

# E.H. Pechan & Associates, Inc.

## Emissions Inventory Guidance for Anthropogenic Non-Agricultural Ammonia Sources



Stephen M. Roe, Holly C. Lindquist, Kirstin B. Thesing, Melissa D. Spivey, Randy P. Strait  
E.H. Pechan & Associates, Inc.

**Roy Huntley**

U.S. Environmental Protection Agency, Emission Factor and Inventory Group

June 9, 2004

**PECHAN**

# Anthropogenic Non-agricultural Sources of $\text{NH}_3$

- ❖ Objective: update information presented by Battye et al (1994) for industrial, municipal, combustion, and miscellaneous sources;
- ❖ Perform this update based on a literature review; and
- ❖ No testing was performed in association with this project.

# Table of Contents

## CHAPTER I. INTRODUCTION

## CHAPTER II. INDUSTRIAL, COMMERCIAL, AND MUNICIPAL SOURCES

- A. INDUSTRIAL REFRIGERATION LOSSES
- B. EMISSIONS FOR SPECIFIC INDUSTRIAL, COMMERCIAL, AND MUNICIPAL PROCESSES
  - 1. Sewage Treatment
  - 2. Composting
  - 3. Bakeries
  - 4. Pulp and Paper
  - 5. Surface Coatings
  - 6. Municipal Solid Waste Landfills
  - 7. Portland Cement Kilns
- C. ACCIDENTAL RELEASES
- D. MISCELLANEOUS SOURCES

## CHAPTER III. COMBUSTION SOURCES

- A. EMISSIONS FROM STATIONARY COMBUSTION SOURCES
- B. AMMONIA SLIP EMISSIONS FROM NO<sub>x</sub>-CONTROLLED COMBUSTION SOURCES
- C. MOBILE SOURCES
  - 1. Onroad Mobile Sources
  - 2. Nonroad Mobile Sources
- D. BIOMASS COMBUSTION

## CHAPTER IV. RECOMMENDATIONS FOR FUTURE WORK

## CHAPTER V. REFERENCES

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

**PECHAN**

# Industrial, Commercial and Municipal Sources

- ❖ Listings of available  $\text{NH}_3$  EF's from AP-42 and CARB's CEIDARS database;
- ❖ New EF's for POTWs: water treatment, biosolids processes, biosolids land application;
- ❖ New emission factors for composting, including VOC and  $\text{CH}_4$ ;

# Industrial, Commercial and Municipal Sources (cont.)

- ❖ Methods and default EF for estimating industrial refrigeration losses;
- ❖ New EF's for cement kilns, pulp and paper, and surface coatings;
- ❖ EF's for miscellaneous sources (e.g. human breath/sweat, household use, domestic fertilizers).

# Composting SCC's

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.

# Composting EF's

Table II-8. Recommended NH<sub>3</sub> Emission Factors for Composting Operations

SCC	NH <sub>3</sub> EF		CH <sub>4</sub> EF		VOC EF		EF Rating; Notes
	lb/ton	lb/10 <sup>3</sup> ft <sup>2</sup> -hr	lb/ton	lb/10 <sup>3</sup> ft <sup>2</sup> -hr	lb/ton	lb/10 <sup>3</sup> ft <sup>2</sup> -hr	
2680010000 <sup>a</sup>	3.28	0.175	2.23	0.119	1.70	0.090	D; Source: SCAQMD, 1996a.
2680020000 <sup>b</sup>	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 <sup>c</sup>	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 <sup>d</sup>	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.

# Combustion Sources

- ❖ EF's for stationary coal, oil, natural gas, wood, MSW, and others;
- ❖ Emission estimation methods and factors for ammonia slip emissions;
- ❖ On-road Sources: emissions data from recent test programs, recommended EF's from MOBILE6;



