

Introduction

Objectives

- Update and improve 1997 AQMP NH₃ emission inventory to support SCAQMD's 2000 AQMP
- Develop gridded inventory at 1-km resolution
- Provide more accurate representation of NH₃ in SoCAB

**Development of an
Updated Gridded Ammonia Emissions
Inventory for the South Coast Air Basin**

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May 1, 2001

Introduction

Approach

- Focus on sources contributing $> 10\%$ in 1997 inventory
- Review previous inventory development work and literature
- Include potential new sources
- Review new literature sources
- Update and revise emission factor and activity data

Review of Existing 1997 AQMP NH₃ Emissions Inventory

Source Categories

- Livestock waste
- Mobile sources
- Fertilizer application
- Soil surfaces
- Sewage Treatment Plants (POTW's)
- Industrial sources
- Domestic sources

Review of Existing 1997 AQMP NH₃ Emissions Inventory (cont.)

Emission Factors

- Livestock Waste
 - Gharib and Cass (1984) - cattle, sheep hogs
 - Dickson et al. (1988) - horses, poultry
- Mobile Sources
 - Bottom-up development based on:
 - VMT
 - Fraction per model year
 - Failure rate
 - Emission factors from Gharib and Cass (1984)

Review of Existing 1997 AQMP NH₃ Emissions Inventory (cont.)

Emission Factors

- Fertilizer Application
 - Gharib and Cass (1984) - cropland, orchards, non-farm; dry and liquid fertilizers
- Soil Surfaces
 - Gharib and Cass (1984); Dickson et al. (1991) (Radian Study)
- POTW's
 - Analysis of limited survey data; Kogan and Torres (1997)

Review of Existing 1997 AQMP NH₃ Emissions Inventory (cont.)

Emission Factors

- Industrial Sources
 - 1987 SARA 313 Toxics Release Inventory (TRI); facilities handling > 10,000 lb/yr
- Domestic Sources
 - Gharib and Cass (1984) - dogs, cats, respiration, perspiration, household use
 - Radian Study (1991) - untreated human waste

Review of Existing 1997 AQMP NH₃ Emissions Inventory (cont.)

Activity Data

- Livestock Waste
 - County Agricultural Commissioner's Office
 - Census of Agricultural
 - LA County Veterinary Services Department
- Mobile Sources
 - Based on light-duty exhaust particulate emission from ARB gridded, hourly inventory

Review of Existing 1997 AQMP NH₃ Emissions Inventory (concluded)

- Fertilizer Application
 - California Dept. of Food and Agriculture (CDFA) Tonnage Report
 - County Agricultural Commissioner's Office
- Soil Surfaces
 - Soil surface area from USGS Landuse database
- POTW's
 - POTW flowrates
- Domestic Sources
 - Population - US Census

2000 AQMP Inventory Update

Literature Review

- **Gharib and Cass (1984) - Comprehensive study; basis for Radian Study**
- **Warn, et al. (1990) - Native animals and domestic sources**
- **Dickson, et al. (1991) - Radian Study; basis for 1997 AQMP EI**
- **Schmidt and Winegar (1996) - Dairy emission in SoCAB**
- **Kogan and Torres (1997) - POTW's**
- **SCAQMD AQMP (1996)**

2000 AQMP Inventory Update (cont.)

Literature Review

- **Asman (1992) - Comprehensive NH₃ EI for Europe; Livestock and Agriculture**
- **Battye et al. (1994) - Literature survey of NH₃ EF; Livestock and poultry**
- **Sutton, et al. (1995) - Literature survey; Analysis of Gharib & Cass Emission factors**
- **The San Joaquin Valley Study (1998) - Most recent comprehensive study; reviews new literature; provides new test results**

2000 AQMP Inventory Update (cont.)

(New) Source Categories

- Native animal waste
- Landfills
- Composting
- Oceans and water bodies
- Prescribed burning

2000 AQMP Inventory Update (cont.)

Activity Data

- Chicken population revised from 25 million to 17 million
- Total cattle population increased by ~330,000 head (Santa Ana Regional Water Quality Board)
- Beef cattle population increased 15,353 to 20,020
- Industrial sources -- Refrigeration, NOx control, Metal heat treating, Waste water treatment, Blue printing

