Review of ASEM
and
CMU Ammonia Model

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Gwen Judson WI-DNR

ASEM Background

- Built by EPA to build area source emissions estimates
- GUI built around Visual Basic
- Drop Down boxes with Mouse-over
- Pollutant Descriptions
- Great Help Menu
- Big Step Forward For Inventory Transparency

The Review

- Last RPO meeting RPO's committed to review ASEM
- Review done by Gwen Judson, Wisconsin DNR.
  - Very experienced emissions modeler
  - Build the Point/Area components in EMS-2002

Gwen’s Interpretation

- “ASEM's focus on interface leads me to believe that the developers improperly focused on style over the process of inventory development and the end use of those inventories including regional modeling.” May, 2002

ASEM limitations

- Reliance on Excel and Access
- New categories cannot be added by user
  - Limited Ammonia categories
  - Coarse resolution for those that are there
- States Must be Run Separately.
  - Raw inputs are also separate so regional modifications more difficult.
- No options for temporalization, only annual totals.
- No Visualization Tools

MWRPO Recommendations

- For experienced inventory staff ASEM limitations become apparent
- More work on the methods and less on the style. EPA should spend resources on
  - Better activity data
  - Emission factors
  - Data transparency
  - Model usability
  - Better temporalization
- Great Start for National Transparency

Update on Area Source Emissions Model (ASEM)

- 6 Beta testers provided feedback on ASEM
  - Revised ASEM (Version 1.092) is now on the CHIEF Website
  - Several bugs addressed & separate installation program for Windows XP provided
- Feedback
  - Pro:
    - known bugs fixed,
    - reproduces NEI for all area source categories where consistent EI methodology is available for all criteria & HAPs;
    - most category calculations are transparent, but some need to be combined w/ additional info on web.
  - Con:
    - New categories must be added by developer
    - Temporal limitations
- Any additional modifications or enhancements will depend on user feedback and resource availability

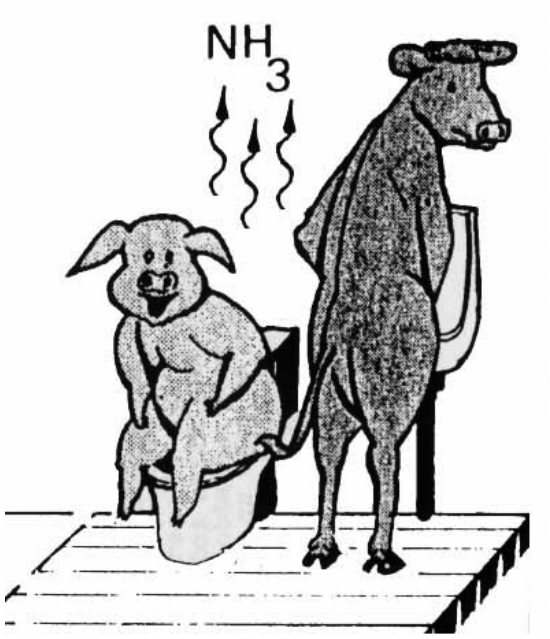
Area Source Emissions Model (ASEM)

- ASEM is one of several ways to approach EI
  - No one approach fits all needs
  - EI development is a eclectic process
- Target Users for ASEM:
  - State & local emission inventory preparers
- Target Use of ASEM:
  - Selective improvements to portions of NEI
  - NOT “build from scratch” or “methodology change”
  - NOT duplicate external temporal allocation tools

Area Source Emissions Model (ASEM)

- ASEM Increases Transparency of & Facilitates Changes to NEI
  - Provides NEI input data (also, for some categories, use with NEI detailed documentation files on EPA FTP site)
  - State or county-specific changes to an NEI Category
    - Emission Factor?
    - Activity data (OB, RWC, Construction, Unpaved Roads)
    - Control efficiency(OB)
    - Rule effectiveness(OB)
    - Temporal allocation / start-stop dates (do in NIF output file)