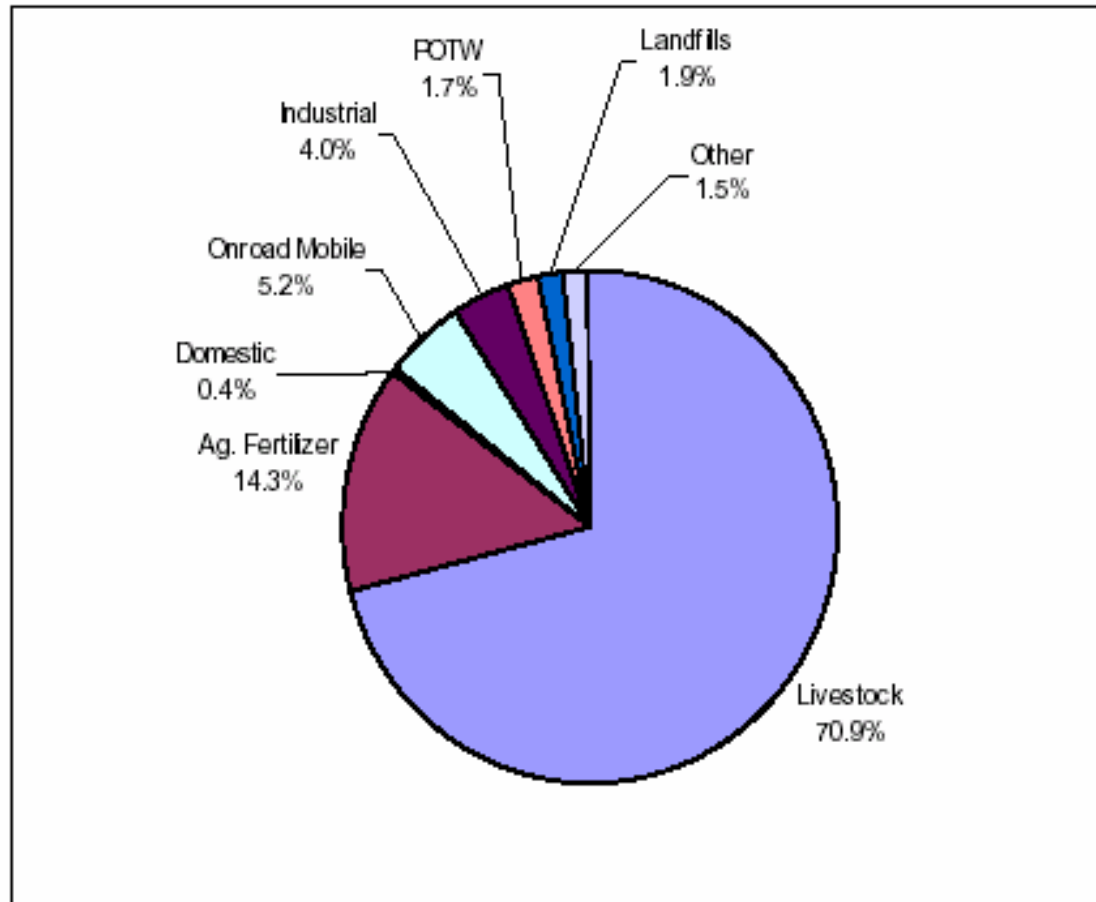
# Combustion Sources (cont.)

---

- ❖ Emission factors for nonroad gasoline and diesel combustion (based on the NONROAD model); and
- ❖ Emission factors for biomass combustion (based on test data from wildfires).

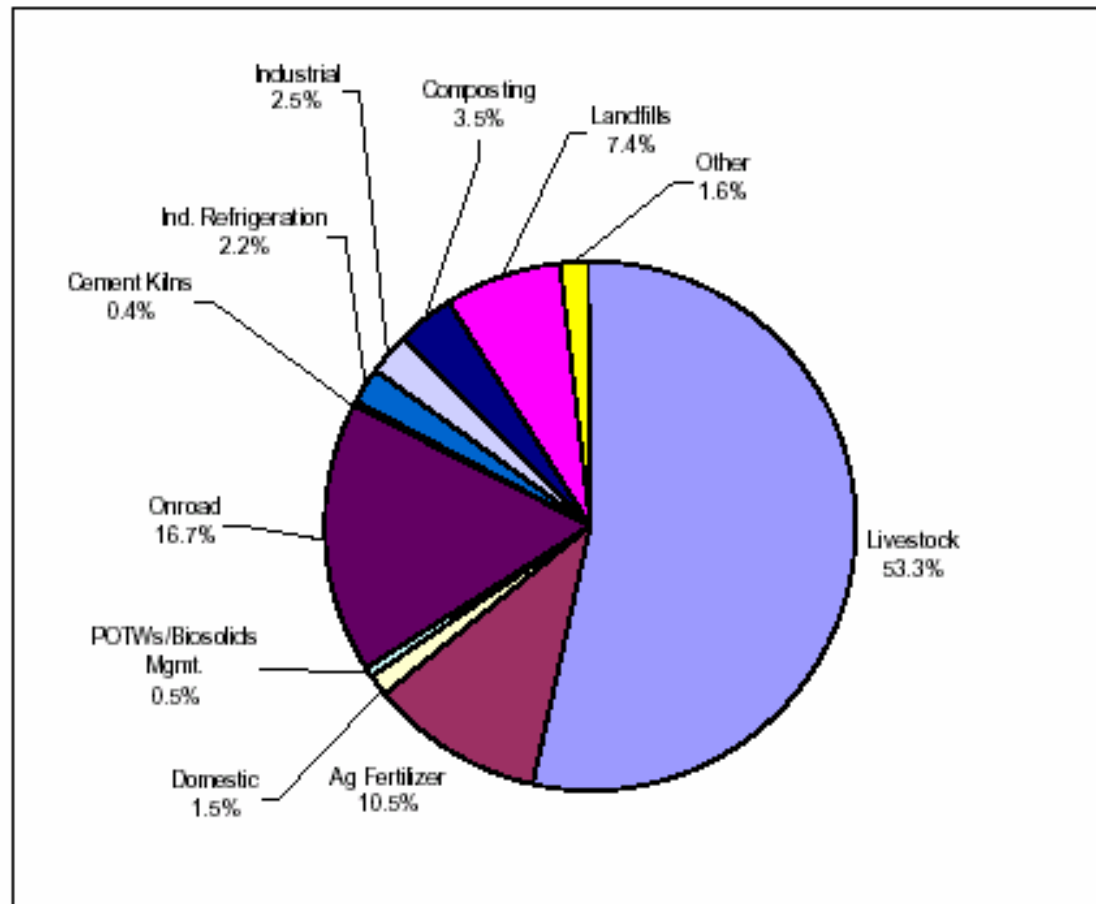
# National Source Sector NH<sub>3</sub> Contributions (filling in the “urban hole”)

