02	KS	FORD	FARMLAND INDUSTRY	MANUFACTURING	EAST HWY 50	67801	AMMONIA, ANHYDROUS	0	UNKNOWN
12/31/02	KS	FORD	FARMLAND INDUSTRY	MANUFACTURING	EAST HWY 50	67801	AMMONIA, ANHYDROUS	0	UNKNOWN
05/31/02	KS	GRANT	CROPLAND COOP INC	OTHER			AMMONIA, ANHYDROUS	772	POUND(S)
06/03/02	KS	HARVEY	MID KANSAS CO-OP	UNKNOWN			AMMONIA, ANHYDROUS	3,000	POUND(S)
01/14/02	KS	JOHNSON	EDGERTON FARMLAND	OTHER	612 EAST 3RD		AMMONIA, ANHYDROUS	0	UNKNOWN
04/17/02	KS	KIOWA	WILLIAMS	OTHER			AMMONIA, ANHYDROUS	21	GALLON(S)
04/17/02	KS	KIOWA	WILLIAMS	OTHER			AMMONIA, ANHYDROUS	21	GALLON(S)
07/11/02	KS	KIOWA	WILLIAMS MIDAMERICA NH3 PIPELINE	UNKNOWN			AMMONIA, ANHYDROUS	35	GALLON(S)
12/01/00	KS	LYON	IBP CORP	OTHER	IBP PLANT		AMMONIA, ANHYDROUS	0	OTHER
03/26/02	KS	LYON	IBP INC.	MANUFACTURING	2101 W 6TH AVE	66801	AMMONIA, ANHYDROUS	0	UNKNOWN
05/05/02	KS	LYON	IBP INC	OTHER	2101 WEST 6TH AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
05/14/02	KS	MONTGOMERY	FARMLAND INDUSTRIES	MANUFACTURING	701 EAST NORTH STREET		AMMONIA, ANHYDROUS	100	POUND(S)
06/21/02	KS	MONTGOMERY	FARMLAND INDUSTRIES	MANUFACTURING	701 EAST NORTH ST		AMMONIA, ANHYDROUS	100	POUND(S)
07/22/02	KS	MONTGOMERY	FARMLAND INDUSTRIES	FLARE STACK	701 EAST NORTH STREET	67337	AMMONIA, ANHYDROUS	100	POUND(S)
08/16/02	KS	MONTGOMERY	FARMLAND INDUSTRIES REFINERY	REFINERY	PO BOX 570	67337	AMMONIA	0	UNKNOWN
10/10/02	KS	MONTGOMERY	FARMLAND INDUSTRIES	OTHER	701 EAST NORTH STREET	67337	AMMONIA, ANHYDROUS	100	POUND(S)
12/06/02	KS	MONTGOMERY	FARMLAND INDUSTRIES	OTHER	701 EAST NORTH ST		AMMONIA, ANHYDROUS	100	POUND(S)
04/18/02	KS	OTTAWA		UNKNOWN	2395 NORTH 60TH RD		AMMONIA, ANHYDROUS	4,560	POUND(S)
01/14/02	KS	RENO	UAP FERTILIZER	MANUFACTURING	KANSAS HWY 96 AND HOLIDAY ST	67561	AMMONIA, ANHYDROUS	512	POUND(S)
01/17/02	KS	RENO	UAP FERTILIZER	MANUFACTURING	KANSAS HWY 96 AND HOLIDAY ST	67561	AMMONIA, ANHYDROUS	512	POUND(S)
01/21/02	KS	RENO	UAP FERTILIZER	MANUFACTURING	KANSAS HWY 96 AND HOLIDAY ST	67561	AMMONIA, ANHYDROUS	512	POUND(S)
01/24/02	KS	RENO	UAP FERTILIZER	MANUFACTURING	KANSAS HWY 96 AND HOLIDAY ST	67561	AMMONIA, ANHYDROUS	512	POUND(S)
01/29/02	KS	RENO	UAP FERTILIZER	MANUFACTURING	KANSAS HWY 96 AND HOLIDAY ST	67561	AMMONIA, ANHYDROUS	512	POUND(S)
04/10/02	KS	RENO		UNKNOWN			AMMONIA, ANHYDROUS	6,180	POUND(S)
07/14/02	KS	RENO		UNKNOWN	AM 465		AMMONIA, ANHYDROUS	0	UNKNOWN
09/26/02	KS	RENO	NICKERSON CO-OP	UNKNOWN	3819 SOUTH WHITE SIDE	67501	AMMONIA, ANHYDROUS	100	POUND(S)
06/28/02	KS	SALINE	TONY'S PIZZA SERVICE	MANUFACTURING	3019 SCANLAN AVE	67401	AMMONIA, ANHYDROUS	1,000	POUND(S)

DATE	STATE	COUNTY	COMPANY	TYPE OF FACILITY	ADDRESS	ZIP CODE	MATERIAL RELEASED	AMOUNT OF MATERIAL RELEASED	AMOUNT RELEASED UNITS
01/12/02	KS	SEDGWICK		UNKNOWN	4935 HEMLOCH PLACE		AMMONIA, ANHYDROUS	0	UNKNOWN
07/01/02	KS	SEDGWICK	FARMLAND INDUSTRIES	UNKNOWN	2323 SOUTH SHERIDAN	67123	AMMONIA, ANHYDROUS	0	UNKNOWN
12/03/02	KS	SEDGWICK	FARMLAND FOODS INC	OTHER	2323 S. SHERIDAN		AMMONIA, ANHYDROUS	100	POUND(S)
06/12/02	KS	STAFFORD	KANZA CO OPERTIVE	UNKNOWN	ROUTE 1 BOX 17		AMMONIA, ANHYDROUS	0	UNKNOWN
12/02/02	KS	WASHINGTON			YANKEE RD		AMMONIA, ANHYDROUS	0	UNKNOWN
11/04/02	KY	BOONE	KEEBLER COMPANY	OTHER	500 WEAVER ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
11/03/02	KY	BOONE	CROSSET COMPANY	UNKNOWN	10295 TOEBBEN DRIVE	41051	AMMONIA, ANHYDROUS	100	POUND(S)
07/09/02	KY	CAMPBELL	LOUIS TRAUTH DAIRY	OTHER		41071	AMMONIA, ANHYDROUS	100	POUND(S)
03/08/02	KY	DAVISS	FIELD PACKING CO.	MANUFACTURING	6 DUBLIN LN	42301	AMMONIA, ANHYDROUS	500	POUND(S)
06/25/02	KY	DAVISS	FIELD PACKING CO.	UNKNOWN	6 DUBLIN LN	42301	AMMONIA, ANHYDROUS	130	POUND(S)
08/26/02	KY	GREENUP	SUN CHEMICAL PCI I INC.	CHEMICAL	100 WURTS ROAD	41144	AMMONIA, ANHYDROUS	100	POUND(S)
12/11/02	KY	JEFFERSON	DEAN FOODS	OTHER	4420 BISHOP LN		AMMONIA	160	POUND(S)
06/11/02	KY	MARSHALL	CELANESE	CHEMICAL	408 NORTH MAINE STREET		AMMONIA, ANHYDROUS	32	POUND(S)
05/13/02	KY	MERCER	KENTUCKY UTILITIES COMPANY	POWER PLANT	E.W. BROWN GENERATION STATION		AMMONIA, ANHYDROUS	0	UNKNOWN
02/12/02	LA	ASCENSION	CF INDUSTRIES	UNKNOWN	HWY 3089	70346	AMMONIA, ANHYDROUS	200	POUND(S)
03/07/02	LA	ASCENSION	CF INDUSTRIES	MANUFACTURING	HWY 3089		AMMONIA, ANHYDROUS	1,000	POUND(S)
04/25/02	LA	ASCENSION	BASF CHEMICAL	CHEMICAL	8404 RIVER ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
06/12/02	LA	ASCENSION	PCS NITROGEN FERTILIZER	MANUFACTURING	HIGHWAY 30 AND HIGHWAY 3115		AMMONIA, ANHYDROUS	0	UNKNOWN
06/14/02	LA	ASCENSION	SOUTHERN TOWING CO	UNKNOWN			AMMONIA, ANHYDROUS	12	POUND(S)
07/22/02	LA	ASCENSION	BASF CORPORATION	OTHER	8404 RIVER RD	70734	AMMONIA, ANHYDROUS	0	UNKNOWN
08/26/02	LA	ASCENSION	TRIAD NITROGEN LLC.	FLARE STACK	39041 HWY 18 WEST		AMMONIA, ANHYDROUS	300	POUND(S)
09/15/02	LA	ASCENSION	TRIAD NITROGEN LLC.	OTHER	39041 HWY 18 WEST		AMMONIA, ANHYDROUS	100	POUND(S)
09/28/02	LA	ASCENSION	CF INDUSTRIES	MANUFACTURING	39018 HWY 3089		AMMONIA, ANHYDROUS	1,000	POUND(S)
10/01/02	LA	ASCENSION	CF INDUSTRIES	OTHER	39018 HWY 3089		AMMONIA, ANHYDROUS	10,000	POUND(S)
11/10/02	LA	ASCENSION	PCS NITROGEN FERTILIZER	UNKNOWN	HIGHWAY 30 AND HIGHWAY 3115		AMMONIA, ANHYDROUS	0	UNKNOWN
12/16/02	LA	ASCENSION	PCS NITROGEN FERTILIZER	CHEMICAL	HIGHWAY 30 AND HIGHWAY 3115	70734	AMMONIA, ANHYDROUS	0	UNKNOWN
05/10/02	LA	CALCASIEU	ARCH CHEMICAL	CHEMICAL	960 INTERSTATE 10W	70669	AMMONIA, ANHYDROUS	0	UNKNOWN
12/10/02	LA	E. BATON ROUGE	EXXON/MOBILE BATON ROUGE REFINERY	REFINERY	4045 SCENIC HWY	70805	AMMONIA, ANHYDROUS	0	UNKNOWN
12/18/01	LA	IBERVILLE	PCS NITROGEN	CHEMICAL	HWY 3315 AT HWY 30	70734	AMMONIA, ANHYDROUS	788	POUND(S)
07/19/02	LA	IBERVILLE		UNKNOWN	21255 LOUISIANA HWY 1		AMMONIA, ANHYDROUS	0	UNKNOWN
09/26/02	LA	JEFFERSON	CYTEC INDUSTRIES INC	FLARE STACK	10800 RIVER RD	70094	AMMONIA, ANHYDROUS	0	UNKNOWN
11/04/02	LA	JEFFERSON		OTHER	500 TIME SAVER AVE.	70123	AMMONIA, ANHYDROUS	500	GALLON(S)
11/14/02	LA	JEFFERSON	CYTEC INDUSTRIES INC	MANUFACTURING	10800 RIVER RD		AMMONIA, ANHYDROUS	100	POUND(S)
08/02/02	LA	LAFAYETTE	BORDEN MILK PRODUCTS	OTHER	1308 BERTRAND DRIVE	70506	AMMONIA, ANHYDROUS	100	POUND(S)
11/18/02	LA	LAFOURCHE		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN

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11/18/02	LA	LAFOURCHE	ST. VINCENT GULF SHRIMP COMPANY	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
02/26/02	LA	OUACHITA	KOCH NITROGEN COMPANY	FLARE STACK	6310 HORSESHOE LAKE RD	71203	AMMONIA, ANHYDROUS	0	UNKNOWN