2000 AQMP Inventory Update (cont.)

Emission Factors

- Livestock and Poultry
 - Chickens - 1.6 lb/layer/yr → 1.0 lb/layer/yr
 - Chickens - 0.79 lb/broiler/yr → 0.37 lb/broiler/yr
 - Dairy cattle - 21 lb/head/yr → 51 lb/head/yr
 - Horses and ponies - 52 lb/horse/yr → 26.9 lb/horse/yr

2000 AQMP Inventory Update (cont.)

Emission Factors

- Domestic Sources
 - Dogs - 5.5 lb/animal/yr → 2.17 lb/animal/yr
 - Cats - 1.8 lb/animal/yr → 0.348 lb/animal/yr
 - Cigarettes - 2.07×10^{-05} lb/cigarette → 2.2×10^{-07} lb/cigarette

2000 AQMP Inventory Update (concluded)

Emission Factors

- Mobile Sources
 - Bulk emission factor based on Fraser and Cass Tunnel Study (1989) - requires only VMT
- POTW's
 - EF revised downward to 0.118 lb/MMgal (Kogan and Torres)

Comparison of 1997 AQMP and 2000 Update EI

Major Changes/Differences

- Dairy Cattle - decreased from 15.89 to 4.32 tpd
- Horses - increased from 10.77 to 32.41 tpd
- Domestic animals - decreased from 14.69 to 7.81 tpd
- Sewage treatment - decreased from 3.95 to 0.08 tpd
- Overall - increased from 155 to 185 tpd

Emission Summary

Source	1997 SoCAB		2000 SoCAB	
	Emissions (tons/day)	Percent of Total	Emissions (tons/day)	Percent of Total
Livestock	56.6	36.6%	60.4	32.72%
Soil	39.0	25.2%	34.2	18.55%
Fertilizer (TOTAL)	11.0	7.10%	7.68	4.16%
Domestic	28.1	18.1%	25.9	14.02%
On-Road Mobile	7.10	4.59%	33.2	17.99%
Industrial Sources	9.00	5.82%	13.2	7.13%
Composting	0	0.00%	9.69	5.25%
Landfills	0	0.00%	0.007	0.00%
Sewage Treatment	3.94	2.55%	0.082	0.04%
Mobile - Other	0.080	0.05%	0.080	0.04%
Native Animal Waste	0	0.00%	0.163	0.09%
Prescribed burning	0	0.00%	0	0.00%
SoCAB TOTAL	155	100.00%	185	100.00%

Inventory Processing/Gridding Methodology

EPS2.0

- Emission Processing System Version 2.0
(EPA, 1992)
- Modified for SCAQMD modeling inventory
format

Inventory Processing/Gridding Methodology (concluded)

Land Use/Land Cover (LULC) Data

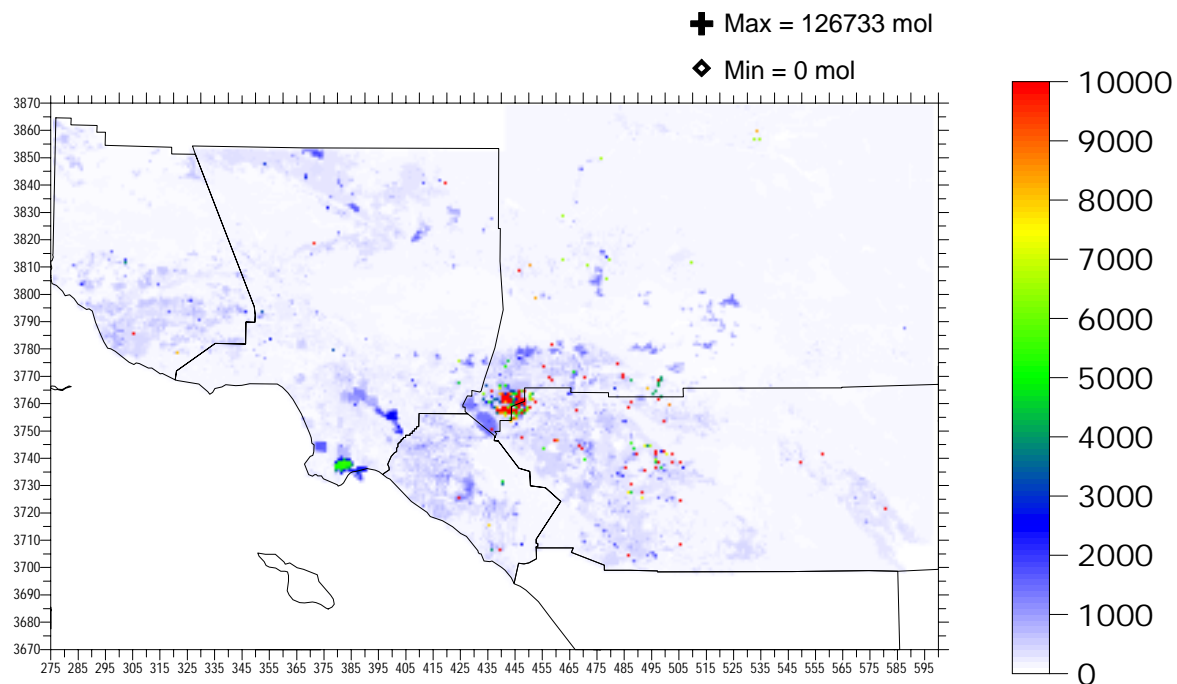
- USGS Land Use/Land Cover (LULC) database
1:100,000 scale (~200 meter) resolution
- Aerial Information Systems 1990 Aerial Land Use
Study (1990)
- Spatial surrogates developed in ARC/Info

