

# Emissions Inventory System



Austin, TX

Oct / 2003

Prof. Jesse Thé, Ph.D., P.Eng.

Lakes  
Environmental

# Objectives & Requirements



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Environmental

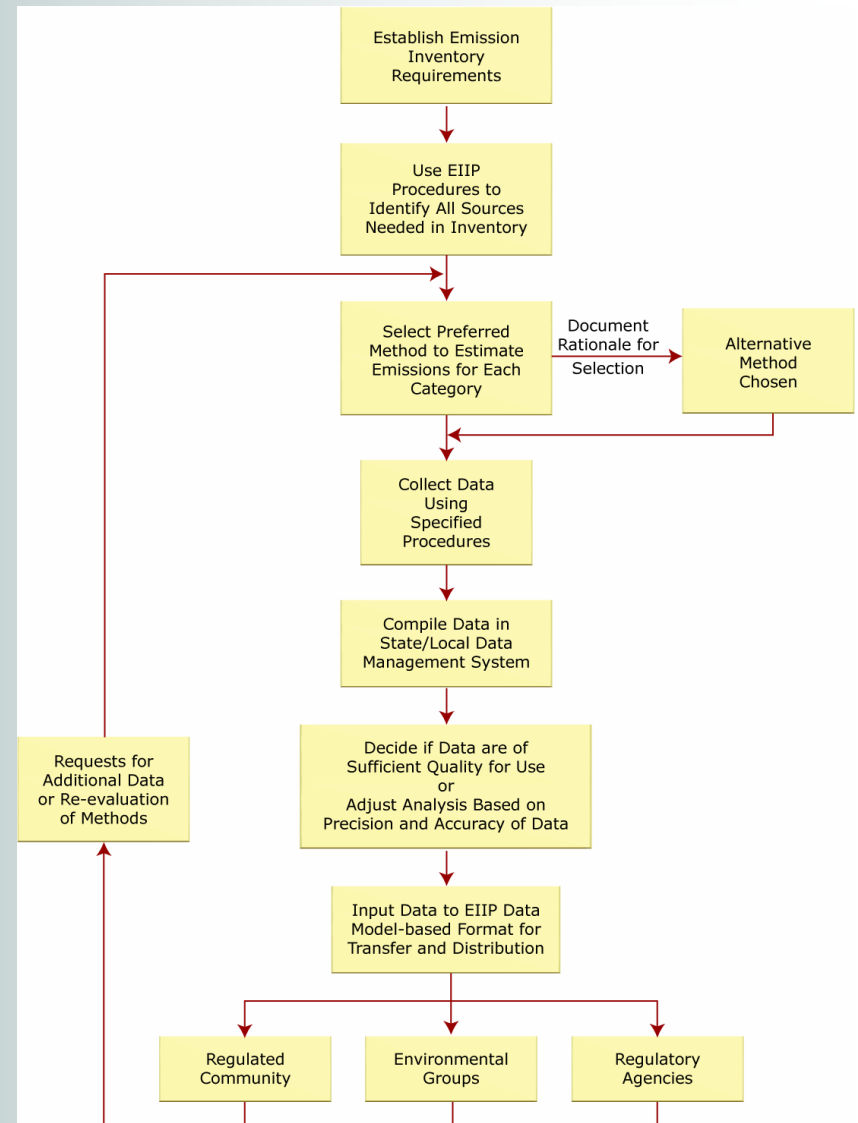
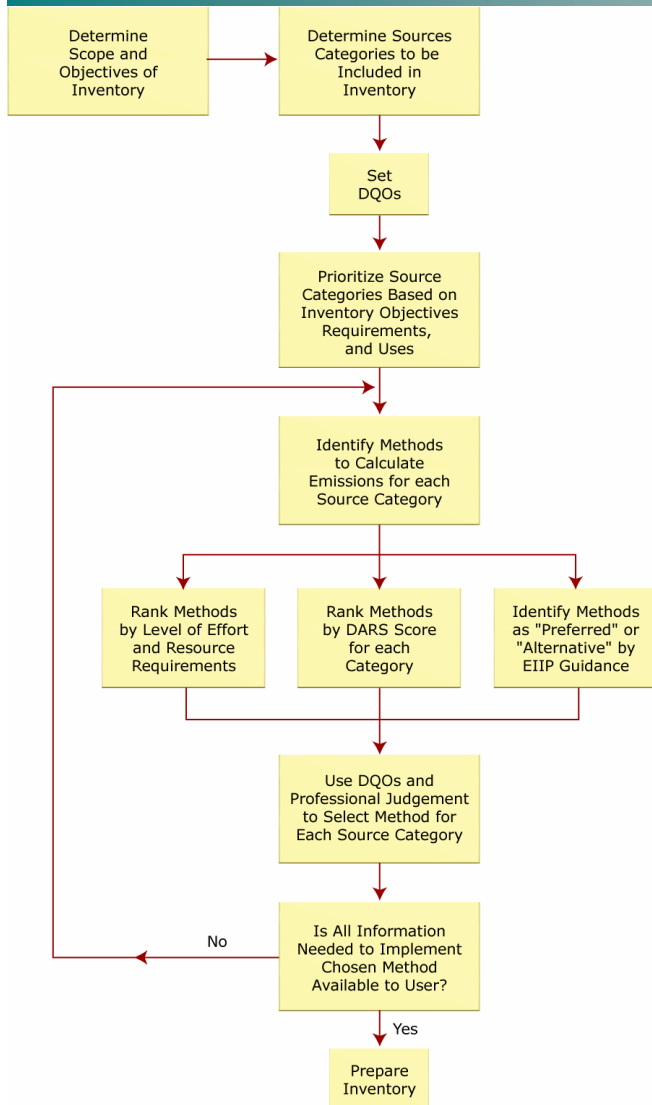
# Objectives