04/30/02	LA	OUACHITA	KOCH NITROGEN CO	CHEMICAL	6310 HORSESHOE LAKE RD	71203	AMMONIA, ANHYDROUS	0	UNKNOWN
06/23/02	LA	OUACHITA	KOCH NITROGEN COMPANY	FLARE STACK	6310 HORSESHOE LAKE RD	71203	AMMONIA, ANHYDROUS	0	UNKNOWN
06/29/02	LA	OUACHITA	KOCH NITROGEN COMPANY	MANUFACTURING	6310 HORSESHOE LAKE RD	71203	AMMONIA, ANHYDROUS	0	UNKNOWN
07/17/02	LA	OUACHITA	KOCH NITROGEN COMPANY	MANUFACTURING	6310 HORSESHOE LAKE RD		AMMONIA, ANHYDROUS	0	UNKNOWN
07/22/02	LA	OUACHITA	KOCH NITROGEN COMPANY	FLARE STACK	6310 HORSESHOE LAKE RD		AMMONIA, ANHYDROUS	0	UNKNOWN
09/29/02	LA	OUACHITA	KOCH NITROGEN COMPANY	CHEMICAL	6310 HORSESHOE LAKE RD	71203	AMMONIA, ANHYDROUS	100	POUND(S)
01/23/02	LA	ST. CHARLES	KOCH NITROGEN	FLARE STACK	17000 RIVER RD	70057	AMMONIA, ANHYDROUS	0	UNKNOWN
06/26/02	LA	ST. CHARLES	DOW CHEMICAL	UNKNOWN	17000 RIVER RD	70057	AMMONIA, ANHYDROUS	274	POUND(S)
10/10/02	LA	ST. CHARLES	MONSANTO CO.	UNKNOWN	12501 RIVER ROAD	70070	AQUA AMMONIA	110	GALLON(S)
01/02/02	LA	ST. JAMES	MOTIVA ENTERPRISES	FLARE STACK	LA HWY 44 AT HWY 70	70723	AMMONIA, ANHYDROUS	350	POUND(S)
08/18/02	LA	ST. JAMES	MOTIVA ENTERPRISES	FLARE STACK	HWY 70 AT HIGHWAY 44	70723	AMMONIA	100	POUND(S)
11/13/02	LA	ST. JOHN THE BAPTIST	DUPONT	MANUFACTURING	586 HIGHWAY 44	700686912	AMMONIA, ANHYDROUS	100	POUND(S)
03/17/02	LA	TANGIPAHOA	SANDERSON FARMS	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
05/19/02	LA	TANGIPAHOA	TANNER INDUSTRIES	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
05/20/02	LA	TANGIPAHOA	TANNER INDUSTRIES	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
06/01/02	LA	UNION	KOCH PIPELINE	UNKNOWN	917 PLEASANT HILL RD.		AMMONIA, ANHYDROUS	0	UNKNOWN
08/08/02	MA	ESSEX		UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)
08/08/02	MA	ESSEX	MYSTICAL ROLLS	UNKNOWN	89 ROGER ST.	1930	AMMONIA, ANHYDROUS	0	UNKNOWN
07/28/02	MA	HAMPDEN	SPRINGFIELD FOOD SERVICE	OTHER	340 TAYLOR STREET	1101	AMMONIA, ANHYDROUS	100	POUND(S)
07/28/02	MA	HAMPDEN	SPRINGFIELD FOOD SERVICE	WAREHOUSE	340 TAYLOR ST		AMMONIA, ANHYDROUS	5,000	POUND(S)
09/25/02	MA	MIDDLESEX	NORTH SHORE ICE	MANUFACTURING	131 SPRING STREET		AMMONIA	0	UNKNOWN
03/04/02	MA	SUFFOLK	WADLEIGH AND ELLERY REALTY	OTHER	1 WADLEIGH PL.		AMMONIA, ANHYDROUS	10	POUND(S)
05/12/02	MA	SUFFOLK	NEW ENGLAND CONFECTIONARY CO.	OTHER	254 MASSACHUSETTES AVE.	2139	AMMONIA, ANHYDROUS	0	UNKNOWN
06/26/02	MA	SUFFOLK	AMERICOLD LOGISTICS	OTHER	100 WIDETT CIRCLE	2118	AMMONIA, ANHYDROUS	400	POUND(S)
06/19/02	MD	DORCHESTER	ALLEN FAMILY FOODS	OTHER	274 NEALSON STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
06/21/02	MD	DORCHESTER	COLD WATER SEAFOOD CORP	UNKNOWN	904 WOODS RD		AMMONIA, ANHYDROUS	79	POUND(S)
02/26/02	MD	HARFORD	TANNER INDUSTRIES		1750 CLARK ROAD	21078	AMMONIA, ANHYDROUS	0	UNKNOWN
08/19/02	MD	HARFORD	TANNER INDUSTRIES	UNKNOWN	1750 CLARK RD		AMMONIA, ANHYDROUS	20	GALLON(S)
12/31/02	MD	HARFORD	TANNER INDUSTRIES		1750 CLARK ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
03/18/02	MD	PRINCE GEORGES	SAFEWAY	MANUFACTURING	4525 ADDISION ROAD		AMMONIA, ANHYDROUS	1,000	POUND(S)
09/17/02	MD	WICOMICO	PURDUE FARMS INC	OTHER	WILLOW STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
02/19/02	ME	CUMBERLAND	SYSCO FOOD SVCS	UNKNOWN	55 THOMAS DR	4092	AMMONIA, ANHYDROUS	1,000	POUND(S)
10/12/02	ME	CUMBERLAND	AMERICOLD LOGISTICS	OTHER	165 READ ST.	4103	AMMONIA, ANHYDROUS	0	UNKNOWN

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10/15/02	ME	CUMBERLAND	FLORIDA POWER AND LIGHT ENERGY	POWER PLANT	677 COUSIN STREET		AMMONIA, ANHYDROUS	380	POUND(S)
11/30/02	ME	CUMBERLAND	AMERICO LOGISTICS	OTHER	165 READ STRET	4103	AMMONIA, ANHYDROUS	0	UNKNOWN
11/30/02	ME	CUMBERLAND	AMERICOLD CO.		165 READ ST		AMMONIA, ANHYDROUS	0	UNKNOWN
01/22/02	ME	OXFORD	HEBRON ACADEMY	UNKNOWN	ROUTE 119		AMMONIA, ANHYDROUS	0	UNKNOWN
03/06/02	MI	BERRIEN	LA PORTE COUNTY CO-OP	UNKNOWN	16724 BAKERTOWN ROAD	49107	AMMONIA, ANHYDROUS	0	UNKNOWN
06/04/02	MI	BERRIEN	OLD EUROPE CHEESE	UNKNOWN	1330 EAST EMPIRE AVE		AMMONIA, ANHYDROUS	800	POUND(S)
05/29/02	MI	BRANCH	ANDERSON	UNKNOWN		49094	AMMONIA, ANHYDROUS	1,000	POUND(S)
06/12/02	MI	BRANCH	NORTH CENTRAL COOP	UNKNOWN	220 WEST GARFIELD RD	49036	AMMONIA, ANHYDROUS	1,000	POUND(S)
12/09/02	MI	HILLSDALE		WAREHOUSE	1090 HOMER RD	49252	AMMONIA, ANHYDROUS	30	GALLON(S)
07/13/02	MI	LEELANAU	CHERRY GROWERS	OTHER	9440 CENTER HAY		AMMONIA, ANHYDROUS	2,500	POUND(S)
07/13/02	MI	LEELANAU	CHERRY GROWERS	OTHER		49684	AMMONIA, ANHYDROUS	0	UNKNOWN
10/09/02	MI	MIDLAND	DOW CHEMICAL	OTHER	47 MAIN ST		AMMONIA, ANHYDROUS	0	UNKNOWN
04/21/02	MI	OAKLAND	SPECIALTY STEEL TREATING INC.	OTHER	31610 WEST 8 MILE RD		AMMONIA, ANHYDROUS	355	POUND(S)
01/17/02	MI	WAYNE	ATOFINA	MANUFACTURING	17168 WEST JEFFERSON		AMMONIA, ANHYDROUS	100	POUND(S)
03/16/02	MI	WAYNE	NATIONAL STEEL CORPORATION	CHEMICAL	NUMBER 1 QUALITY DRIVE		AMMONIA	0	UNKNOWN
03/25/02	MI	WAYNE	SOLUTIA INC.	UNKNOWN	5045 WEST JEFFERSON	48183	AMMONIA, ANHYDROUS	0	UNKNOWN
04/21/02	MI	WAYNE	SPECIALTY STEEL TREATING	OTHER	31610 W. 8 MILE RD.	48336	AMMONIA, ANHYDROUS	0	UNKNOWN
04/18/02	MI	WAYNE	FARMERS COLD STORAGE	UNKNOWN	1921 EAST FERRY		AMMONIA, ANHYDROUS	0	UNKNOWN
06/27/02	MI	WAYNE	DAIRY FRESH	OTHER	TROLLEY DR		AMMONIA, ANHYDROUS	0	UNKNOWN
04/16/02	MI	WAYNE	FARMERS COLD STORAGE	UNKNOWN	1921 EAST FERRY STREET		AMMONIA, ANHYDROUS	1,000	POUND(S)
08/28/02	MI	WAYNE	NATIONAL STEEL CORP.	OTHER	ZUG ISLAND		AMMONIA, ANHYDROUS	0	UNKNOWN
09/11/02	MI	WAYNE	ATOOFINA CHEMICALS INC.	OTHER	17168 W JEFFERSON		AMMONIA, ANHYDROUS	0	UNKNOWN
09/14/02	MI	WAYNE	NATIONAL STEEL GREAT LAKES	OTHER	1 QUALITY DR	48229	AMMONIA, ANHYDROUS	0	UNKNOWN
10/19/02	MI	WAYNE	NATIONAL STEEL CORP	MANUFACTURING	1 QUALITY DRIVE	48229	AMMONIA	80	POUND(S)
11/19/02	MN	BLUE EARTH	WANTONWAN FARM SERVICE	UNKNOWN	COUNTY RD 18		AMMONIA, ANHYDROUS	400	GALLON(S)
10/31/02	MN	BROWN	FARMERS ELEVATOR CO	UNKNOWN			AMMONIA, ANHYDROUS	1,000	POUND(S)
03/15/02	MN	DAKOTA	EXCEL ENERGY	POWER PLANT	1400 EAST BLACK DOG RD		AMMONIA, ANHYDROUS	275	POUND(S)
06/10/02	MN	DAKOTA	COCA-COLA ENTERPRIZES	UNKNOWN	2750 EGANDALE BLVD		AMMONIA, ANHYDROUS	100	POUND(S)
06/30/02	MN	DAKOTA	CF INDUSTRIES	UNKNOWN	13040 PINE BEND TRAIL	55068	AMMONIA, ANHYDROUS	100	POUND(S)
07/18/02	MN	DAKOTA	FLINT HILLS RESOURCES	FLARE STACK	HWY 52 & 55	55077	AMMONIA, ANHYDROUS	200	POUND(S)
08/03/02	MN	DAKOTA	FLINT HILLS RESOURCES	REFINERY	12555 US HWY 52	55068	AMMONIA (NH3)	402	POUND(S)