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



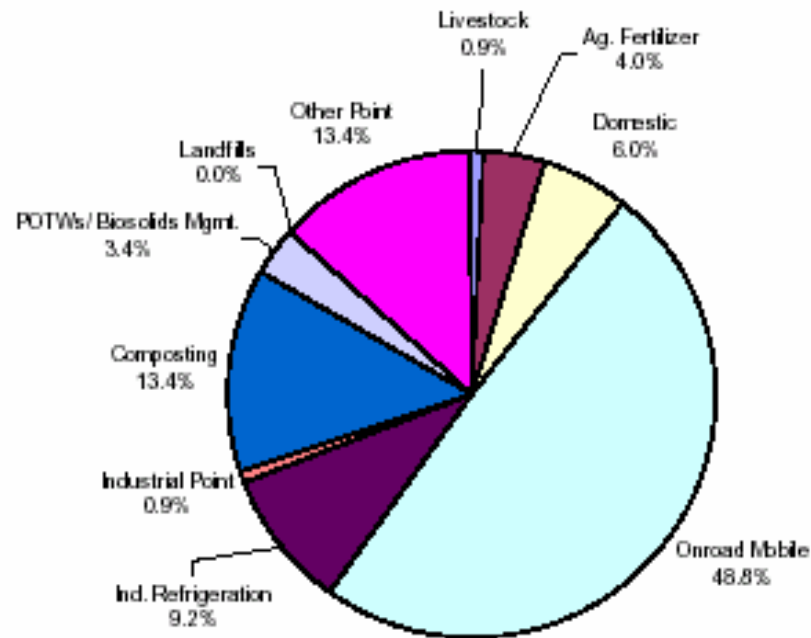
# Regional Source Sector NH<sub>3</sub> Contributions (filling in the “urban hole”)

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



# Urban-Scale Source Sector NH<sub>3</sub> Contributions (filling in the “urban hole”)

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



# Recommendations for Future Work

- ❖ *Additional characterization of emissions from biosolids processes at POTWs and biosolids management activities;*
- ❖ *Studies to identify and characterize additional emission sources in municipal sewage treatment systems;*
- ❖ *Further evaluation of potentially important industrial, commercial, and municipal source categories;*
- ❖ *Continued study and refinement of methods for estimating emissions from industrial refrigeration;*
- ❖ *Additional information on the ammonia content of water-based surface coatings (especially architectural coatings); and*
- ❖ *Additional study of biomass combustion.*

# Acknowledgements

Thanks to the technical committee and reviewers:

Technical Committee:

- ❖ Steve Anderson - Texas Commission on Environmental Quality
- ❖ Gary Beckstead - Illinois Environmental Protection Agency
- ❖ Bob Betterton - South Carolina Department of Health and Environmental Conservation
- ❖ Julia Lester - South Coast Air Quality Management District
- ❖ Jim Southerland - North Carolina Department of Environment and Natural Resources
- ❖ Bob Wooten - North Carolina Department of Environment and Natural Resources

Reviewers/Contributors:

- ❖ Ms. Brenda Smyth of the California Integrated Waste Management Board - composting;
- ❖ Mr. Garth Hawkins of the Portland Cement Association - cement kilns; and
- ❖ The Western States Petroleum Association - oil and gas production and refining;
- ❖ CARB – data from the CEIDARS database.

# Location of the Review Draft

---

[http://www.epa.gov/ttn/chief/eiip/techreport/volume03/eiip\\_areasourcesnh3.pdf](http://www.epa.gov/ttn/chief/eiip/techreport/volume03/eiip_areasourcesnh3.pdf)