- Emission inventory software with a very user-friendly interface
- Facilitate emission inventories by environmental professionals
- Emission estimates technically defensible

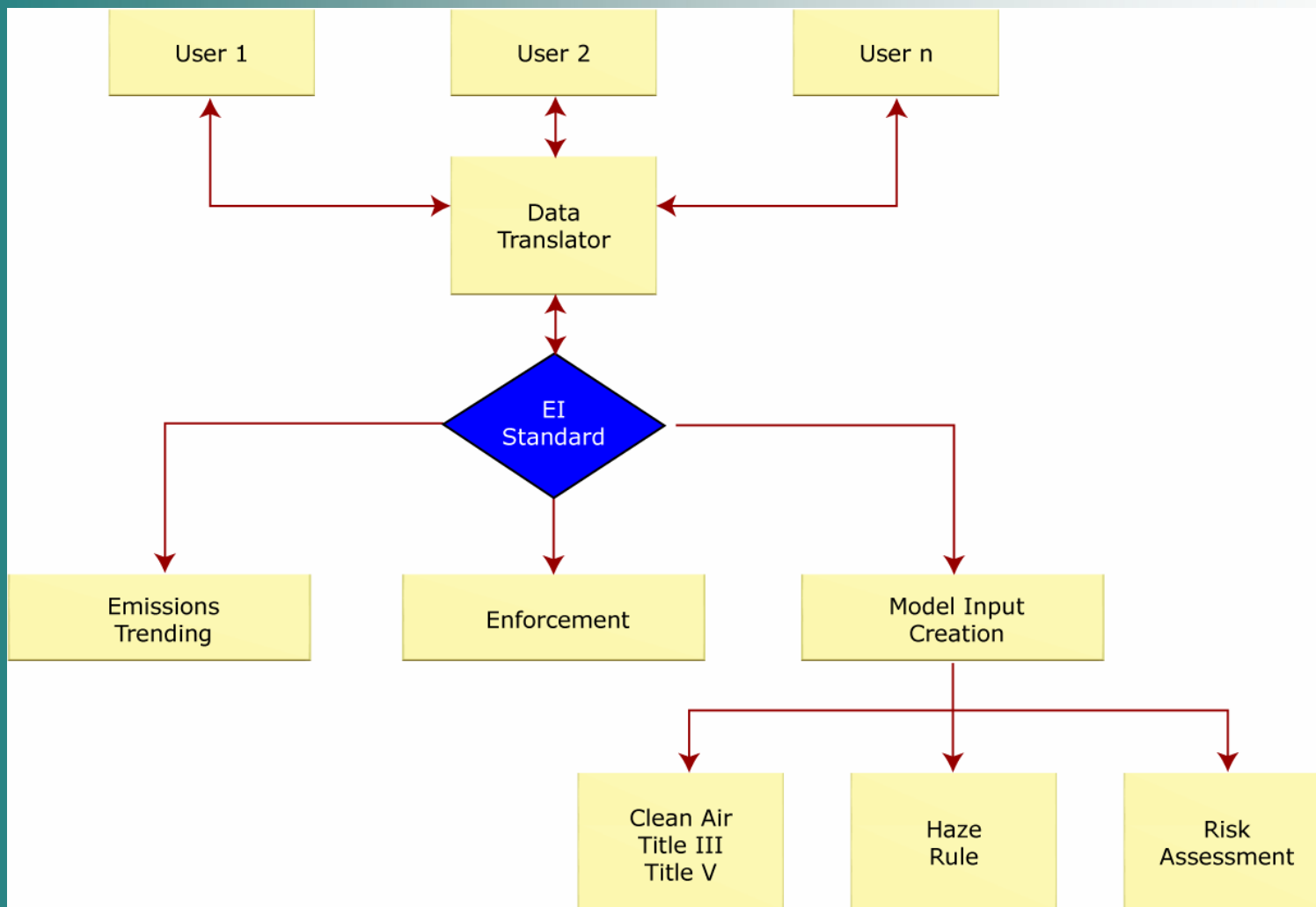
# Requirements

- Requirement Specification
- User Feedback
- QA \ QC Procedures
- Consistent Interface
- Documentation
- Training

# Objectives & Requirements



# Multi-User & Objectives



# Emissions Inventory View

- TEISS View – 1,000+ tribes (Desktop)