08/30/02	MN	DAKOTA	CF INDUSTRIES	UNKNOWN	13040 PINE BEND TRAIL RD		AMMONIA, ANHYDROUS	0	UNKNOWN
10/17/02	MN	DAKOTA	EXCEL	OTHER	1400 E BLACK DOG RD		AMMONIA, ANHYDROUS	2,180	POUND(S)
04/17/02	MN	DODGE		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/14/02	MN	DODGE	CENTREL CO OP	UNKNOWN			AMMONIA, ANHYDROUS	3,080	POUND(S)
11/09/02	MN	FARIBAULT		UNKNOWN	COUNTY RD 15		AMMONIA, ANHYDROUS	5,940	POUND(S)
04/17/02	MN	FREEBORN	HAYWARD COOP	UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)

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04/09/02	MN	HENNEPIN	HUTCHINSON TECHNOLOGY	UNKNOWN	5905 TRENTON LANE NORTH	55442	AMMONIA, ANHYDROUS	212	POUND(S)
03/11/02	MN	HOUSTON		UNKNOWN	6435 HIGHWAY 14 EAST	55904	AMMONIA, ANHYDROUS	450	GALLON(S)
11/01/02	MN	LYON	SCHWAN'S SALES ENTERPRISES	OTHER	601 MICHIGAN RD.	56258	AMMONIA, ANHYDROUS	100	POUND(S)
04/18/02	MN	MARTIN	WATONWAN FARM SERVICE	UNKNOWN			AMMONIA, ANHYDROUS	300	POUND(S)
11/07/02	MN	NICOLLET	HWY AG SERVICES	UNKNOWN			AMMONIA, ANHYDROUS	2,000	POUND(S)
04/14/02	MN	OLMSTED	ALL AMERICAN COOP.	UNKNOWN	113 4TH STREET SE		AMMONIA, ANHYDROUS	100	POUND(S)
07/21/02	MN	OLMSTED	PACE DAIRY FOOD	UNKNOWN	2700 VALLEY HIGH DRIVE	55901	AMMONIA, ANHYDROUS	0	UNKNOWN
08/29/02	MN	OLMSTED	ALL AMERICAN COOP.	UNKNOWN	113 4TH STREET SE	55976	AMMONIA, ANHYDROUS	0	UNKNOWN
01/10/02	MN	PENNINGTON	CENEX HARVEST STATES	UNKNOWN	206 2ND STREET WEST		AMMONIA, ANHYDROUS	0	UNKNOWN
08/21/02	MN	PIPESTONE	ELLISON MEAT CO.	OTHER	1401 SIOUX	56156	AMMONIA, ANHYDROUS	0	UNKNOWN
10/26/02	MN	POLK	CENEX HARVEST STATES/MIDVALLEY GREEN	OTHER	HWY 75 SOUTH		AMMONIA, ANHYDROUS	1,500	GALLON(S)
11/07/02	MN	POPE	PERLISH LAKE COOPERATE	UNKNOWN			AMMONIA, ANHYDROUS	200	GALLON(S)
06/25/02	MN	SHERBURNE		UNKNOWN	17930 193RD AVE		AMMONIA, ANHYDROUS	500	GALLON(S)
05/30/02	MN	STEARNS	ASSOCIATED MILK PRODUCERS	UNKNOWN	200 RAILROAD STREET		AMMONIA, ANHYDROUS	300	POUND(S)
06/23/02	MN	STEARNS		UNKNOWN	26125 CNTY RD 201	56316	AMMONIA, ANHYDROUS	100	GALLON(S)
07/10/02	MN	STEARNS	MELROSE DAIRY PROTEINS	MANUFACTURING	1000 EAST KRAFT DR.	56352	AMMONIA	1,100	POUND(S)
07/10/02	MN	STEARNS	MELROSE DAIRY PROTEINS	MANUFACTURING	1000 EAST KRAFT DR.		AMMONIA	131	POUND(S)
08/27/02	MN	STEELE	SUN RICH INC	UNKNOWN	3824 SOUTHWEST 93RD ST		AMMONIA, ANHYDROUS	100	POUND(S)
09/03/02	MN	STEELE	SUN RICH INC	UNKNOWN	3824 SOUTHWEST 93RD ST	56046	AMMONIA, ANHYDROUS	150	GALLON(S)
08/19/02	MN	WABASHA	MEARS FERTILIZER	OTHER	409 SMITH ST		AMMONIA, ANHYDROUS	100	POUND(S)
08/28/02	MN	WATONWAN	TONY DOWNS FOODS	OTHER	418 BENZEL AVE		AMMONIA, ANHYDROUS	100	POUND(S)
05/20/02	MN	WILKIN	SIGCO SUN PRODUCTS	OTHER	1 MILE EAST OF BRECKENRIDGE		AMMONIA, ANHYDROUS	2,000	POUND(S)
03/23/02	MO	BATES		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/07/02	MO	BUCHANAN	VENTURA FOODS	MANUFACTURING	6000 INDUSTRIAL RD.	64504	AMMONIA, ANHYDROUS	1,100	POUND(S)
11/08/02	MO	BUCHANAN	ST. JOSEPHS FOODS	OTHER	5807 MICHELLE AVE.	64507	AMMONIA, ANHYDROUS	200	POUND(S)
11/08/02	MO	CARROLL	RAY CAROL COMAPNY	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
02/22/02	MO	GREENE	DEPARTMENT OF NATURAL RESOURCES	OTHER	2545 WEST FARM RD 34		AMMONIA, ANHYDROUS	100	POUND(S)
05/24/02	MO	GREENE	READY ICE - PACKAGED ICE	MANUFACTURING	2530 EAST LIVINGSON	65803	AMMONIA, ANHYDROUS	100	POUND(S)
05/24/02	MO	GREENE	READY ICE - PACKAGED ICE	UNKNOWN	2530 EAST LIVINGSON	65803	AMMONIA, ANHYDROUS	5,000	POUND(S)
07/18/02	MO	GREENE	NORTHROP GRUMMON INTERCONNECT TECH	MANUFACTURING	4811 WEST KEARNEY	65803	AMMONIA, ANHYDROUS	1,200	POUND(S)
03/19/02	MO	HARRISON	C.T.L. FARM SERVICE	UNKNOWN		64424	AMMONIA, ANHYDROUS	0	UNKNOWN
01/11/02	MO	JASPER		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
02/01/02	MO	JASPER	INLAND PRODUCTS	MANUFACTURING	545 NORTH MAIN		AMMONIA, ANHYDROUS	0	UNKNOWN
02/05/02	MO	JASPER	INLAND PRODUCTS	UNKNOWN	200 NORTH RIVER STREET		AMMONIA, ANHYDROUS	0	UNKNOWN
04/23/02	MO	JASPER	AMERICOLD LOGISTICS	WAREHOUSE	NO.1331 CIVIL WAR ROAD	64836	AMMONIA, ANHYDROUS	100	POUND(S)

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11/14/02	MO	MACON	CORP PRODUCTION SERVICES	OTHER			AMMONIA, ANHYDROUS	2,000	POUND(S)
01/09/02	MO	NEW MADRID	GOOD HUMOR BREYERS ICE CREAM	MANUFACTURING	1010 COUNTY LINE ROAD		AMMONIA, ANHYDROUS	1,500	POUND(S)
10/12/02	MO	NEWTON	TANNER INDUSTRIES	UNKNOWN	11723 LIME KILN DR.	64850	AMMONIA, ANHYDROUS	0	UNKNOWN
08/21/02	MO	OSAGE	MFA INC	OTHER		65201	AMMONIA, ANHYDROUS	1,040	POUND(S)
07/05/02	MO	PETTIS	TYSON FOODS	OTHER	19571 WITFIELD RD		AMMONIA, ANHYDROUS	160	POUND(S)
03/30/02	MO	RAY	RAY CARROLL COUNTY GRAIN	UNKNOWN			AMMONIA, ANHYDROUS	750	POUND(S)
03/04/02	MO	SALINE	EXCEL	OTHER	HWY 20 WEST	65340	AMMONIA, ANHYDROUS	0	UNKNOWN
03/05/02	MO	SALINE	ACME SUPPLY COMPANY	UNKNOWN			AMMONIA, ANHYDROUS	800	GALLON(S)
04/28/02	MO	SALINE	EXCEL	OTHER	HWY 20 WEST	65340	AMMONIA, ANHYDROUS	0	UNKNOWN
11/13/02	MO	SHELBY		UNKNOWN			AMMONIA, ANHYDROUS	2	TON(S)
04/04/02	MO	ST. CHARLES		UNKNOWN	OFF OF HWY T		AMMONIA, ANHYDROUS	2	TON(S)
02/08/02	MO	ST. LOUIS	SERVICE REPROGRAPHICS	UNKNOWN	1055 CASSENS INDUSRTRIAL COURT		AMMONIA, ANHYDROUS	0	UNKNOWN
06/05/02	MO	SULLIVAN	PREMIUM STANDARD FARMS	MANUFACTURING			AMMONIA, ANHYDROUS	0	UNKNOWN
03/06/02	MS	JACKSON	CHEVRON USA	FLARE STACK	HWY 611	39581	AMMONIA, ANHYDROUS	1,000	POUND(S)
03/08/02	MS	JACKSON	CHEVRON USA	UNKNOWN	HWY 611	39581	AMMONIA, ANHYDROUS	0	UNKNOWN
08/05/02	MS	JACKSON	MISSISSIPPI CHEMICAL CORP	OTHER	601 HWY 611	39567	AMMONIA, ANHYDROUS	800	POUND(S)
11/20/02	MS	LEAKE	CHOCTAW MAID FARMS	OTHER	3865 HWY 35 N		AMMONIA, ANHYDROUS	0	UNKNOWN
06/04/02	MS	SCOTT	TYSON FOODS	MANUFACTURING	110 CLEVELAND ST		AMMONIA, ANHYDROUS	0	UNKNOWN
04/11/02	MS	YAZOO	MISSCHEM NITROGEN LLC	OTHER	4612 HWY 49 EAST		AMMONIA, ANHYDROUS	2,095	POUND(S)
07/15/02	MS	YAZOO	MISSCHEM NITROGEN	MANUFACTURING	3612 HWY 49 EAST		AMMONIA, ANHYDROUS	200	POUND(S)
10/08/02	MT	GLACIER	HARVEST STATES	UNKNOWN	29 N CENTRAL		AMMONIA, ANHYDROUS	0	UNKNOWN
07/16/02	MT	LIBERTY	HARVEST STATES	UNKNOWN	HWY 2		AMMONIA, ANHYDROUS	10	POUND(S)
10/29/02	MT	YELLOWSTONE	EXXON MOBIL	REFINERY	700 EXXON RD		AMMONIA, ANHYDROUS	0	UNKNOWN
07/14/02	NC	BEAUFORT	NORFOLK SOUTHERN RAILROAD	UNKNOWN	HWY 33 WEST		AMMONIA, ANHYDROUS	0	UNKNOWN
04/30/02	NC	DUPLIN	CAROLINA TURKEY	MANUFACTURING	1628 GARNER'S CHAPEL ROAD		AMMONIA, ANHYDROUS	500	POUND(S)
06/26/02	NC	DUPLIN	CAROLINA TURKEY	MANUFACTURING	1628 GARNER'S CHAPEL ROAD	28365	AMMONIA, ANHYDROUS	744	POUND(S)