Improvements to the CMU Ammonia Model



Ross Strader

Carnegie Mellon

Ammonia Model

BETA VERSION - EXPIRES 12/31/02

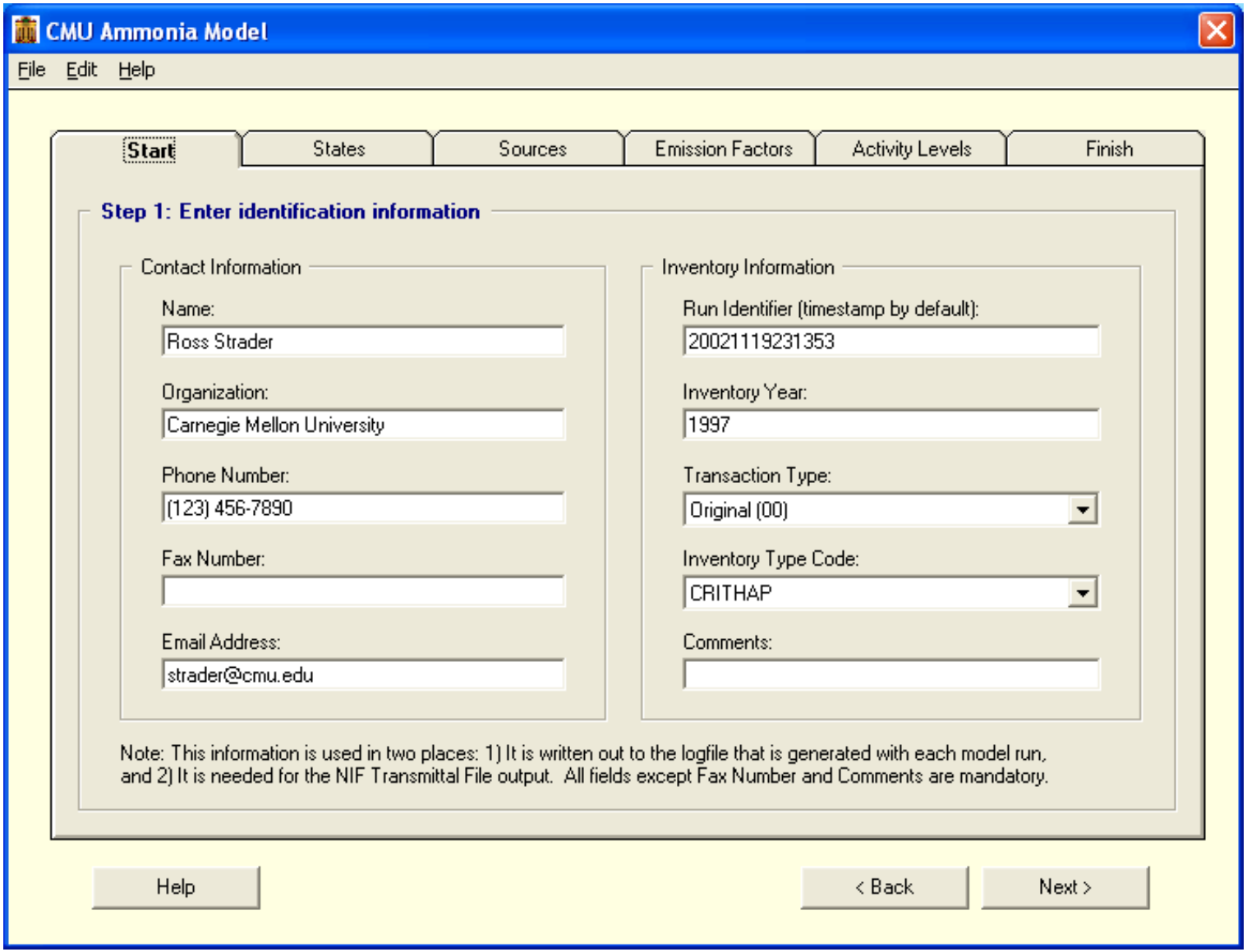
Overview of Changes

- New Windows-based interface allows user to:
  - Choose states for which to run model
  - Choose sources to include in model
  - View data being used in model run
  - Choose among various output formats

- Better logging / easier to perform multiple runs using different sources, different emission factors or activity levels, different states

Overview of Changes

- Additional output options
  - Summary output - permits easy viewing of results in spreadsheet program
  - NIF 2.0 output - facilitates CMAQ/CAMX model runs, submission of inventory to EPA
  - GIS output - permits results to be displayed in ARCVIEW/ARCINFO
- Model can now handle input data (activity levels, emission factors) at monthly resolution
  - Monthly resolved fertilizer activity levels in model now
  - Monthly resolved dairy cattle emission factors coming soon!