- State 1 – Contract won
- State 2 – Under analysis
- State 3 – Moving from competitor
- EPA funded / ITEP Managed:
- Accuracy
- User friendliness

# Advantages

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- Large user base
- Optional Improvement Sharing
- Model ready
- Modular



# System Modules



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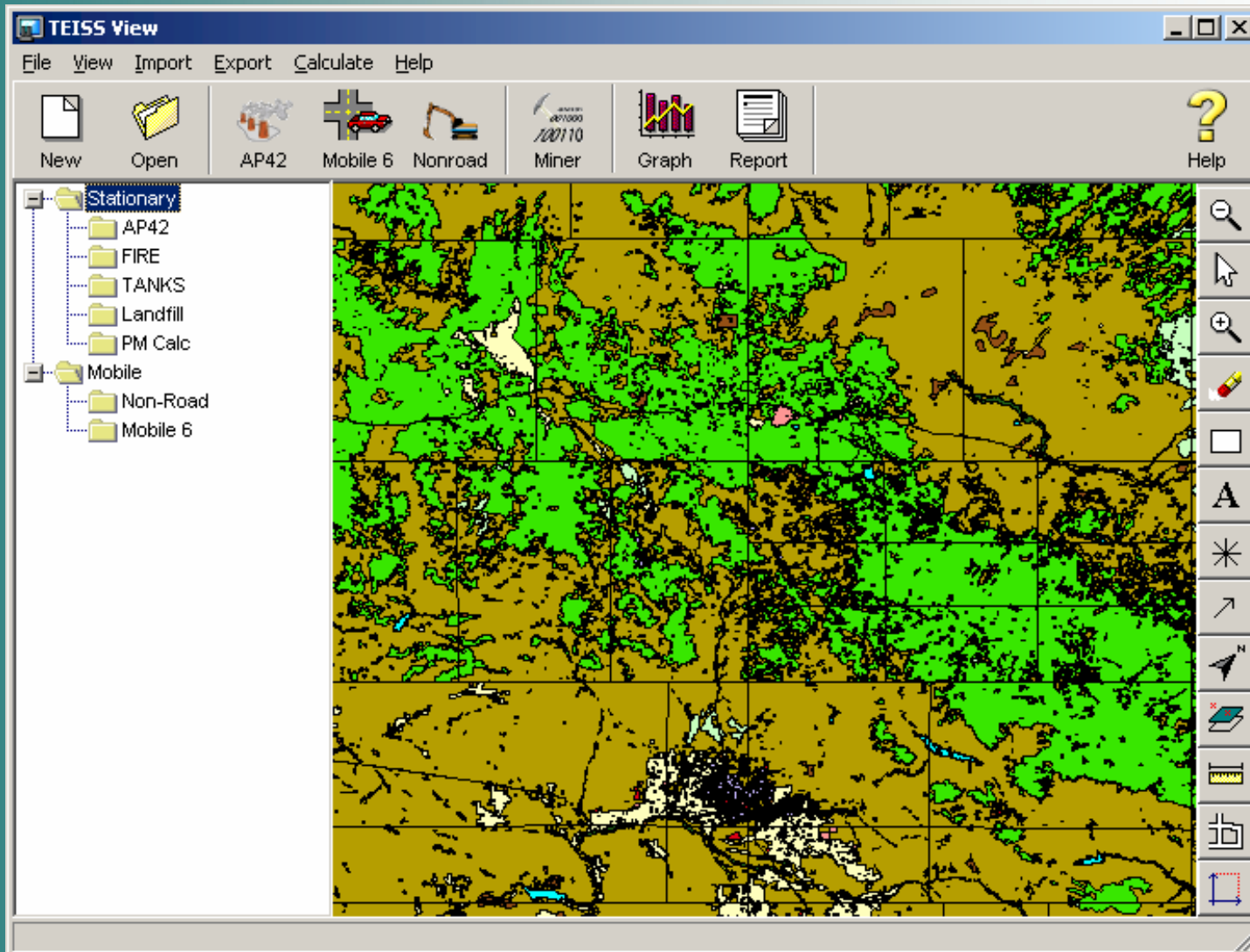
**Lakes**  
Environmental

