Appendix I

Nonpoint Source Emissions Sample Calculations

Nonpoint Source Emissions Sample Calculations

2007 Prescribed Burning
AMS: 2810014000
Suffolk County, NY (FIPS: 36103)

PM2.5 Flaming Fuel Emission Calculations:

((Acres burned)[1] × (Fuel Loading Factor (tons/acre burned))[2] × (PM2.5 Flaming Fuel Emission Factor (lb/ton)))[2] × 0.75 = PM2.5 Flaming Fuel Emissions (lbs/yr)

((77.5 acres burned) × (8.2 tons/acre burned) × (24.1 lb/ton)) × 0.75
= 11,490 lbs/yr

PM2.5 Smoldering Fuel Emission Calculations:

((Acres burned)[1] × (Fuel Loading Factor (tons/acre burned))[2] × (PM2.5 Emission Factor (lb/ton)))[3] × 0.25 = PM2.5 Smoldering Fuel Emissions (lbs/yr)

((77.5 acres burned) × (8.2 tons/acre burned) × (24.1 lb/ton)) × 0.25
= 3,830 lbs/yr

PM2.5 Annual Emissions = PM2.5 Flaming Fuel Emissions + PM2.5 Smoldering Fuel Emissions
= 11,490 lbs/yr + 3,830 lbs/yr
= 15,320 lbs/yr
= 7.66 tons/yr

Notes:
1. 2007 data was compiled by the New York State Department of Environmental Conservation's Division of Lands And Forests.

2. Fuel Loading factor and Emission Factors: EPA's Documentation For The 1996 Base Year National Toxics Inventory for Area Sources dated May 31, 2001 (Appendix A; Pages A-31 and A-32).

3. PM2.5 Emission Factor: The PM2.5 emission factor (24.1 lbs/ton) was forwarded to the Department's Division of Air Resources in an email from Randy Strait of E. H. Pechan & Associates, Inc. on 08/02/2004.

2007 Residential Heating (Oil)
AMS: 2104004000 & 2104011000
Nassau, NY (FIPS: 36059)

1. County: Nassau

2. Allocation of Fuel to County Level

   a. Raw Data
      i number of households heated w/oil: 247,586 (2000 Census)
      ii heating degree days (2007 calendar year): 5,252 days (NOAA)
      iii statewide fuel usage for sector:

      distillate oil: $1{,}338{,}120 \times 10^3$ gallons
      kerosene: $52{,}164 \times 10^3$ gallons

   b. Weighted Average Allocation

   For each county, the product of census data times heating degree days was determined. For Nassau County:

   = (247,586 homes)(5,252 heating degree days)
   = 1,300,321,672 homes-heating degree days

   The statewide sum: 12,925,564,782 homes-heating degree days

   The Nassau County allocation factor (AF) for residential fuel oil then is calculated by dividing the county-specific value by the statewide value:

   AF = (1,209,210,024)/(11,988,704,610)
   AF = 0.1006

   The residential fuel oil allocation for Nassau County is then determined by multiplying the statewide fuel usage for the sector by AF:

   distillate oil: $(0.1006)(1{,}338{,}120 \times 10^3 \text{ gallons})$

   $= 134{,}615 \times 10^3$ gallons

   kerosene: $(0.1006)(52{,}164 \times 10^3 \text{ gallons})$

   $= 5{,}248 \times 10^3$ gallons

3. Emission Factors

   a. sulfur content of fuel oil:

      distillate oil: 0.21 percent
      kerosene: 0.053 percent

      NOTE: Sulfur content in fuel oil as reported on 2007 Emission Statements submitted by facilities in Rockland and Nassau Counties.

   b. Area Source Classifications:

      distillate oil: 2104004000

kerosene: 2104011000

c. Emission Factors (EF)

Sources: AP-42, FIRE for commercial/institutional facilities using distillate or kerosene.

Pollutant	EF (lb/10^3 gallons)
NO_x	24
CO	5
PM_{10}	2.38
SO_2	142[S] where [S] is sulfur content (%)

4. Emissions Calculations – Residential Heating Oil – Nassau County

a. Annual

Emissions calculated by multiplying fuel allocation by emission factors. Sample calculations presented below:

1. Distillate Oil

NO_x ($134{,}615 \times 10^3$ gallons)(24 lb/10^3 gallons) = 3,230,800 lb = 1615.4 tons
CO ($134{,}615 \times 10^3$ gallons)(5 lb/10^3 gallons) = 673,100 lb = 336.6 tons
PM_{10} ($134{,}615 \times 10^3$ gallons)(2.38 lb/10^3 gallons) = 320,400 lb = 160.2 tons
SO_2 ($134{,}615 \times 10^3$ gallons)(142 lb/10^3 gallons)(0.21) = 4,014,200 lb = 2007.1 tons