CMU Ammonia Model
File Edit Help
Start
States
Sources
Emission Factors
Activity Levels
Finish
Step 1: Enter identification information
Contact Information
Name:
Ross Strader
Organization:
Carnegie Mellon University
Phone Number:
(123) 456-7890
Fax Number:
Email Address:
strader@cmu.edu
Inventory Information
Run Identifier (timestamp by default):
20021119231353
Inventory Year:
1997
Transaction Type:
Original (00)
Inventory Type Code:
CRITHAP
Comments:
Note: This information is used in two places: 1) It is written out to the logfile that is generated with each model run, and 2) It is needed for the NIF Transmittal File output. All fields except Fax Number and Comments are mandatory.
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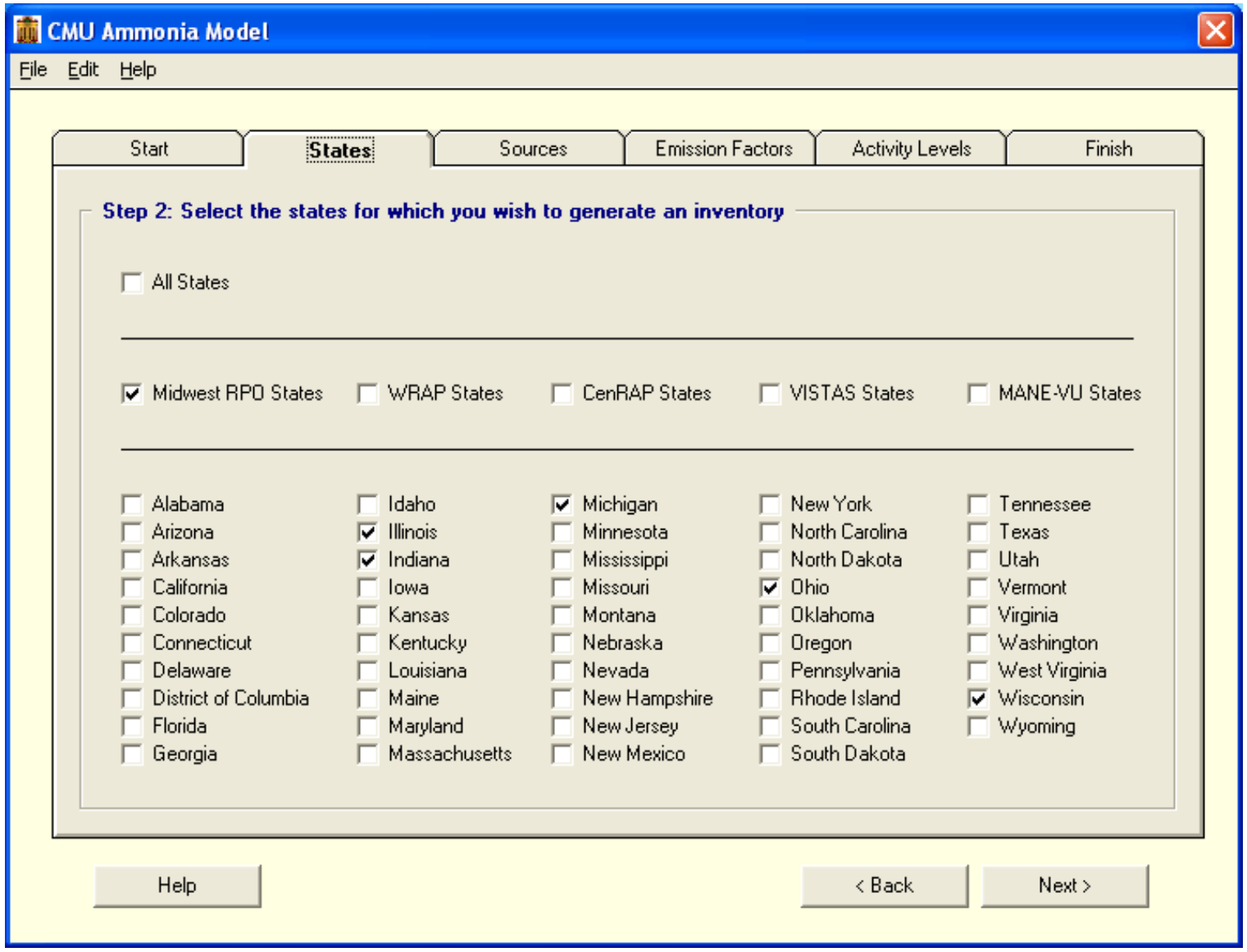
CMU Ammonia Model
File Edit Help
Start
States
Sources
Emission Factors
Activity Levels
Finish
Step 2: Select the states for which you wish to generate an inventory
All States
Midwest RPO States
WRAP States
CenRAP States
VISTAS States
MANE-VU States
Alabama
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
District of Columbia
Florida
Georgia
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming
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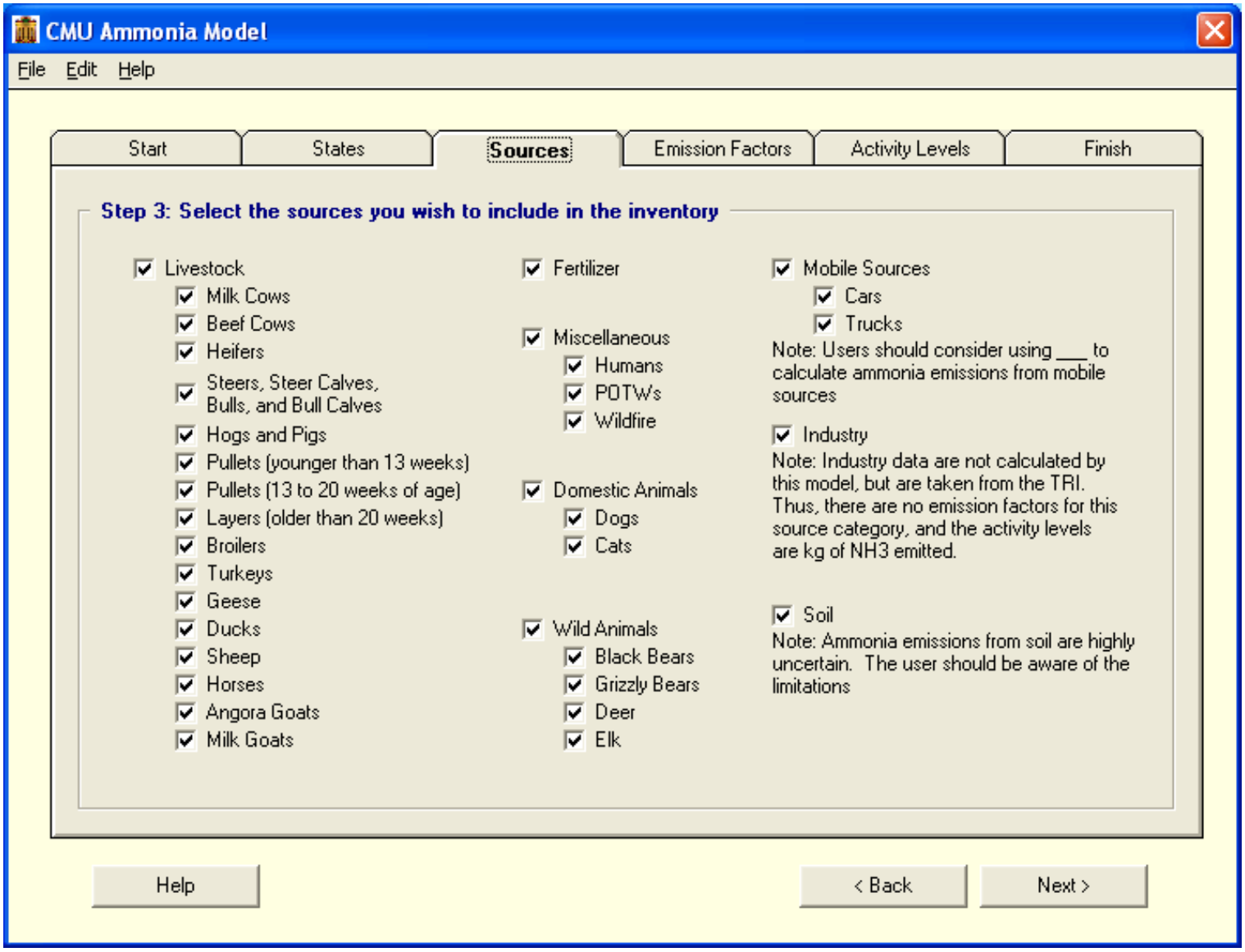
CMU Ammonia Model
File Edit Help
Start States Sources Emission Factors Activity Levels Finish
Step 3: Select the sources you wish to include in the inventory
Livestock
Milk Cows
Beef Cows
Heifers
Steers, Steer Calves, Bulls, and Bull Calves
Hogs and Pigs
Pullets (younger than 13 weeks)
Pullets (13 to 20 weeks of age)