Inventory Processing/Gridding Methodology (cont.)

Spatial Allocation by Source Category

Source Category	Spatial Allocation
Livestock	
Beef Cows	GIS Rangeland
Heifers/Calves	GIS Rangeland
Steers/Bulls	GIS Rangeland
Hogs/Pigs	GIS Confined Feedlots
Sheep/Lambs	GIS Rangeland
Mules/Burros/Donkeys	AIS Rural Residential Low Density/Horse Ranches
Goats	AIS Dairy & Intensive Livestock
Rabbits	GIS Confined Feedlots
Horses	AIS Rural Residential Low Density/Horse Ranches
Soil	
Urban	GIS Urban
Agriculture	GIS Agriculture
Range/Pasture	GIS Rangeland
Wetland	GIS Wetland
Forest	GIS Forest
Barren	GIS Barren
Fertilizer	
Farm - Dry	GIS Farmland
Farm - Wet	GIS Farmland
NonFarm - Dry	GIS Nonfarm Agriculture
NonFarm - Wet	GIS Nonfarm Agriculture
Domestic	Population
Industrial Points	ZIP Code
Native Animals	GIS Forest

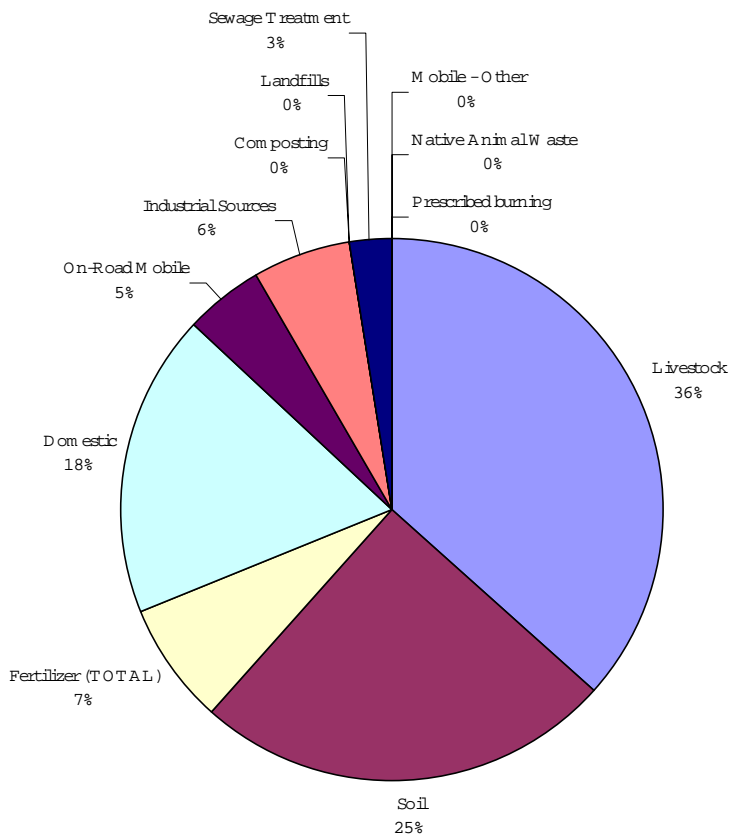
Emission Density Plots



Daily Total NH₃ (moles)
All Gridded NH₃ Sources
January 1, 1997

Summary

1997 SoCAB Ammonia Emissions by Source



1997 Updated SoCAB Ammonia Emissions by Source