2. Kerosene

NO_x ($5{,}248 \times 10^3$ gallons)(24 lb/10^3 gallons) = 126,000 lb = 63.0 tons
CO ($5{,}248 \times 10^3$ gallons)(5 lb/10^3 gallons) = 26,240 lb = 13.1 tons
PM_{10} ($5{,}248 \times 10^3$ gallons)(2.38 lb/10^3 gallons) = 12,490 lb = 6.2 tons
SO_2 ($5{,}248 \times 10^3$ gallons)(142 lb/10^3 gallons)(0.053) = 39,500 lb = 19.8 tons

2007 Residential Natural Gas Combustion
AMS: 2104006000
Nassau, NY (FIPS: 36059)

1. County: Nassau

2. Allocation of Fuel to County Level

   a. Raw Data
      i number of households heated w/CH4: 171,500 (2000 Census)
      ii total number of households in state heated w/CH4: 3,651,869
      iii statewide fuel usage for sector:

      natural gas: 397,000 x 10^6 cubic feet

   b. Weighted Average Allocation

   The Nassau County allocation factor (AF) for residential natural gas combustion is then calculated by dividing the number of households in the county heated with natural gas by the statewide value:

   AF = (171,500)/(3,651,869)
   AF = 0.04696

   The residential natural gas allocation for Nassau County is then determined by multiplying the statewide fuel usage for the sector by AF:

   natural gas: (0.04696)(397,000 x 10^6 cubic feet)

   = 18,640 x 10^6 cubic feet

3. Emission Factors

   a. Area Source Classification: 2104006000

   b. Emission Factors (EF)

   Sources: AP-42, FIRE for commercial/institutional facilities using natural gas.

Pollutant	EF (lb/10^6 cubic feet)
NO_x	94
CO	40
PM_{10}	7.6
SO_2	0.6

4. Emissions Calculations – Residential Natural Gas Combustion – Nassau County

   a. Annual

   Emissions calculated by multiplying fuel allocation by emission factors. Sample calculations presented below:

NO_x	(18,640 x 10^6 cubic feet)(94 lb/10^6 cubic feet) = 1,752,200 lb = 876.1 tons
CO	(18,640 x 10^6 cubic feet)(40 lb/10^6 cubic feet) = 745,600 lb = 372.8 tons
PM_{10}	(18,640 x 10^6 cubic feet)(7.6 lb/10^6 cubic feet) = 141,700 lb = 70.9 tons
SO_2	(18,640 x 10^6 cubic feet)(0.6 lb/10^6 cubic feet) = 11,180 lb = 5.6 tons

2007 Residential Wood Combustion
AMS: 2104008100, 2104008320 & 2104008700
Nassau, NY (FIPS: 36059)

1. County: Nassau

2. Allocation of Fuel to County Level

   a. Raw Data
      i number of households heated w/wood: 157 (2000 Census)
      ii heating degree days (2007 calendar year): 5,252 days (NOAA)
      iii statewide fuel usage for sector:

         wood: 1,208,917 tons

   b. Weighted Average Allocation

   For each county, the product of census data times heating degree days was determined. For Nassau County:

   = (157 homes)(5,252 heating degree days)
   = 824,564 homes-heating degree days

   The statewide sum: 568,220,462 homes-heating degree days

   The Nassau County allocation factor (AF) for residential fuel oil then is calculated by dividing the county-specific value by the statewide value:

   AF = (824,564)/(568,220,462)
   AF = 0.001451

   The residential wood allocation for Nassau County is then determined by multiplying the statewide fuel usage for the sector by AF:

   wood: (0.001451)(1,208,917 tons)

   = 1754 tons

3. Emission Factors

   a. Area Source Classifications and Allocations:

Category	SCC	Fraction of Wood	Nassau Co. (tons)
Indoor Fireplaces	2104008100	0.57	999.8
Indoor Wood Stoves	2104008320	0.38	666.5
Outdoor Sources	2104008700	0.05	87.7
Total		1.00	1754

   b. Emission Factors (EF)

      Sources: AP-42, GLC

Pollutant	Fireplaces	EF (lb/ton) Wood Stoves	Outdoor
NO_x	2.6	2	2.6
PM_{10}	23.6	20.4	23.6
SO_2	0.4	0.4	0.4

4. Emissions Calculations – Residential Wood Combustion – Nassau County

   a. Annual

      Emissions calculated by multiplying fuel allocation by emission factors. Sample calculations presented below:

      Fireplaces

      NO_x (999.8 tons)(2.6 lb/ton) = 2600 lb = 1.3 tons
      PM_{10} (999.8 tons)(23.6 lb/ ton) = 23,600 lb = 11.8 tons
      SO_2 (999.8 tons)(0.4 lb/ ton) = 400 lb = 0.20 tons

      Indoor Woodstoves

      NO_x (666.5 tons)(2 lb/ton) = 1,333 lb = 0.67 tons
      PM_{10} (666.5 tons)(20.4 lb/ ton) = 13,600 lb = 6.8 tons
      SO_2 (666.5 tons)(0.4 lb/ ton) = 267 lb = 0.13 tons

      Outdoor Sources

      NO_x (87.7 tons)(2.6 lb/ton) = 228 lb = 0.11 tons
      PM_{10} (87.7 tons)(23.6 lb/ ton) = 2070 lb = 1.04 tons
      SO_2 (87.7 tons)(0.4 lb/ ton) = 35 lb = 0.02 tons