Layers (older than 20 weeks)
Broilers
Turkeys
Geese
Ducks
Sheep
Horses
Angora Goats
Milk Goats
Fertilizer
Miscellaneous
Humans
POTWs
Wildfire
Domestic Animals
Dogs
Cats
Wild Animals
Black Bears
Grizzly Bears
Deer
Elk
Mobile Sources
Cars
Trucks
Note: Users should consider using ___ to calculate ammonia emissions from mobile sources
Industry
Note: Industry data are not calculated by this model, but are taken from the TRI. Thus, there are no emission factors for this source category, and the activity levels are kg of NH3 emitted.
Soil
Note: Ammonia emissions from soil are highly uncertain. The user should be aware of the limitations
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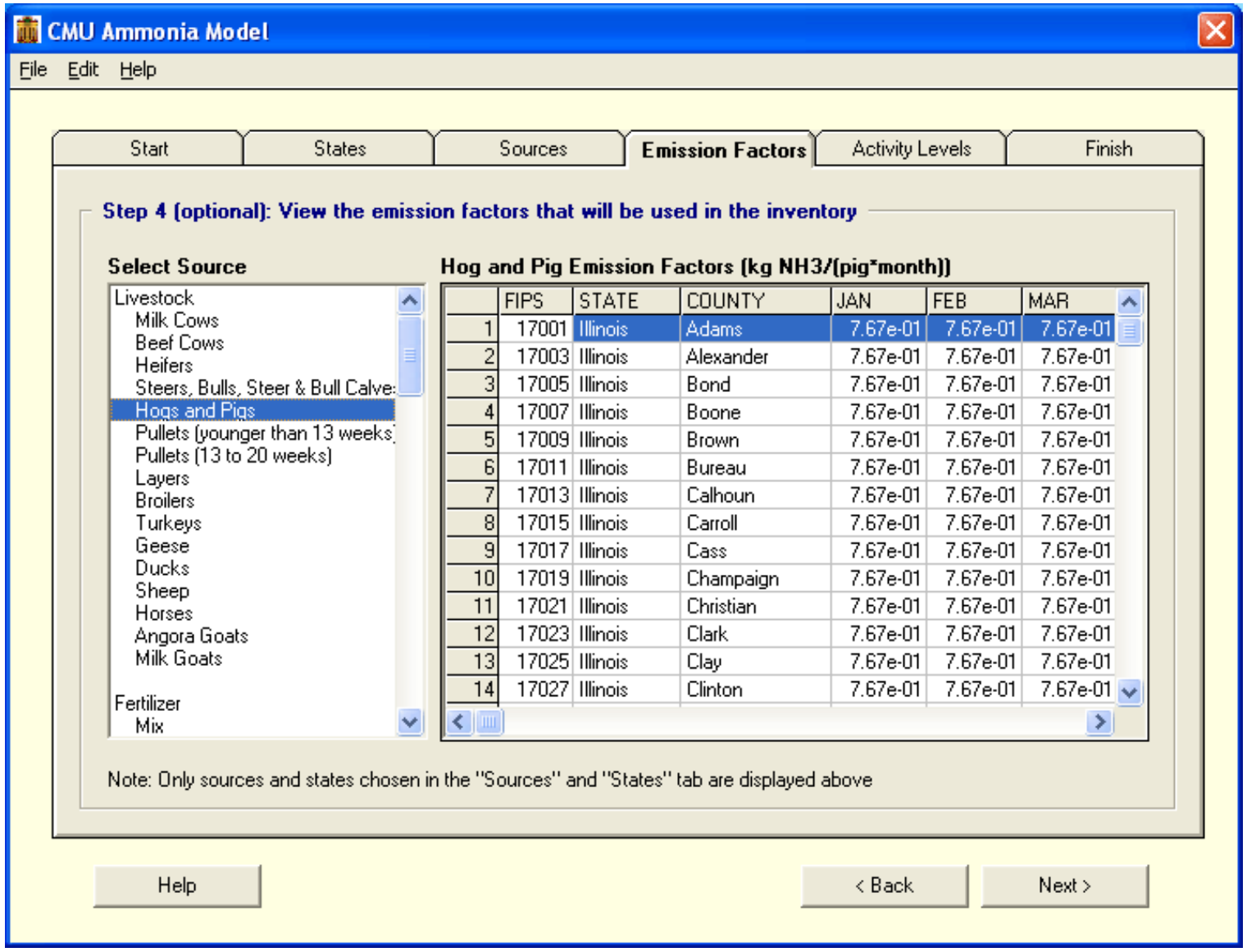
CMU Ammonia Model
File Edit Help
Start States Sources Emission Factors Activity Levels Finish
Step 4 (optional): View the emission factors that will be used in the inventory
Select Source
Livestock
Milk Cows
Beef Cows
Heifers
Steers, Bulls, Steer & Bull Calve
Hogs and Pigs
Pullets (younger than 13 weeks)
Pullets (13 to 20 weeks)
Layers
Broilers
Turkeys
Geese
Ducks
Sheep
Horses
Angora Goats
Milk Goats
Fertilizer
Mix
Hog and Pig Emission Factors (kg NH3/(pig*month))
FIPS STATE COUNTY JAN FEB MAR
1 17001 Illinois Adams 7.67e-01 7.67e-01 7.67e-01
2 17003 Illinois Alexander 7.67e-01 7.67e-01 7.67e-01
3 17005 Illinois Bond 7.67e-01 7.67e-01 7.67e-01
4 17007 Illinois Boone 7.67e-01 7.67e-01 7.67e-01
5 17009 Illinois Brown 7.67e-01 7.67e-01 7.67e-01
6 17011 Illinois Bureau 7.67e-01 7.67e-01 7.67e-01
7 17013 Illinois Calhoun 7.67e-01 7.67e-01 7.67e-01
8 17015 Illinois Carroll 7.67e-01 7.67e-01 7.67e-01