07/02/02	NC	DUPLIN	CAROLINA TURKEY	OTHER	1628 GARNER'S CHAPEL ROAD	28365	AMMONIA, ANHYDROUS	7,500	POUND(S)
08/13/02	NC	DUPLIN	CAROLINA TURKEY	OTHER	1628 GARNER'S CHAPEL ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
09/01/02	NC	DUPLIN	CAROLINA TURKEYS	OTHER	1628 GARNER CHAPEL ROAD		AMMONIA, ANHYDROUS	100	GALLON(S)
09/01/02	NC	DUPLIN	CAROLINA TURKEY	MANUFACTURING	1628 GARNER'S CHAPEL ROAD	28365	AMMONIA, ANHYDROUS	7,000	POUND(S)
11/20/02	NC	GUILFORD	HUNTER FARMS DAIRY	OTHER	1900 NORTH MAIN ST.	28120	AMMONIA, ANHYDROUS	300	POUND(S)
10/16/02	NC	MARTIN	PURDUE FARMS	OTHER	800 W GREEN		AMMONIA, ANHYDROUS	125	POUND(S)
08/03/02	NC	RICHMOND	PURDUE FARMS INC	MANUFACTURING	416 S LONG DRIVE		AMMONIA, ANHYDROUS	1,200	POUND(S)

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04/22/02	ND	GRAND FORKS	CENEX HARVEST STATES	UNKNOWN	406 MANVIL AVE		AMMONIA, ANHYDROUS	120	POUND(S)
05/12/02	ND	MERCER	DAKOTA GASIFICATION	UNKNOWN	N/A		AMMONIA, ANHYDROUS	187	POUND(S)
10/15/02	ND	NELSON		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/05/02	ND	RAMSEY	FARMLAND INDUSTRIES	OTHER	HWY 2		AMMONIA, ANHYDROUS	0	UNKNOWN
12/16/02	ND	STARK	S.W. AMMONIA				AMMONIA, ANHYDROUS	0	UNKNOWN
04/20/02	ND	STUTSMAN	CAVENDISH FARMS	OTHER	5855 3RD ST SE	58401	AMMONIA, ANHYDROUS	0	UNKNOWN
01/18/02	ND	WARD	CANADIAN PACIFIC RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
01/10/02	NE	ADAMS	CROP MATE COMPANY	FLARE STACK	4935 EAST J STREET	68901	AMMONIA, ANHYDROUS	468	POUND(S)
01/10/02	NE	ADAMS	AGRI COOP	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
06/05/02	NE	ADAMS	ARMOUR FOOD CO.	MANUFACTURING	2001 SUMMIT AVENUE	68901	AMMONIA, ANHYDROUS	0	UNKNOWN
11/27/02	NE	ADAMS	CONAGRA FOOD SERVICE	MANUFACTURING	2001 SUMMIT AVE		AMMONIA	24	POUND(S)
	NE	AURORA	KOCH FERTILIZER STORAGE AND TERMINAL CO	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
05/09/02	NE	BOX BUTTE	FARMERS CO-OP ELEVATOR CO	UNKNOWN	1012 LARAMIE STREET	69348	AMMONIA, ANHYDROUS	550	GALLON(S)
09/24/02	NE	BUFFALO		UNKNOWN	102 LINCOLN AVE	68869	AMMONIA, ANHYDROUS	0	UNKNOWN
01/15/02	NE	CHASE	UNITED AGRI PRODUCTS	MANUFACTURING	EAST HWY 6	69033	AMMONIA, ANHYDROUS	402	POUND(S)
08/11/02	NE	DAKOTA	BEEF PRODUCTS INC	OTHER	360 164TH ST		AMMONIA, ANHYDROUS	447	POUND(S)
04/25/02	NE	DEUEL	AGRILIANCE COMPANY	UNKNOWN			AMMONIA, ANHYDROUS	4,370	POUND(S)
08/13/02	NE	DIXON	MG WALDBAUM	OTHER	105 NORTH MAIN		AMMONIA, ANHYDROUS	1,600	POUND(S)
04/10/02	NE	DOUGLAS	MILLARD REFRIGERATED SVC	OTHER		68137	AMMONIA, ANHYDROUS	0	UNKNOWN
06/03/02	NE	DOUGLAS	MONKE BROTHERS FERTILIZER COMPANY INC.	UNKNOWN	WEST BENNINGTON	68044	AMMONIA, ANHYDROUS	35,000	POUND(S)
04/04/02	NE	FILMORE	DORCHESTER FARMERS COOP	UNKNOWN			AMMONIA, ANHYDROUS	7,900	POUND(S)
01/01/02	NE	GAGE	FARMLAND INDUSTRIES	CHEMICAL	21178 SW 89TH ROAD	68310	AQUA AMMONIA	0	UNKNOWN
02/06/02	NE	GAGE	WILLIAMS ENERGY SERVICES	UNKNOWN			AMMONIA, ANHYDROUS	70	GALLON(S)
02/06/02	NE	GAGE	WILLIAMS ENERGY SERVICES	UNKNOWN			AMMONIA, ANHYDROUS	20	GALLON(S)
02/07/02	NE	HAMILTON	KOCH FERTILIZER STORAGE AND TERMINAL CO	OTHER	5 MILES WEST OF AURORA		AMMONIA, ANHYDROUS	132	POUND(S)
02/07/02	NE	HAMILTON	KOCH FERTILIZER STORAGE AND TERMINAL CO	FLARE STACK			AMMONIA, ANHYDROUS	132	POUND(S)
09/18/02	NE	HAMILTON	KOCH FERTILIZER STORAGE AND TERMINAL	OTHER	1101 W HWY 34		AMMONIA, ANHYDROUS	0	UNKNOWN
09/21/02	NE	HAMILTON	FARMLAND INDUSTRIES INC	OTHER	5 MILES WEST OF AURORA ON HWY 34		AMMONIA, ANHYDROUS	0	UNKNOWN
10/02/02	NE	HOWARD	AGRILANCE	OTHER	1009 TWIN FORK LANE		AMMONIA, ANHYDROUS	2,500	POUND(S)
07/10/02	NE	KEARNEY	CARGILL INC.	UNKNOWN	HWY 6		AMMONIA, ANHYDROUS	650	POUND(S)
11/20/02	NE	LANCASTER	MIDWEST FARMERS COOP	UNKNOWN	1621 SOUTH 118TH		AMMONIA, ANHYDROUS	0	UNKNOWN
01/19/02	NE	MADISON	IBP INC	OTHER	1200 INDUSTRIAL PARK	57049	AMMONIA, ANHYDROUS	0	UNKNOWN
07/01/02	NE	OTOE	EXCEL EMPACK	MANUFACTURING	2601 INDUSTRIAL RD	68480	AMMONIA, ANHYDROUS	0	UNKNOWN
09/09/02	NE	OTOE	MID-WEST FARMER'S CO-OP	UNKNOWN	NEAR NE SPUR 66C		AMMONIA, ANHYDROUS	100	POUND(S)

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11/12/02	NE	PHELPS		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
07/03/02	NE	SAUNDERS	WILLIAMS ENERGY SERVICES	UNKNOWN			AMMONIA, ANHYDROUS	2	BARREL(S)
12/22/02	NE	SAUNDERS					AMMONIA, ANHYDROUS	800	POUND(S)
04/30/02	NE	SCOTTS BLUFF	AGRILIANCE	OTHER	PANHANDLE CO-OP		AMMONIA, ANHYDROUS	1,800	POUND(S)
11/15/02	NE	YORK	UNITED FARMERS CO-OP	UNKNOWN			AMMONIA, ANHYDROUS	100	POUND(S)
01/02/02	NJ	UNION	INFINEUM	CHEMICAL	BRUNSWICK AND PARK AVE	7036	AMMONIA, ANHYDROUS	102	POUND(S)
10/11/02	NV	HUMBOLDT	CYANCO	CHEMICAL	5505 CYANCO DRIVE	89445	AMMONIA, ANHYDROUS	2,000	POUND(S)
11/21/02	NY	ERIE	PERRYS ICE CREAM CO	OTHER	1 ICE CREAM PLAZA	14001	AMMONIA, ANHYDROUS	0	UNKNOWN
04/09/02	NY	STEUBEN		UNKNOWN	6 WILCOX ST	14826	AMMONIA, ANHYDROUS	3,150	GALLON(S)
04/22/02	NY	ULSTER	COCA-COLA ENTERPRIZES	OTHER	123 UPPER FALLS BLVD		AMMONIA, ANHYDROUS	80	POUND(S)
08/12/02	NY	ULSTER	CONSOLIDATED FRUIT PACKERS	UNKNOWN	14 SOUTH PUTT CORNERS ROAD		AMMONIA, ANHYDROUS	600	POUND(S)
10/05/02	OH	ALLEN	BP CHEMICAL	MANUFACTURING	1900 FORT AMANDA RD	45804	AMMONIA	0	UNKNOWN
10/22/02	OH	ALLEN	PCS NITROGEN	CHEMICAL	1900 FORT AMANDA ROAD	45802	AMMONIA	0	UNKNOWN
06/07/02	OH	ASHTABULA	PLASTICOLORS	MANUFACTURING	2600 MICHIGAN AVENUE	44005	AMMONIA, ANHYDROUS	100	POUND(S)
09/30/02	OH	AUGLAIZE	CENTRAL SOYA	MANUFACTURING	455 WEST MONROE ST	45869	AMMONIA, ANHYDROUS	500	POUND(S)
01/23/02	OH	CLARK	ALDI FOODS	WAREHOUSE	4400 SOUTH CHARLESTON PIKE	45502	AMMONIA, ANHYDROUS	0	UNKNOWN
06/22/02	OH	CUYAHOGA	WINTERHURST ICE RINK	OTHER	14740 LAKEWOOD HEIGHTS BLVD.		AMMONIA, ANHYDROUS	40	POUND(S)
10/05/02	OH	ERIE	NORFOLK SOUTHERN RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/27/02	OH	GREENE	SOUTHWEST LANDMARKS	OTHER	70 E. MAPLE ST.		AMMONIA, ANHYDROUS	100	GALLON(S)
07/28/02	OH	HAMILTON	COGNIS CORP.	MANUFACTURING	4900 ESTE AVE.		AMMONIA, ANHYDROUS	0	UNKNOWN
05/18/02	OH	JACKSON	LUIGINO'S	MANUFACTURING	100 EAST BROADWAY		AMMONIA, ANHYDROUS	100	POUND(S)
08/11/02	OH	LAKE	TANNER INDUSTRIES	OTHER	1966 FAIRPORT NURSERY ROAD	44077	AMMONIA, ANHYDROUS	0	UNKNOWN
04/26/02	OH	LICKING	GENERAL ELECTRIC	MANUFACTURING	611 O'NEILL DR SE	43025	AMMONIA, ANHYDROUS	0	UNKNOWN
06/17/02	OH	LICKING	H. W. MARTIN AND SON	UNKNOWN	11104 ITHICA ROAD		AMMONIA, ANHYDROUS	210	GALLON(S)
09/28/02	OH	MONTGOMERY	DMAX LTD	UNKNOWN	3100 DRYDEN ROAD	45439	AMMONIA, ANHYDROUS	100	POUND(S)