2007 Commercial/Institutional Natural Gas Combustion
AMS: 2103004001, 2103011000 & 2103004002
Nassau, NY (FIPS: 36059)

1. County: Nassau

2. Allocation of Fuel to County Level

   a. Number of people employed in C/I sector in Nassau County: 510,757.2
   b. Total number of people employed in C/I sector in the state: 6,874,365.98
   c. The fraction of those employed in the C/I sector that live in Nassau County was determined by:

      AF = (510,757.2 employees in Nassau Co.)/(6,874,365.98 employees statewide)

      = 0.0743

   d. Statewide Fuel Use – C/I Sector
      i. All Sources (NYSERDA)
         1. Natural Gas: 78,836 x 10^6 cubic feet
      ii. Title V Sources (based upon 2007 Emission Statements)
         1. Natural Gas: 20,500.45 x 10^6 cubic feet

   e. Allocation Calculation

      Natural Gas (Nassau) = AF(All Sources – Title V Sources)

      = (0.0743)(78,836 x 10^6 cubic feet – 20,500.45 x 10^6 cubic feet)
      = 4334 x 10^6 cubic feet

   f. Emission Factors

      NO_x: 100 lb/10^6 cubic feet
      PM2.5: 7.6 lb/10^6 cubic feet

   g. Emissions Calculations
      i. Annual

      NO_x: (100 lb/10^6 cubic feet)(4334 x10^6 cubic feet)

      = 433,400 lb = 216.7 tons

      PM2.5: (7.6 lb/10^6 cubic feet)(4334 x10^6 cubic feet)

      = 32,900 lb = 16.5 tons

2007 Commercial/Institutional Fuel Oil Combustion
AMS: 2103004001, 2103011000, 2103004002
Nassau, NY (FIPS: 36059)

1. County: Nassau

2. Allocation of Fuel to County Level

   a. Number of people employed in C/I sector in Nassau County: 510,757.2
   b. Number of Heating Degree Days in Nassau County: 5,252
   c. For each county, the product of the employment data times heating degree days was determined. For Nassau County:

      = (510,757.2 employees)(5,252 heating degree days)
      = 2,682,496,814 employee-heating degree days

   d. The statewide sum: 38,759,752,656 employee-heating degree days
   e. The allocation factor (AF) for fuel oil consumption by the C/I sector in Nassau County:
      AF = 2,682,496,814 /38,759,752,656
      = 0.0692

   f. Statewide Fuel Use – C/I Sector
      i. All Sources (NYSERDA)
         1. No. 2 oil: 608,118 x 10^3 gallons
         2. Kerosene: 20,706 x 10^3 gallons
      ii. Title V Sources (based upon 2007 Emission Statements)
         1. No. 2 oil: 11,047 x 10^3 gallons
         2. Kerosene: 0

   g. Process Level Data

Process	Fuel	ASC	Process Factor (PF)
Boilers	No. 2	2103004001	0.938
	Kerosene	2103011000	1
Engines	No. 2	2103004002	0.062

   h. Calculation. For each process, the following equation was used for allocating distillate oil consumption in Nassau County:

      Distillate Oil: (AF)(PF)(Fuel Used by All C/I Sources – Fuel Used at Title V Facilities)

      ASC: 2103004001:

      = (0.0692)(0.938)(649,278 x 10^3 gallons – 10,688.17 x 10^3 gallons)
      = 41,450 x 10^3 gallons No.2 fuel oil

      ASC: 2103004002:

      = (0.0692)(0.062)(649,278 x 10^3 gallons – 10,688.17 x 10^3 gallons)
      = 2,740 x 10^3 gallons No. 2 fuel oil

      ASC: 2103011000:

      = (0.0692)(1)(114 x 10^3 gallons - 114 x 10^3 gallons)
      = 0 x 10^3 gallons kerosene

3. Emission Factors

ASC	Pollutant	EF (lb/10^3 gallons)
2103004001	NO_x	24
	PM2.5	2.38
2103004002	NO_x	604
	PM2.5	42.5
2103011000	NO_x	24
	PM2.5	1.833

4. Emissions Calculations

a. Annual

ASC: 2103004001:

NOx: (24 lb/10^3 gallons)(41,450 x10^3 gallons) = 994,800 lb = 497.4 tons

PM2.5: (2.38 lb/10^3 gallons)(41,450 x10^3 gallons) = 98,700 lb = 49.4 tons

ASC: 2103004002:

NOx: (604 lb/10^3 gallons)(2,740 x10^3 gallons) = 1,655,000 lb = 827.5 tons

PM2.5: (42.5 lb/10^3 gallons)(2,740 x10^3 gallons) = 116,500 lb = 58.3 tons

ASC: 2103011000:

NO_x: (24 lb/10^3 gallons)(0 x10^3 gallons) = 0 lb

PM2.5: (1.833 lb/10^3 gallons)(0 x10^3 gallons) = 0 lb