9 17017 Illinois Cass 7.67e-01 7.67e-01 7.67e-01
10 17019 Illinois Champaign 7.67e-01 7.67e-01 7.67e-01
11 17021 Illinois Christian 7.67e-01 7.67e-01 7.67e-01
12 17023 Illinois Clark 7.67e-01 7.67e-01 7.67e-01
13 17025 Illinois Clay 7.67e-01 7.67e-01 7.67e-01
14 17027 Illinois Clinton 7.67e-01 7.67e-01 7.67e-01
Note: Only sources and states chosen in the "Sources" and "States" tab are displayed above
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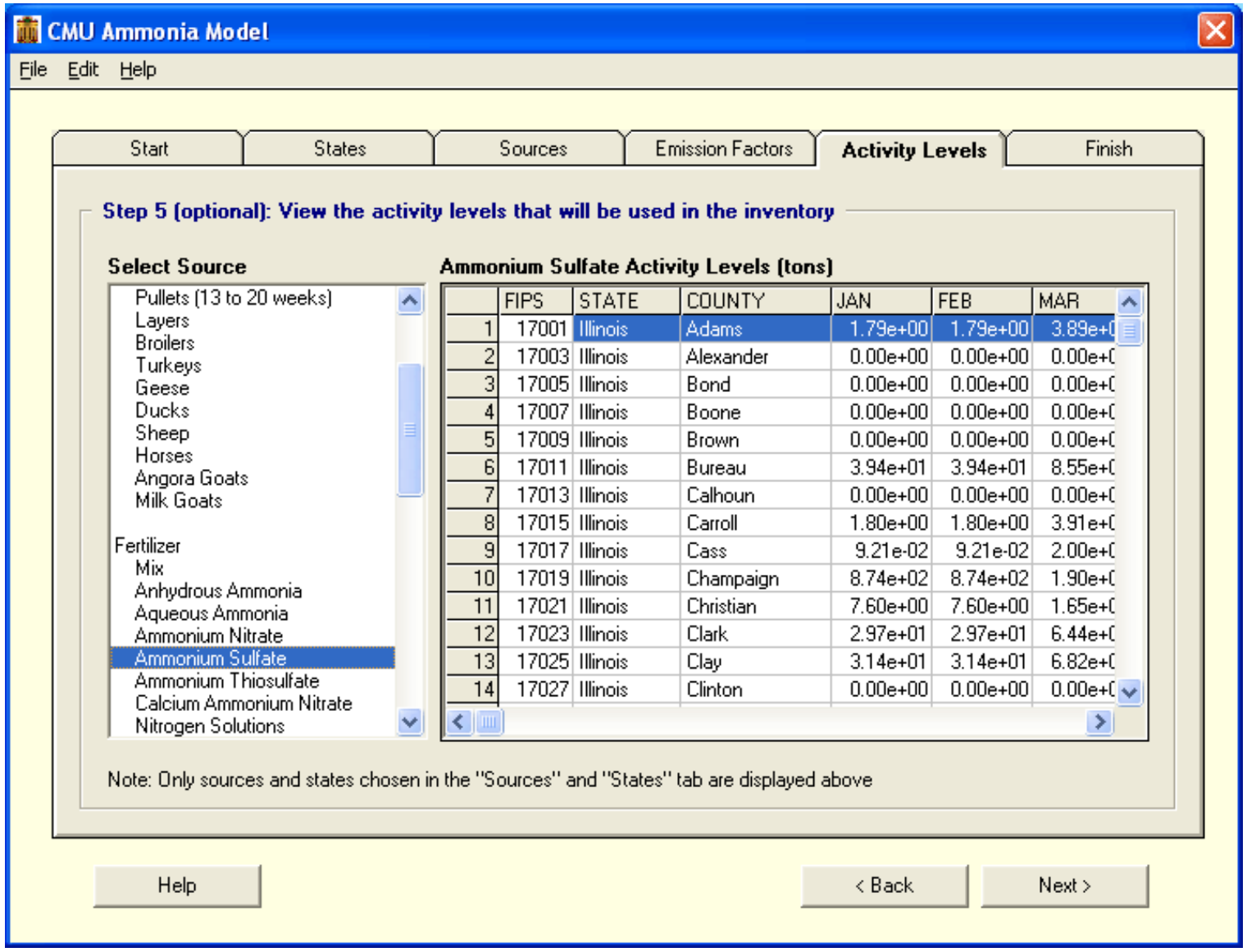
CMU Ammonia Model
File Edit Help
Start States Sources Emission Factors Activity Levels Finish
Step 5 (optional): View the activity levels that will be used in the inventory
Select Source
Pullets (13 to 20 weeks)
Layers
Broilers
Turkeys
Geese
Ducks
Sheep
Horses
Angora Goats
Milk Goats
Fertilizer
Mix
Anhydrous Ammonia
Aqueous Ammonia
Ammonium Nitrate
Ammonium Sulfate
Ammonium Thiosulfate
Calcium Ammonium Nitrate
Nitrogen Solutions
Ammonium Sulfate Activity Levels (tons)
FIPS STATE COUNTY JAN FEB MAR
1 17001 Illinois Adams 1.79e+00 1.79e+00 3.89e+0
2 17003 Illinois Alexander 0.00e+00 0.00e+00 0.00e+0
3 17005 Illinois Bond 0.00e+00 0.00e+00 0.00e+0
4 17007 Illinois Boone 0.00e+00 0.00e+00 0.00e+0
5 17009 Illinois Brown 0.00e+00 0.00e+00 0.00e+0
6 17011 Illinois Bureau 3.94e+01 3.94e+01 8.55e+0
7 17013 Illinois Calhoun 0.00e+00 0.00e+00 0.00e+0
8 17015 Illinois Carroll 1.80e+00 1.80e+00 3.91e+0
9 17017 Illinois Cass 9.21e-02 9.21e-02 2.00e+0
10 17019 Illinois Champaign 8.74e+02 8.74e+02 1.90e+0
11 17021 Illinois Christian 7.60e+00 7.60e+00 1.65e+0
12 17023 Illinois Clark 2.97e+01 2.97e+01 6.44e+0