08/28/02	OH	MUSKINGUM	KELLOG'S	OTHER	1675 FAIRVIEW RD		AMMONIA, ANHYDROUS	0	UNKNOWN
11/25/02	OH	ROSS	MEADWESTVACO	MANUFACTURING	401 SOUTH PAINT ST	45601	AMMONIA	220	POUND(S)
01/20/02	OH	SCIOTO	ARISTECH CHEMICAL CORP.	CHEMICAL	1019 HAVERHILL-OHIO	45636	AMMONIA, ANHYDROUS	100	POUND(S)
07/12/02	OH	SCIOTO	NORFOLK SOUTHERN RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
08/23/02	OH	SHELBY	CARGILL	REFINERY	2400 INDUSTRIAL DR.	45365	AMMONIA, ANHYDROUS	200	POUND(S)
06/22/02	OH	STARK	FRESH MARK	MANUFACTURING	1600 HARMONT AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
07/27/01	OH	STARK	FRESH MARK	MANUFACTURING	1600 HARMONT AVE	44705	AMMONIA, ANHYDROUS	718	POUND(S)
06/22/02	OH	SUMMIT	REITER DAIRY	OTHER	1055 WOOSTER RD	44203	AMMONIA, ANHYDROUS	0	UNKNOWN
11/10/02	OH	VAN WERT	COOPER FARMS COOKED MEATS	MANUFACTURING	6793 US ROUTE 127 NORTH		AMMONIA, ANHYDROUS	0	UNKNOWN

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10/07/02	OK	ADAIR	TYSON FOODS	OTHER	HWY 51 EAST	74960	AMMONIA	100	POUND(S)
04/12/02	OK	CADDO	APACHE FARMER CO-OP	UNKNOWN	WEST FLOYD ST	73006	AMMONIA, ANHYDROUS	2,500	POUND(S)
08/09/02	OK	CADDO	APACHE FARMER CO-OP	UNKNOWN	WEST FLOYD ST		AMMONIA, ANHYDROUS	2,000	POUND(S)
03/05/02	OK	GARFIELD	FARMLAND INDUSTRIES	OTHER	FARMLAND RD		AMMONIA, ANHYDROUS	100	POUND(S)
05/28/02	OK	GARFIELD	FARMLAND INDUSTRIES	UNKNOWN	2 MILES SOUTH ON FARM LAND ROAD		AMMONIA, ANHYDROUS	101	POUND(S)
07/02/02	OK	GARFIELD	FARMLAND	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
08/06/02	OK	GARFIELD	FARMLAND INDUSTRIES	MANUFACTURING	HWY 412		AMMONIA, ANHYDROUS	100	POUND(S)
10/04/02	OK	GARFIELD	FARMLAND INDUSTRIES	MANUFACTURING	HWY 412 (4 MILES -E)		AMMONIA, ANHYDROUS	100	POUND(S)
08/25/02	OK	MCCURTAIN	TYSON FOODS INC	OTHER	PO BOX 220	74728	AMMONIA, ANHYDROUS	0	UNKNOWN
08/27/02	OK	MUSKOGEE	REDDY ICE CORP.	MANUFACTURING	541 NORTH CHEROKEE		AMMONIA, ANHYDROUS	100	POUND(S)
08/05/02	OK	OKLAHOMA	TANNER INDUSTRIES	UNKNOWN	6924 SOUTHEASTERN	73149	AMMONIA, ANHYDROUS	0	UNKNOWN
10/17/02	OK	OKLAHOMA	REDDY ICE CORP.	MANUFACTURING	5525 SW 29TH STREET		AMMONIA, ANHYDROUS	25	POUND(S)
12/30/02	OK	OKLAHOMA	HORMEL FOODS, INC.	MANUFACTURING	7300 SOUTHWEST 29TH ST		AMMONIA, ANHYDROUS	125	POUND(S)
06/30/02	OK	PAWNEE		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/12/02	OK	ROGERS	TERRA NITREN	OTHER	6606 EAST 540 RD	74017	AMMONIA, ANHYDROUS	524	POUND(S)
12/06/02	OK	ROGERS	TERRA NITROGEN	OTHER	6606 EAST 540 RD		AMMONIA, ANHYDROUS	100	POUND(S)
01/02/02	OK	TULSA	BAMA FROZEN DOUGH	MANUFACTURING	2435 N LEWIS AVE	74110	AMMONIA, ANHYDROUS	0	UNKNOWN
10/04/02	OK	TULSA	WILLIAMS PIPE LINE COMPANY	OTHER	66 ST NORTH/ HGWY 75		AMMONIA, ANHYDROUS	0	UNKNOWN
02/03/02	OK	WOODWARD	TERRA NITROGEN	FLARE STACK	1000 TERRA DRIVE	73801	AMMONIA, ANHYDROUS	101	POUND(S)
04/21/02	OK	WOODWARD	TERRA NITROGEN	CHEMICAL	1000 TERRA DRIVE	73801	AMMONIA, ANHYDROUS	100	POUND(S)
05/24/02	OK	WOODWARD	TERRA NITROGEN	CHEMICAL	1000 TERRA DRIVE		AMMONIA, ANHYDROUS	100	POUND(S)
10/16/02	OK	WOODWARD	TERRA NITROGEN	CHEMICAL	1000 TERRA DRIVE	73801	AMMONIA, ANHYDROUS	100	POUND(S)
05/12/02	OR	COLUMBIA	COASTAL ST.HELENS CHEMICAL	CHEMICAL	63149 COLUMBIA RIVER		AMMONIA, ANHYDROUS	100	POUND(S)
11/17/02	OR	COLUMBIA	COASTAL ST HELENS CHEMICAL	UNKNOWN	63149 COLUMBIA RIVER		AMMONIA, ANHYDROUS	0	UNKNOWN
12/21/02	OR	COLUMBIA	COASTAL ST. HELENS CHEMICAL COMPANY	OTHER	NORTH COLUMBIA HWY	97051	AMMONIA, ANHYDROUS	0	UNKNOWN
12/03/02	OR	LANE	GEORGIA PACIFIC RESINS		2665 HWY 99 NORTH	97402	AMMONIA HYDROXIDE	0	UNKNOWN
07/01/02	OR	LINN	GEORGIA PACIFIC	UNKNOWN	2190 OLD SALEM RD N.E.	97321	AMMONIA, ANHYDROUS	822	POUND(S)
09/28/02	OR	MULTNOMAH	JR SIMPLOT	CHEMICAL	14003 N. RIVERGATE BLVD	97203	AMMONIA, ANHYDROUS	0	UNKNOWN
05/03/02	OR	UMATILLA	J R SINPLOT COMPANY	OTHER	79319 SINPLOT ROAD	97838	AMMONIA, ANHYDROUS	1,600	POUND(S)
10/22/02	OR	UMATILLA	J R SINPLOT COMPANY	OTHER	79319 SINPLOT ROAD	97838	AMMONIA, ANHYDROUS	100	POUND(S)
11/12/02	OR	UMATILLA	ROCKY MOUNTAIN COLBY PIPE	OTHER	4650 MCKINNON RD.	97801	AMMONIA, ANHYDROUS	100	POUND(S)
04/22/02	PA	ALLEGHENY		CHEMICAL	400 STATE STREET	15025	AMMONIA, ANHYDROUS	700	POUND(S)
11/03/02	PA	ALLEGHENY	UNITED STATES STEEL	MANUFACTURING	400 STATE ST	15025	AMMONIA	1,000	POUND(S)
09/18/02	PA	BEAVER	NORFOLK SOUTHERN RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
08/07/02	PA	CARBON	LA ROCHE INDUSTRY	UNKNOWN	900 DELAWEAR AVE		AMMONIA, ANHYDROUS	0	UNKNOWN

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08/21/02	PA	CHESTER	H. J. HINES COMPANY LP	MANUFACTURING	700 OLD FERN HILL RD	19380	AMMONIA, ANHYDROUS	0	UNKNOWN
05/18/02	PA	DELAWARE	SUNCO MARKUS HOOK	REFINERY	2ND AND GREEN STREET	19061	AMMONIA, ANHYDROUS	0	UNKNOWN
08/01/02	PA	DELAWARE	CONCORD BEVERAGE LP	MANUFACTURING	CONCHESTER AND ALDEN		AMMONIA, ANHYDROUS	90	POUND(S)
03/09/02	PA	FAYETTE	METRO CHEMICAL CO	OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
07/28/02	PA	LEBANON	MURRY'S INC	OTHER	1501 WILLOW ST		AMMONIA, ANHYDROUS	0	UNKNOWN
08/11/02	PA	LEBANON	FARMERS PRIDE INC.	OTHER	154 W MAIN ST		AMMONIA, ANHYDROUS	80	POUND(S)
08/29/02	PA	LEHIGH	KRAFT FOODS	UNKNOWN	7352 INDUSTRIAL BLVD	18106	AMMONIA, ANHYDROUS	0	UNKNOWN
04/30/02	PA	MERCER	DEAN DIARY PRODUCTS	MANUFACTURING	1858 ONEIDA LANE	16150	AMMONIA, ANHYDROUS	0	UNKNOWN
03/10/02	PA	MONTGOMERY	ATEECO	OTHER	1717 PILLSBURY RD	18051	AMMONIA, ANHYDROUS	0	UNKNOWN
06/14/02	PA	MONTGOMERY	LONZA INCORPERATED	CHEMICAL	900 RIVER ROAD	19428	AMMONIA, ANHYDROUS	100	POUND(S)
04/29/02	PA	PHILADELPHIA	PHILADELPHIA WSE AND COLD STORAGE	OTHER	500 NORTH CHRISTOPHER COLUMBIS BLVD		AMMONIA, ANHYDROUS	100	POUND(S)
06/04/02	PA	PHILADELPHIA		MANUFACTURING	175 WEST OXFORD ST		AMMONIA, ANHYDROUS	2,000	POUND(S)
02/08/02	PA	SCHUYKILL	EXCEL CORP	UNKNOWN	65 GREEN MT. RD	18202	AMMONIA, ANHYDROUS	0	UNKNOWN
05/16/02	PA	SCHUYKILL	EXCEL CORP	MANUFACTURING	65 GREEN MT RD	18202	AMMONIA, ANHYDROUS	0	UNKNOWN
06/13/02	PA	SCHUYKILL	EXCEL CORP	MANUFACTURING	65 GREEN MOUNTAIN RD		AMMONIA, ANHYDROUS	0	UNKNOWN
05/08/02	PA	WASHINGTON		UNKNOWN	PLANT NUMBER 241	15033	AMMONIA, ANHYDROUS	0	UNKNOWN
11/04/02	PR	UNKNOWN		OTHER	ROW NUMBER 2		AMMONIA, ANHYDROUS	0	UNKNOWN
10/01/02	RI	NEWPORT	NEWPORT CREAMERY INC	OTHER	208 WEST MAIN RD		AMMONIA, ANHYDROUS	0	UNKNOWN
06/25/02	SC	ANDERSON	ANDERSON BAKERY	OTHER	433 SAYRE ST		AMMONIA, ANHYDROUS	182	POUND(S)