13 17025 Illinois Clay 3.14e+01 3.14e+01 6.82e+0
14 17027 Illinois Clinton 0.00e+00 0.00e+00 0.00e+0
Note: Only sources and states chosen in the "Sources" and "States" tab are displayed above
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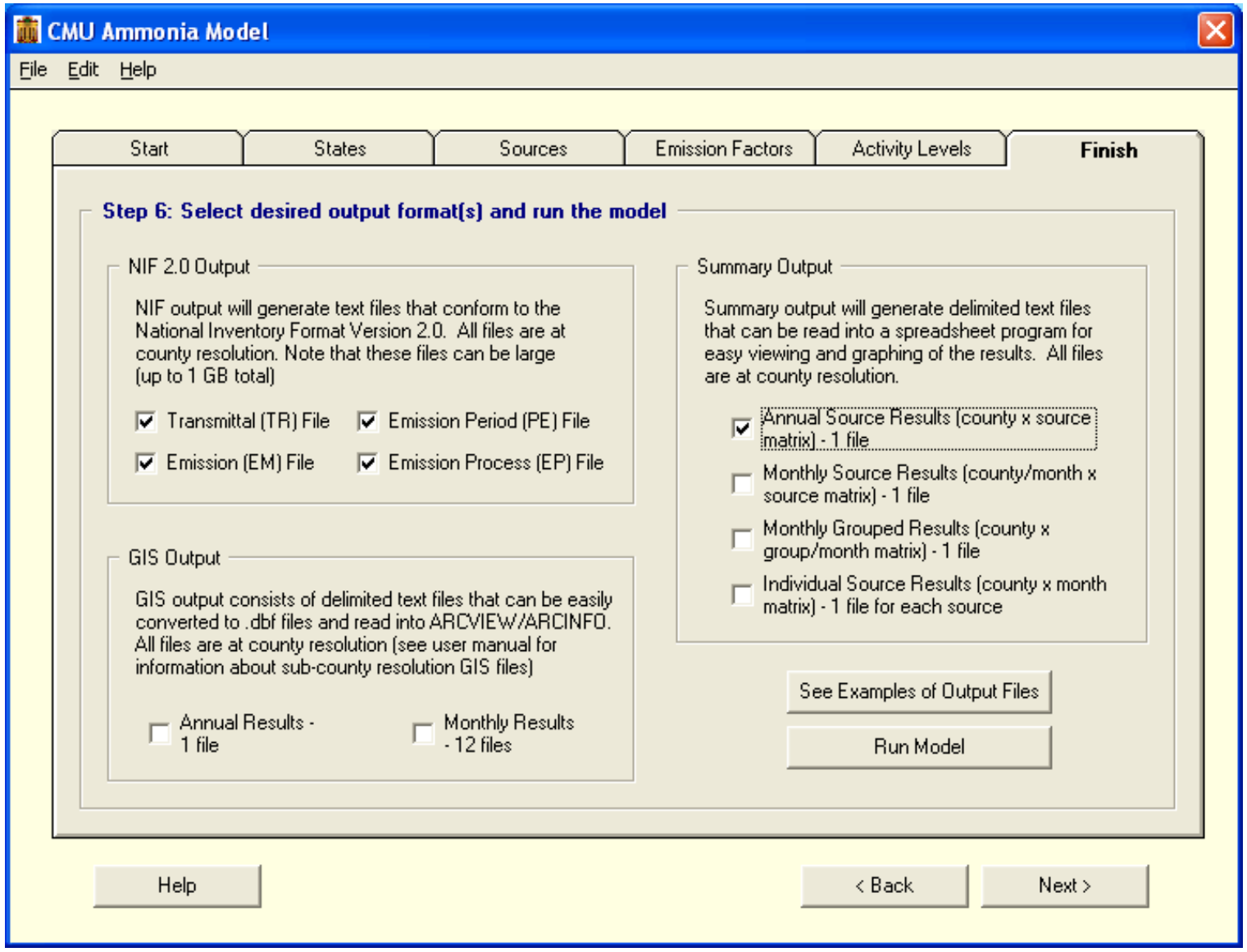
CMU Ammonia Model
File Edit Help
Start
States
Sources
Emission Factors
Activity Levels
Finish
Step 6: Select desired output format(s) and run the model
NIF 2.0 Output
NIF output will generate text files that conform to the National Inventory Format Version 2.0. All files are at county resolution. Note that these files can be large (up to 1 GB total)
Transmittal (TR) File
Emission Period (PE) File
Emission (EM) File
Emission Process (EP) File
GIS Output
GIS output consists of delimited text files that can be easily converted to .dbf files and read into ARCVIEW/ARCINFO. All files are at county resolution (see user manual for information about sub-county resolution GIS files)
Annual Results - 1 file
Monthly Results - 12 files
Summary Output
Summary output will generate delimited text files that can be read into a spreadsheet program for easy viewing and graphing of the results. All files are at county resolution.
Annual Source Results (county x source matrix) - 1 file
Monthly Source Results (county/month x source matrix) - 1 file
Monthly Grouped Results (county x group/month matrix) - 1 file
Individual Source Results (county x month matrix) - 1 file for each source
See Examples of Output Files
Run Model
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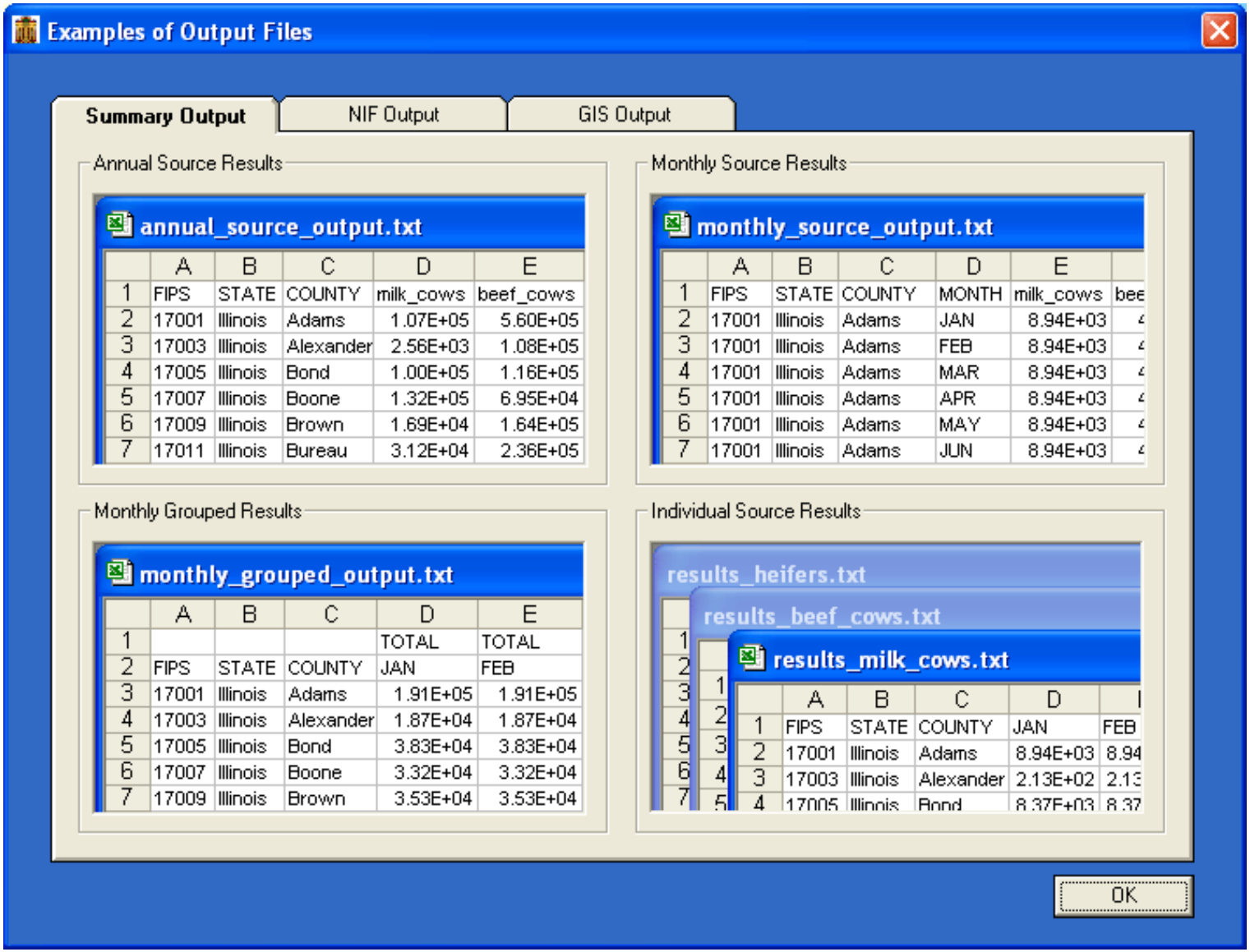