04/26/02	SC	CHARLESTON	TRIANGLE ICE COMPANY	MANUFACTURING	4287 SPRUILL AVE	29405	AMMONIA, ANHYDROUS	0	UNKNOWN
05/10/02	SC	CHARLESTON	TRIANGLE ICE COMPANY	MANUFACTURING	4287 SPRUILL AVE	29405	AMMONIA, ANHYDROUS	0	UNKNOWN
10/30/02	SC	CHEROKEE	CHEROKEE COUNTY COGENERATION PARTNERS LP	POWER PLANT	132 PEOPLES CREEK RD		AMMONIA VAPOR	20	POUND(S)
05/23/02	SC	DILLON	PURDUE FARMS INC	UNKNOWN	2047 HWY 9 WEST	29536	AMMONIA, ANHYDROUS	100	POUND(S)
03/26/02	SC	GREENVILLE	BOSCH REXROTH	UNKNOWN	8 SOUTH CHASE COURT		AMMONIA, ANHYDROUS	150	POUND(S)
08/23/02	SC	GREENWOOD	GREENWOOD PACKING	MANUFACTURING	1 PACKARD AVE	29646	AMMONIA, ANHYDROUS	100	POUND(S)
09/07/02	SC	SUMTER	GOLDKIST	OTHER	2050 HWY 15 SOUTH		AMMONIA, ANHYDROUS	75	POUND(S)
01/19/02	SD	EDMUNDS	REACTOR INCORP.	UNKNOWN	HWY 45 AND ALMA AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
04/22/02	SD	HUGHES	REACTOR INCORP.	MANUFACTURING	1919 EAST SIOUX	67501	AMMONIA, ANHYDROUS	0	OTHER
05/07/02	TN	CROCKETT	PICTSWEET FROZEN FOODS	UNKNOWN	10 PICTSWEET DRIVE		AMMONIA, ANHYDROUS	100	POUND(S)
11/09/02	TN	CROCKETT	PICTSWEET FROZEN FOODS	MANUFACTURING	10 PICTSWEET DRIVE	38006	AMMONIA, ANHYDROUS	100	POUND(S)
01/02/02	TN	DAVIDSON	FLEMMING COMPANIES INC.	MANUFACTURING	500 S CARTWRIGHT ST	37072	AMMONIA, ANHYDROUS	400	POUND(S)
08/06/02	TN	DAVIDSON	REFRIGERATION SYSTEMS CO	OTHER	1905 HACKWORTH		AMMONIA, ANHYDROUS	300	POUND(S)
09/18/02	TN	GIBSON	AMERICAN COLD STORAGE	OTHER	WEST MULLINS STREET		AMMONIA	150	POUND(S)
09/18/02	TN	GIBSON	AMERICAN COLD STORAGE	OTHER	965 MULLINS	38343	AMMONIA, ANHYDROUS	150	POUND(S)
10/31/02	TN	HAMILTON	NORFOLK SOUTHERN RAILWAY	UNKNOWN	1600 RIVERSIDE DRIVE		AMMONIA, ANHYDROUS	0	UNKNOWN
11/14/02	TN	KNOX		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
11/15/02	TN	KNOX	NORFOLK SOUTHERN RAILROAD	UNKNOWN	7208 OLD RUTLEDGE PARK		AMMONIA, ANHYDROUS	0	UNKNOWN

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04/16/02	TN	LOUDON	PRAXAIR INC.	OTHER	139 BLAIR BEND DR		AMMONIA, ANHYDROUS	450	POUND(S)
01/06/02	TN	SHELBY	PCS NITROGEN	MANUFACTURING	5790 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	0	UNKNOWN
01/19/02	TN	SHELBY	PCS NITROGEN	UNKNOWN	5790 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	0	UNKNOWN
02/27/02	TN	SHELBY	PCS NITROGEN	MANUFACTURING	5790 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	0	UNKNOWN
03/04/02	TN	SHELBY	AIR LIQUIDE AMERICA CORP	OTHER	5808 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	300	POUND(S)
03/06/02	TN	SHELBY	PCS NITROGEN	OTHER	5790 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	0	UNKNOWN
03/23/02	TN	SHELBY	COORS	MANUFACTURING	5151 EAST RAINES		AMMONIA, ANHYDROUS	0	UNKNOWN
05/28/02	TN	SHELBY	PCS NITROGEN	MANUFACTURING	5790 OLD MILLINGTON RD	38053	AMMONIA, ANHYDROUS	0	UNKNOWN
10/16/02	TN	SHELBY	PCS NITROGEN	UNKNOWN	5790 OLD MILLINGTON RD		AMMONIA, ANHYDROUS	0	UNKNOWN
11/05/02	TN	SHELBY		MANUFACTURING	5808 OLD MILLINGTON RD		AMMONIA, ANHYDROUS	100	POUND(S)
12/12/02	TN	SHELBY	AGRILIANCE, LLC	OTHER	2256 WHARF STREET	38113	AMMONIA SULFUR	5	TON(S)
12/12/02	TN	SHELBY	PCS NITROGEN	OTHER	5790 OLD MILLINGTON RD		AMMONIA, ANHYDROUS	0	UNKNOWN
02/25/02	TX	BRAZORIA	SOLUTIA CHOCOLATE BAYOU	UNKNOWN	FM 2917	77512	AMMONIA, ANHYDROUS	100	POUND(S)
05/08/02	TX	BRAZORIA	HUNTSMAN	OTHER	307 COUNTY RD. 624	77541	AMMONIA, ANHYDROUS	1,167	POUND(S)
05/29/02	TX	BRAZORIA	SOLUTIA INC.	CHEMICAL	2917 FARM ROAD	77512	AMMONIA, ANHYDROUS	101	POUND(S)
07/20/02	TX	BRAZORIA	BP CHEMICAL CHOCOLATE BAYOU WORKS	FLARE STACK	FM 2004 2 MILES SOUTH OF FM 2917	77511	AMMONIA, ANHYDROUS	115	POUND(S)
08/15/02	TX	BRAZORIA	SOLUTIA	FLARE STACK	FM 20917		AMMONIA, ANHYDROUS	193	POUND(S)
09/13/02	TX	BRAZORIA	BASF CORP	UNKNOWN	602 COPPER RD	77541	AMMONIA, ANHYDROUS	0	UNKNOWN
09/13/02	TX	BRAZORIA	HUNTSMAN	MANUFACTURING	307 COUNTY RD. 624		AMMONIA	1,629	POUND(S)
12/05/02	TX	BRAZORIA	AIR LIQUIDE	MANUFACTURING	2398 VICTORIA ST	77541	AEQUEOUS AND VAPORIZED AMMONIA	3,000	POUND(S)
04/12/02	TX	CALHOUN	FORMOSA PLASTICS	OTHER	201 FORMOSA DRIVE	77978	AMMONIA, ANHYDROUS	0	UNKNOWN
12/10/02	TX	CALHOUN	FORMOSA PLASTICS	MANUFACTURING	201 FORMOSA DRIVE	77978	AMMONIA, ANHYDROUS	0	UNKNOWN
07/22/02	TX	CHAMBERS	BAYER INCORPORATED	MANUFACTURING	8500 W. BAY RD.	77520	AMMONIA	655	POUND(S)
09/29/02	TX	DALLAS	SYSCO FOOD SERVICE OF DALLAS	OTHER	14310 GILLIS ROAD	75244	AMMONIA, ANHYDROUS	300	POUND(S)
01/16/02	TX	EL PASO	REDDY ICE CORP.	UNKNOWN	1621 TEXAS AVE		AMMONIA, ANHYDROUS	20	POUND(S)
05/04/02	TX	EL PASO	UNION PACIFIC RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
07/24/02	TX	EL PASO		UNKNOWN	22 EAST MISSOURI		AMMONIA, ANHYDROUS RESIDUE	0	UNKNOWN
10/02/02	TX	GAINES	COOPER NATURAL RESOURCES	CHEMICAL	OZARK DIVISION	79342	AMMONIA, ANHYDROUS	16,000	POUND(S)
11/05/02	TX	GALVESTON	VALERO ENERGY	OTHER	1301 LOOP 197 SOUTH		AMMONIA, ANHYDROUS	1,512	POUND(S)
06/18/02	TX	HALE		UNKNOWN	1920 HWY 194		AMMONIA, ANHYDROUS	1,500	POUND(S)
01/06/02	TX	HARRIS	MINH FOOD	OTHER	1251 SCARBOROUGH LANE		AMMONIA, ANHYDROUS	100	POUND(S)
01/30/02	TX	HARRIS	OXY VINYL	UNKNOWN	1105 TIDAL ROAD	77536	AMMONIA, ANHYDROUS	500	POUND(S)
03/18/02	TX	HARRIS	ROHM AND HAAS TEXAS, INC.	MANUFACTURING	1900 TIDAL ROAD	77536	AMMONIA, ANHYDROUS	100	POUND(S)
06/29/02	TX	HARRIS	CELANESE	CHEMICAL	9502 BAYPORT BLVD		AMMONIA, ANHYDROUS	428	POUND(S)
07/05/02	TX	HARRIS	EXXON MOBIL BAYTOWN REFINERY	FLARE STACK	2800 DECKER DRIVE	77522	AMMONIA, ANHYDROUS	200	POUND(S)

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07/22/02	TX	HARRIS	ROHM AND HAAS TEXAS, INC.	CHEMICAL	1900 TIDAL ROAD	77536	AMMONIA, ANHYDROUS	64	POUND(S)
08/06/02	TX	HARRIS	AIR PRODUCTS AND CHEMICALS	CHEMICAL	1423 HWY 225	77506	AQUEOUS AMMONIA	3,193	POUND(S)
08/23/02	TX	HARRIS	VALERO REFINING / TEXAS LP	REFINERY	9701 MANCHESTER AVE	77012	AMMONIA	0	UNKNOWN
08/27/02	TX	HARRIS	EXXON MOBIL	REFINERY	2800 DECKER DRIVE	77520	AMMONIA, ANHYDROUS	400	POUND(S)
09/19/02	TX	HARRIS	EXXON MOBIL REFINERY	OTHER	2800 DECKER DR.	77520	AMMONIA, ANHYDROUS	340	POUND(S)
09/20/02	TX	HARRIS	EXXON MOBILE	FLARE STACK	2800 DECKER DR.	77522	AMMONIA	300	POUND(S)
09/25/02	TX	HARRIS	EXXON MOBIL REFINERY	FLARE STACK	2800 DECKER DR.	77520	AMMONIA, ANHYDROUS	300	POUND(S)
10/15/00	TX	HARRIS	GOODYEAR TIRE AND RUBBER	OTHER	2000 GOODYEAR DRIVE	77262	AMMONIA, ANHYDROUS	211	POUND(S)
10/10/02	TX	HARRIS	GOODYEAR TIRE AND RUBBER	OTHER	2000 GOODYEAR DRIVE	77262	AMMONIA, ANHYDROUS	188	POUND(S)
10/28/02	TX	HARRIS	EXXON MOBIL REFINERY	REFINERY	2800 DECKER DR.		AMMONIA, ANHYDROUS	300	POUND(S)