annual_source_output.txt

	A	B	C	D	E
1	FIPS	STATE	COUNTY	milk_cows	beef_cows
2	17001	Illinois	Adams	1.07E+05	5.60E+05
3	17003	Illinois	Alexander	2.56E+03	1.08E+05
4	17005	Illinois	Bond	1.00E+05	1.16E+05
5	17007	Illinois	Boone	1.32E+05	6.95E+04
6	17009	Illinois	Brown	1.69E+04	1.64E+05
7	17011	Illinois	Bureau	3.12E+04	2.36E+05

monthly_source_output.txt

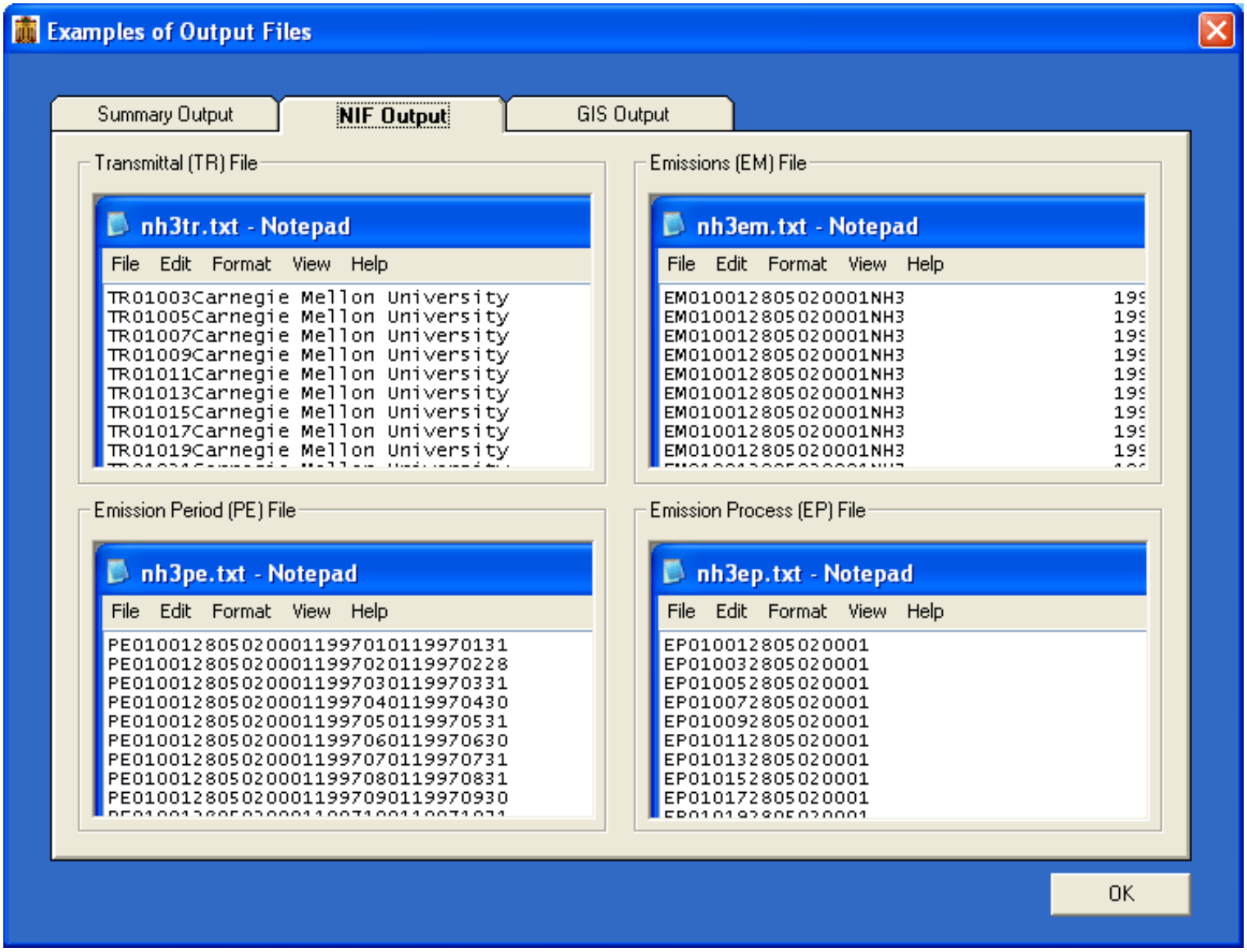
	A	B	C	D	E	
1	FIPS	STATE	COUNTY	MONTH	milk_cows	bee
2	17001	Illinois	Adams	JAN	8.94E+03	4
3	17001	Illinois	Adams	FEB	8.94E+03	4
4	17001	Illinois	Adams	MAR	8.94E+03	4
5	17001	Illinois	Adams	APR	8.94E+03	4
6	17001	Illinois	Adams	MAY	8.94E+03	4
7	17001	Illinois	Adams	JUN	8.94E+03	4