10/29/02	TX	HARRIS	EXXON/MOBIL	REFINERY	2800 DECKER DR.	77522	AMMONIA, ANHYDROUS	190	POUND(S)
12/02/02	TX	HARRIS	EXXON MOBILE		5000 BAYWAY DR.	77522	AMMONIA, ANHYDROUS	1,622	POUND(S)
12/26/02	TX	HARRIS	EXXON MOBIL REFINERY	OTHER	2800 DECKER DR.		AMMONIA, ANHYDROUS	300	POUND(S)
06/26/02	TX	HIDALGO	COCA COLA ENTERPRISES	OTHER	2400 WEST EXPRESSWAY 83	78501	AMMONIA	0	POUND(S)
06/17/02	TX	HOCKLEY	CO OP	UNKNOWN	DUKE STREET		AMMONIA	0	UNKNOWN
01/23/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	REFINERY	STATE HIGHWAY SPUR 119 N	79007	AMMONIA, ANHYDROUS	344	POUND(S)
02/15/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	REFINERY	STATE HIGHWAY SPUR 119 N	79007	AMMONIA, ANHYDROUS	128	POUND(S)
05/04/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	CHEMICAL	STATE HWY SPUR 119 N	79007	AMMONIA, ANHYDROUS	100	POUND(S)
06/23/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	REFINERY	STATE HWY SPUR 119 N	79007	AMMONIA, ANHYDROUS	100	POUND(S)
07/08/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	REFINERY	STATE HWY SPUR 119 N	79007	AMMONIA	0	UNKNOWN
08/10/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	FLARE STACK	STATE HWY SPUR 119N	79008	AMMONIA, ANHYDROUS	0	UNKNOWN
08/11/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	FLARE STACK	PHILLIPS PETROLEUM	79008	AMMONIA, ANHYDROUS	87	POUND(S)
08/13/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	FLARE STACK	STATE HWY SPUR 119 NORTH	79007	AMMONIA, ANHYDROUS	100	POUND(S)
10/09/02	TX	HUTCHINSON	PHILLIPS PETROLEUM	OTHER	STATE HWY SPUR 119 N		AMMONIA, ANHYDROUS	100	POUND(S)
12/25/02	TX	HUTCHINSON	CONOCO PHILLIPS	CHEMICAL	SPUR 119 NORTH	79007	AMMONIA, ANHYDROUS	450	POUND(S)
01/03/02	TX	JEFFERSON	EXXON MOBIL OIL CORP	UNKNOWN	1795 BURT STREET	77704	AMMONIA, ANHYDROUS	4,017	POUND(S)
02/02/02	TX	JEFFERSON	HUNTSMAN PETRO CHEM CO	OTHER	6001 HWY 366	77651	AMMONIA, ANHYDROUS	100	POUND(S)
02/22/02	TX	JEFFERSON	HUNTSMAN CORP	CHEMICAL	6001 HWY 366	77651	AMMONIA, ANHYDROUS	10	POUND(S)
02/27/02	TX	JEFFERSON	EXXON MOBIL OIL CORP	REFINERY	1795 BURT STREET	77704	AMMONIA, ANHYDROUS	4,016	POUND(S)
03/04/02	TX	JEFFERSON	EXXON MOBIL OIL CORP	REFINERY	1795 BURT STREET	77704	AMMONIA, ANHYDROUS	0	UNKNOWN
05/11/02	TX	JEFFERSON	HUNTSMAN PETRO CHEMICAL	CHEMICAL	6001 HIGHWAY 366	77651	AMMONIA, ANHYDROUS	0	UNKNOWN
07/10/02	TX	JEFFERSON	HUNTSMAN CHEMICAL CORP	CHEMICAL	6001 HWY 366	77651	AMMONIA, ANHYDROUS	100	POUND(S)
08/15/02	TX	JEFFERSON	EXXON MOBIL OIL CORP	REFINERY	1795 BURT STREET	77704	AMMONIA, ANHYDROUS	1,987	POUND(S)
08/25/02	TX	JEFFERSON	ATOFINA PETRO CHEMICALS	CHEMICAL	HIGHWAY 366 & 32ND ST.	77641	AMMONIA, ANHYDROUS	60	POUND(S)
12/12/02	TX	JEFFERSON	HUNTSMAN PETRO CHEMICAL		6001 HWY 366	77651	AMMONIA	101	POUND(S)
12/16/02	TX	JEFFERSON	HUNTSMAN PETROCHEMICAL	CHEMICAL	6001 HWY 366	77651	AMMONIA	101	POUND(S)
07/18/02	TX	LAMAR	EARTHGRAINS CO	MANUFACTURING	2020 19TH STREET NW		AMMONIA, ANHYDROUS	220	POUND(S)
07/29/02	TX	LAMAR	CAMPBELL SOUP SUPPLY CO	MANUFACTURING	500 NORTHWEST LOOP 286		AMMONIA, ANHYDROUS	0	UNKNOWN

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01/26/02	TX	MCLENNAN	CARGILL TURKEY PRODUCTS	OTHER	2510 E. LAKE SHORE DR.	76705	AMMONIA, ANHYDROUS	210	POUND(S)
08/11/02	TX	MCLENNAN	HELENA CHEMICALS (EDDY INDLAND TERMINAL)	OTHER	101 HWY 7	67835	AMMONIA, ANHYDROUS	50	POUND(S)
02/28/02	TX	MONTGOMERY	HUNTSMAN PETROCHEMICAL	MANUFACTURING	JEFFERSON CHEMICAL RD		AMMONIA, ANHYDROUS	273	POUND(S)
02/28/02	TX	MONTGOMERY	HUNTSMAN PETROCHEMICAL	MANUFACTURING	JEFFERSON CHEMICAL RD		AMMONIA, ANHYDROUS	27	POUND(S)
07/07/02	TX	MONTGOMERY	HUNTSMAN PETROCHEMICAL	OTHER	JEFFERSON CHEMICAL RD	773050219	AMMONIA, ANHYDROUS	313	POUND(S)
11/18/02	TX	MONTGOMERY	HUNTSMAN PETROCHEMICAL	UNKNOWN	JEFFERSON CHEMICAL RD	773050219	AMMONIA, ANHYDROUS	1,073	POUND(S)
12/19/02	TX	MONTGOMERY	HUNTSMAN PETROCHEMICAL	OTHER	JEFFERSON CHEMICAL RD	77301	AMMONIA, ANHYDROUS	399	POUND(S)
05/01/02	TX	NUECES	RMI	MANUFACTURING	8033 SOUTH PADRE ISLAND DRIVE		AMMONIA, ANHYDROUS	5	POUND(S)
03/05/02	TX	OCHILTREE	WILLIAMS	UNKNOWN	SURVEY GHNH		AMMONIA, ANHYDROUS	29	GALLON(S)
04/08/02	TX	OCHILTREE	WILLIAMS CO	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
04/09/02	TX	OCHILTREE	WILLIAMS	OTHER			AMMONIA, ANHYDROUS	36	GALLON(S)
05/14/02	TX	ORANGE	DUPONT	MANUFACTURING	FARM ROAD 1006		AMMONIA, ANHYDROUS	300	POUND(S)
07/22/02	TX	ORANGE	DUPONT	MANUFACTURING	FARM ROAD 1006		AMMONIA, ANHYDROUS	146	POUND(S)
10/25/02	TX	ORANGE	DUPONT	MANUFACTURING	FARM ROAD 1006	77630	AMMONIA, ANHYDROUS	101	POUND(S)
07/14/02	TX	PALO PINTO	UNION PACIFIC RAILROAD	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
09/28/02	TX	PARKER		UNKNOWN	1730 FRIENSHP ROAD	76085	AMMONIA, ANHYDROUS	0	UNKNOWN
05/28/02	TX	POTTER	IBP INC.	OTHER	HIGHWAY 66 E AND FM 1912	79187	AMMONIA, ANHYDROUS	0	UNKNOWN
07/09/02	TX	POTTER	IBP INC.	OTHER	HIGHWAY 66 E AND FM 1912	79187	AMMONIA, ANHYDROUS	0	UNKNOWN
09/08/02	TX	POTTER		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
08/22/02	TX	SCURRY	KINDER MORGAN CO2 COMPANY	OTHER	715 NORTH FM 1611		AMMONIA, ANHYDROUS	2,500	POUND(S)
10/27/02	TX	SHELBY	TYSON FOODS	OTHER	1019 SHELBYVILLE ST	75935	AMMONIA, ANHYDROUS	0	UNKNOWN
12/31/02	TX	SHELBY	TYSON FOODS	OTHER	1019 SHELBYVILLE ST	75935	AMMONIA, ANHYDROUS	101	POUND(S)
08/15/02	TX	TARRANT	REACTOR INCORP.	MANUFACTURING	3101 NORTH SYLVANIA AVE		AMMONIA, ANHYDROUS	1,000	POUND(S)
08/30/02	TX	TRAVIS		UNKNOWN	615 SOUTH LAMAR	78704	AMMONIA, ANHYDROUS	0	UNKNOWN
08/06/02	TX	VICTORIA	DUPONT	CHEMICAL	HWY 185	77902	AMMONIA, ANHYDROUS	0	UNKNOWN
06/10/02	TX	WILBARGER	WRIGHT BRAND FOODS LTD	MANUFACTURING	700 WHEELER ST	76385	AMMONIA, ANHYDROUS	100	POUND(S)
02/22/02	UT	DAVIS	AMERICOLD LOG.	OTHER	755 EAST 1700 SOUTH	840160441	AMMONIA, ANHYDROUS	0	UNKNOWN
12/15/02	UT	DAVIS	KROGER CO.	OTHER	500 NORTH SUGAR ST.	84041	AMMONIA, ANHYDROUS	9,800	POUND(S)
05/26/02	UT	UTAH	NESTLE USA-FOODS DIV. INC	OTHER	815 WEST RAYMOND KLAUCK		AMMONIA, ANHYDROUS	0	UNKNOWN
07/29/02	UT	UTAH	NESTLE USA-FOODS DIV. INC	MANUFACTURING	815 WEST RAYMOND KLAUCK	84663	AMMONIA, ANHYDROUS	1,100	POUND(S)
11/02/02	UT	UTAH	NESTLE USA-FOODS DIV. INC	OTHER	815 WEST RAYMOND KLAUCK	84663	AMMONIA, ANHYDROUS	54	POUND(S)
02/14/02	VA	CAMPBELL	WEST OVER DAIRY	MANUFACTURING	2801 FORT AVENURE		AMMONIA, ANHYDROUS	328	POUND(S)
07/05/02	VA	CHESTERFIELD	UNIVAR	UNKNOWN	1001 OLD BERMUDA HUNDRED		AMMONIA, ANHYDROUS	150	POUND(S)
11/26/02	VA	CHESTERFIELD	PHILLIP MORRIS USA	MANUFACTURING	PARK 500 COMPLEX	23831	AMMONIA	180	POUND(S)
03/04/02	VA	FAIRFAX	SHENANDOAH PRIDE DARIY	OTHER	5325 PORT ROYAL RD		AMMONIA, ANHYDROUS	505	POUND(S)
01/21/02	VA	HANOVER	TYSON FOODS	OTHER	13264 MOUNTAIN RD	23059	AMMONIA, ANHYDROUS	613	POUND(S)

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08/01/02	VA	HENRICO	COCA-COLA ENTERPRIZES	OTHER	500 E PARK COURT		AMMONIA, ANHYDROUS	100	POUND(S)
11/06/02	VA	HOPEWELL	BOC GASES	MANUFACTURING	100 INDUSTRIAL STREET	23860	AMMONIA, ANHYDROUS	1,400	POUND(S)
11/08/02	VA	ISLE OF WIGHT	GWALTNEWY OF SMITHFIELD	MANUFACTURING	601 N. CHURCH ST.	23430	AMMONIA, ANHYDROUS	15	POUND(S)
12/17/02	VA	ISLE OF WIGHT	RICHMOND COLD STORAGE	OTHER	10070 OLD STAGE HWY	23430	AMMONIA, ANHYDROUS	100	POUND(S)
07/11/02	VA	NORFOLK	SMITHFIELD PACKING	UNKNOWN	435 EAST INDIAN RIVER ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN
03/03/02	VA	PORTSMOUTH	CELANESE CHEMICALS INC.	MANUFACTURING	3230 WEST NORFOLK ROAD		AMMONIA, ANHYDROUS	100	POUND(S)
05/30/02	VA	PRINCE GEORGE	BOC GASES	MANUFACTURING	100 INDUSTRIAL STREET	23860	AMMONIA, ANHYDROUS	400	POUND(S)
08/12/02	VA	PRINCE GEORGE	BOC GASES	CHEMICAL	HONEYWELL HOPEWELL PLANT		AMMONIA, ANHYDROUS	0	UNKNOWN
11/20/02	VA	PRINCE WILLIAM	DOMINION POWER	POWER PLANT	POSSUM POINT POWER STATION		AMMONIATED EDTA SOLUTION	30	GALLON(S)
11/26/02	VA	RICHMOND	PHILLIP MORRIS USA	MANUFACTURING	BLENDED LEAF PLANT	23234	AMMONIA	4,800	POUND(S)
01/02/02	VA	SHENANDOAH	GEORGIA'S CHICKEN	UNKNOWN	19992 SENEDO RD	22824	AMMONIA, ANHYDROUS	261	POUND(S)
07/22/02	VA	YORK	GIANT YORKTOWN INC.	FLARE STACK	2201 GOODWIN NECK RD		AMMONIA, ANHYDROUS	150	POUND(S)
07/31/02	VA	YORK	GIANT YORK TOWN	FLARE STACK	2201 GOODWIN NECK RD	23692	AMMONIA, ANHYDROUS	100	POUND(S)
08/07/02	VA	YORK	GIANT INDUSTRIAL	FLARE STACK	2201 GOODWINN NECK RD		AMMONIA, ANHYDROUS	1	TON(S)
08/20/02	VA	YORK	GIANT YORK TOWN	UNKNOWN	2201 GOODWIN NECK RD	23692	AMMONIA, ANHYDROUS	0	UNKNOWN
09/24/02	VA	YORK	GIANT YORK TOWN	FLARE STACK	2201 GOODWIN NECK RD		AMMONIA	120	POUND(S)
10/01/02	VT	WASHINGTON	CITY OF BARRE, VERMONT	OTHER	20 AUDITORIUM HILL		AMMONIA, ANHYDROUS	120	POUND(S)
07/08/02	WA	ADAMS	CF INDUSTRIES	OTHER	DANEKAS RD AT I 90		AMMONIA, ANHYDROUS	0	UNKNOWN
07/08/02	WA	ADAMS		OTHER	531 BOOKER RD	99344	AMMONIA, ANHYDROUS	0	UNKNOWN
12/24/02	WA	ADAMS	CF INDUSTRIES	MANUFACTURING	DANEKAS RD AT I-90	99169	AQUA AMMONIA	300	GALLON(S)
10/24/02	WA	BENTON	AGRIUM	MANUFACTURING	227515 EAST BALLS RD	99337	AMMONIA, ANHYDROUS	0	UNKNOWN
10/31/02	WA	BENTON	AGRIUM KENNEWICK FERTILIZER OPERATIONS	OTHER	227515 E BOWLES RD		AMMONIA, ANHYDROUS	100	POUND(S)
10/12/02	WA	CHELAN	STEMILT GROWERS INC	WAREHOUSE	88 WARD AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
04/20/02	WA	CLALLAM		OTHER			AMMONIA, ANHYDROUS	0	UNKNOWN
04/20/02	WA	CLALLAM	HIGH TIDE SEAFOOD	UNKNOWN	1100 BAYVIEW AVE	98357	AMMONIA, ANHYDROUS	300	POUND(S)
06/16/02	WA	CLARK	RAINBOW GLACIER	MANUFACTURING	1700 WEST 20TH ST	98660	AMMONIA, ANHYDROUS	100	POUND(S)
07/19/02	WA	COWLITZ	COLOMBIA COLSTOR	OTHER	1635 DOWN RIVER DRIVE		AMMONIA, ANHYDROUS	10	POUND(S)
08/07/02	WA	COWLITZ	WEYERHAEUSER COMPANY	MANUFACTURING	3401 INDUSTRIAL WAY		AMMONIA	520	POUND(S)
06/24/02	WA	FRANKLIN	LAMB-WESTON	MANUFACTURING	811 GUM STREET		AMMONIA, ANHYDROUS	1,403	POUND(S)
07/11/02	WA	GRANT	COLOMBIA COLSTOR	OTHER	80 COLUMBIA WAY		AMMONIA, ANHYDROUS	100	POUND(S)
03/10/02	WA	KING	WESTFARM FOODS	OTHER	4058 RANIER AVE. SOUTH		AMMONIA, ANHYDROUS	100	POUND(S)
06/25/02	WA	KING	F/V AMERICAN VIKING	UNKNOWN	FISHERMAN'S TERMINAL		AMMONIA, ANHYDROUS	100	GALLON(S)
07/07/02	WA	KING	ARCTIC ICE CREAM	MANUFACTURING	1901 23RD AVE SOUTH		AMMONIA, ANHYDROUS	100	POUND(S)
09/14/02	WA	KING	WEST FARM FOODS (DAIRYGOLD)	OTHER	4058 RAINIER AVE SOUTH		AMMONIA, ANHYDROUS	300	POUND(S)
10/29/02	WA	KING	TRIDANT SEA FOODS CORP	OTHER	653 NW 41ST		AMMONIA, ANHYDROUS	50	POUND(S)

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08/03/02	WA	PIERCE	TRIDENT SEAFOODS	UNKNOWN	401 ALEXANDER		AMMONIA, ANHYDROUS	2,000	POUND(S)
08/08/02	WA	SKAGIT	NORTHWEST FARM FOOD CO-OP	OTHER	1370 SOUTH ANTACORTES	98233	AMMONIA, ANHYDROUS	0	UNKNOWN
10/02/02	WA	SKAGIT	TRIDENT SEAFOODS	OTHER	1400 4TH ST		AMMONIA, ANHYDROUS	50	POUND(S)
04/22/02	WA	SNOHOMISH		OTHER	1520 WEST MARINE VIEW	98201	AMMONIA, ANHYDROUS	15	POUND(S)
05/12/02	WA	SNOHOMISH		OTHER	210 SOUTH WEST AVE		AMMONIA, ANHYDROUS	1,000	POUND(S)
10/13/02	WA	WALLA WALLA	AGRIUM	UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
09/26/02	WA	YAKIMA	WASHINGTON FRUIT AND PRODUCE CO	OTHER	315 NORTH 3RD AVE		AMMONIA, ANHYDROUS	400	POUND(S)
10/13/02	WA	YAKIMA		OTHER	1310 SOUTH 1ST	98944	AMMONIA, ANHYDROUS	0	UNKNOWN
11/04/02	WA	YAKIMA		UNKNOWN	1400 KNIGHT HILL RD.	98953	AMMONIA, ANHYDROUS	3,000	POUND(S)
12/17/02	WI	BROWN	NORTH LAND COLD STORAGE	WAREHOUSE	1104 NORTH BROADWAY		AMMONIA, ANHYDROUS	0	UNKNOWN
08/22/02	WI	DANE	OSCAR MAYER FOODS DIV.	UNKNOWN	910 MAYER AVENUE	53704	AMMONIA, ANHYDROUS	100	POUND(S)
04/18/02	WI	DODGE	SENSIENT FLAVORS	OTHER	330 SOUTH MILL ST		AMMONIA, ANHYDROUS	0	UNKNOWN
06/09/02	WI	KENOSHA	OCEAN SPRAY	OTHER	7800 60TH AVN	53142	AMMONIA, ANHYDROUS	0	UNKNOWN
03/14/02	WI	MILWAUKEE	KLEMENT SAUSAGE COMPANY	MANUFACTURING	2650S CHASE AVE		AMMONIA, ANHYDROUS	0	UNKNOWN
09/24/02	WI	MILWAUKEE	KOHL'S FOOD STORES	OTHER	11100 WEST BURLEIGH		AMMONIA, ANHYDROUS	3,800	POUND(S)
06/25/02	WI	ROCK	LANDMARK AGRONOMY SERVICE	FLARE STACK	1036 TERRA DRIVE		AMMONIA, ANHYDROUS	60	POUND(S)
04/30/02	WI	SAUK	FOREMOST FARMS, USA	MANUFACTURING	501 SOUTH PINE ST	53959	AMMONIA, ANHYDROUS	0	UNKNOWN
07/28/02	WI	WALWORTH	AGRILINK FOODS	OTHER	W880 COUNTY ROAD X	53114	AMMONIA, ANHYDROUS	0	UNKNOWN
07/29/02	WI	WALWORTH	AGRILINK FOODS	OTHER	W880 COUNTY ROAD X	53114	AMMONIA, ANHYDROUS	0	UNKNOWN
08/26/02	WV	HARDY	HESTER INDUSTRIES	OTHER	214 SOUTH MAIN ST		AMMONIA, ANHYDROUS	1,404	POUND(S)
11/15/02	WV	HARDY	HESTER INDUSTRIES	MANUFACTURING	104 SOUTH MAIN ST	26836	AMMONIA, ANHYDROUS	0	UNKNOWN
02/06/02	WV	MARSHALL	PPG INDUSTRIES	MANUFACTURING	STATE RT 2	26155	AMMONIA	0	UNKNOWN
07/22/02	WV	RALEIGH		UNKNOWN			AMMONIA, ANHYDROUS	0	UNKNOWN
05/30/02	WV	WETZEL	BAYER CORP	UNKNOWN	STATE ROUTE 2	26155	AMMONIA	100	POUND(S)
07/29/02	WY	LARAMIE	COASTAL CHEM	OTHER	8305 AUTO RD		AMMONIA, ANHYDROUS	0	UNKNOWN
08/14/02	WY	LARAMIE	COASTAL CHEMICAL	FLARE STACK	8305 AUTO ROAD		AMMONIA, ANHYDROUS	0	UNKNOWN