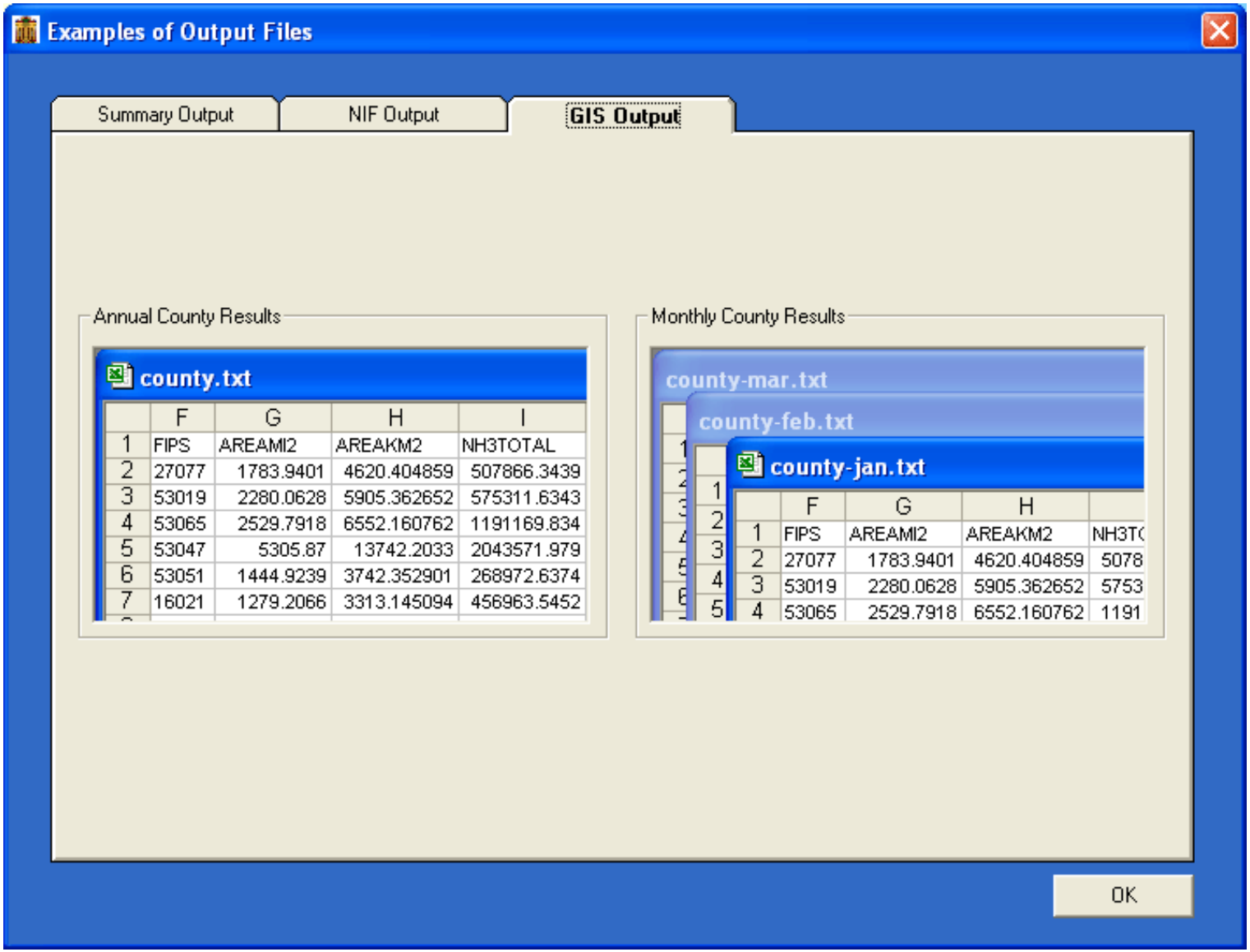
monthly_grouped_output.txt

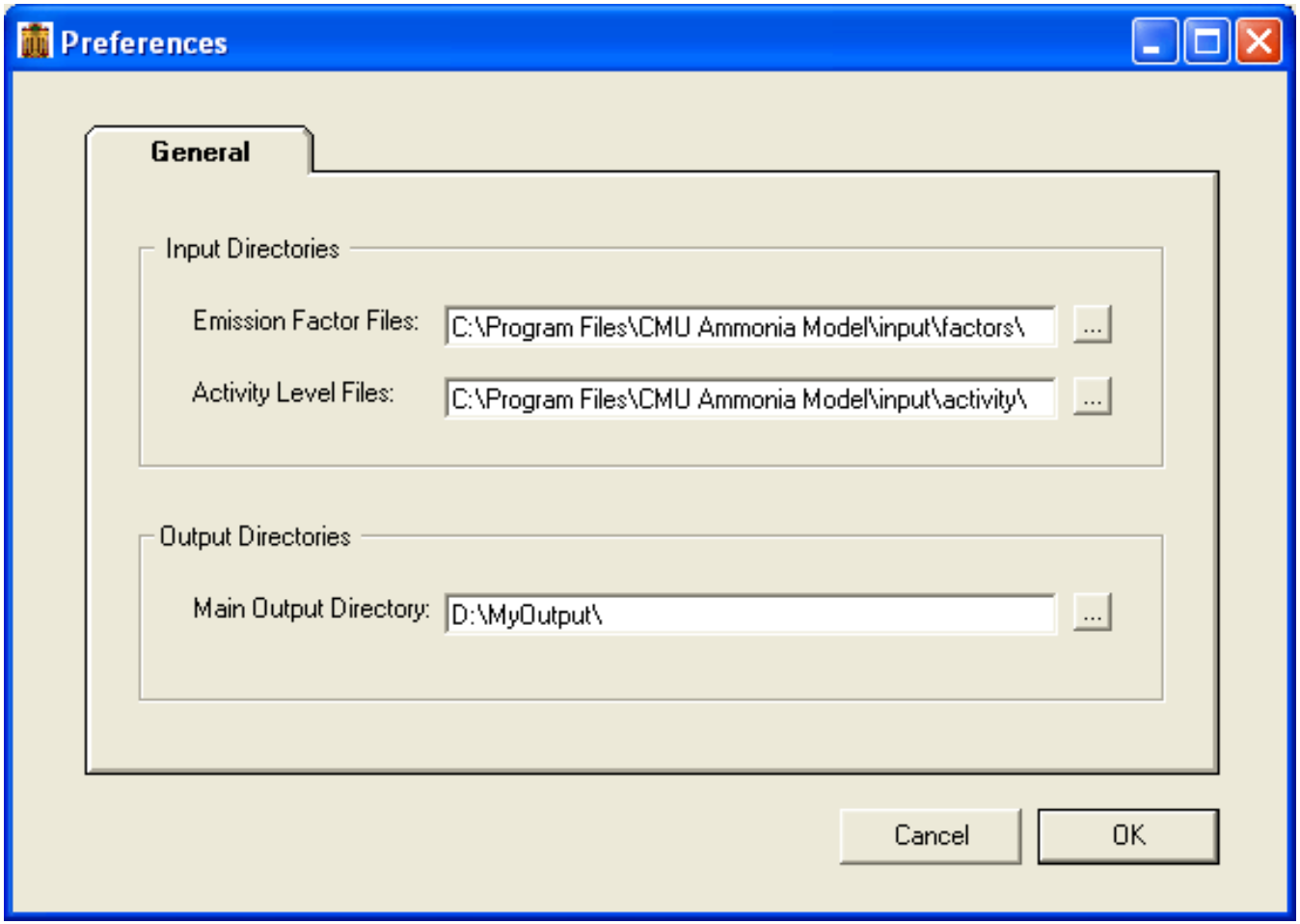
	A	B	C	D	E
1				TOTAL	TOTAL
2	FIPS	STATE	COUNTY	JAN	FEB
3	17001	Illinois	Adams	1.91E+05	1.91E+05
4	17003	Illinois	Alexander	1.87E+04	1.87E+04
5	17005	Illinois	Bond	3.83E+04	3.83E+04
6	17007	Illinois	Boone	3.32E+04	3.32E+04
7	17009	Illinois	Brown	3.53E+04	3.53E+04

results_milk_cows.txt

	A	B	C	D	
1	FIPS	STATE	COUNTY	JAN	FEB
2	17001	Illinois	Adams	8.94E+03	8.94
3	17003	Illinois	Alexander	2.13E+02	2.13
4	17005	Illinois	Bond	8.37E+03	8.37


Examples of Output Files
Summary Output
NIF Output
GIS Output
Transmittal (TR) File
nh3tr.txt - Notepad
File Edit Format View Help
TR01003Carnegie Mellon University
TR01005Carnegie Mellon University
TR01007Carnegie Mellon University
TR01009Carnegie Mellon University
TR01011Carnegie Mellon University
TR01013Carnegie Mellon University
TR01015Carnegie Mellon University
TR01017Carnegie Mellon University
TR01019Carnegie Mellon University
Emissions (EM) File
nh3em.txt - Notepad
File Edit Format View Help
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
EM0100128050200001NH3
Emission Period (PE) File
nh3pe.txt - Notepad
File Edit Format View Help
PE0100128050200011997010119970131
PE0100128050200011997020119970228
PE0100128050200011997030119970331
PE0100128050200011997040119970430
PE0100128050200011997050119970531
PE0100128050200011997060119970630
PE0100128050200011997070119970731
PE0100128050200011997080119970831
PE0100128050200011997090119970930
Emission Process (EP) File
nh3ep.txt - Notepad
File Edit Format View Help
EP0100128050200001
EP0100328050200001
EP0100528050200001
EP0100728050200001
EP0100928050200001
EP0101128050200001
EP0101328050200001
EP0101528050200001
EP0101728050200001
OK


Examples of Output Files
Summary Output
NIF Output
GIS Output
Annual County Results
county.txt
F G H I
1 FIPS AREAMI2 AREAKM2 NH3TOTAL
2 27077 1783.9401 4620.404859 507866.3439
3 53019 2280.0628 5905.362652 575311.6343
4 53065 2529.7918 6552.160762 1191169.834
5 53047 5305.87 13742.2033 2043571.979
6 53051 1444.9239 3742.352901 268972.6374
7 16021 1279.2066 3313.145094 456963.5452
Monthly County Results
county-mar.txt
county-feb.txt
county-jan.txt
F G H
1 FIPS AREAMI2 AREAKM2
2 27077 1783.9401 4620.404859
3 53019 2280.0628 5905.362652
4 53065 2529.7918 6552.160762
OK


Preferences
General
Input Directories
Emission Factor Files:
C:\Program Files\CMU Ammonia Model\input\factors\
...
Activity Level Files:
C:\Program Files\CMU Ammonia Model\input\activity\
...
Output Directories
Main Output Directory:
D:\MyOutput\
...
Cancel
OK

Summary

- Model improvements will hopefully make the ammonia inventory more transparent and easier to generate

- Model currently in beta testing; expected release date is December 5th