# System Modules

- GIS
- Calculators
- MOBILE6
- NON-ROAD
- Other Functions



# Mapping



# Calculators

## AP42 Emissions Estimators

- 1.0 External Combustion Sources
- 2.0 Solid Waste Disposal
- 3.0 Stationary Internal Combustion Sources
- 4.0 Evaporation Loss Sources
- 5.0 Petroleum Industry
- 6.0 Organic Chemical Process Industry
- 7.0 Liquid Storage Tanks
- 8.0 Inorganic Chemical Industry
- 9.0 Food and Agricultural Industries
- 10.0 Wood Products Industry
- 11.0 Mineral Productions Industry
- 12.0 Metallurgical Industry
- 13.0 Miscellaneous Sources
- 14.0 Greenhouse Gas Biogenic Sources

## AP-42

### External Combustion

External combustion sources, such as boilers, and commercial and gas are the major fossil fuel also used in relatively small about 95 percent of the total Nationwide consumption in of bituminous coal, nearly 3 91 x 10 liters (24billion gall of residual oil, and 57x10<sup>12</sup>c

Power generation, process h combustion sources of sulfur The following sections prese others.

## AP42 Emissions Estimators

- 1.0 External Combustion Sources
  - 1.1 Bituminous and Subbituminous Co
  - 1.2 Anthracite Coal Combustion
  - 1.3 Fuel Oil Combustion
  - 1.4 Natural Gas Combustion
  - 1.5 Liquefied Petroleum Gas Combust
  - 1.6 Wood Residue Combustion in Boi
  - 1.7 Lignite Combustion
  - 1.8 Bagasse Combustion in Sugar Mil
  - 1.9 Residential Fireplaces
  - 1.10 Residential Wood Stoves
  - 1.11 Waste Oil Combustion
- 2.0 Solid Waste Disposal
  - 2.1 Refuse Combustion
  - 2.2 Sewage Sludge Incineration
  - 2.3 Medical Waste Incineration
  - 2.4 Municipal Solid Waste Landfills
  - 2.5 Open Burning
  - 2.6 Automobile Body Incineration
  - 2.7 Conical Burners
- 3.0 Stationary Internal Combustion Sources
  - 3.1 Stationary Gas Turbines
  - 3.2 Natural Gas-Fired Reciprocating E
  - 3.3 Gasoline and Diesel Industrial Eng
  - 3.4 Large Stationary Diesel and All St
- 4.0 Evaporation Loss Sources
- 5.0 Petroleum Industry
- 6.0 Organic Chemical Process Industry
- 7.0 Liquid Storage Tanks
- 8.0 Inorganic Chemical Industry
- 9.0 Food and Agricultural Industries
- 10.0 Wood Products Industry
- 11.0 Mineral Productions Industry
- 12.0 Metallurgical Industry
- 13.0 Miscellaneous Sources
- 14.0 Greenhouse Gas Biogenic Sources

## AP-42

### Stationary Gas Turbines

Stationary gas turbines are applied in electric power generators, in gas pipeline pump and compressor drives, and in various process industries. Gas turbines (greater than 4021 horsepower (electric) or 3 megawatts (electric) are used in electrical generation for continuous, peaking, or standby power. The primary fuels used are natural gas and distillate (No. 2) fuel oil, although residual fuel oil is used in a few applications.

#### Stationary Gas Turbines

Turbine Information    General Results    HAP Results    Metal HAP Results

Units:

Reciprocating Engine Type:

Applicable SCCs: 2-01-002-01, 2-02-002-01/03, 2-03-002-02/03

Control System:

Fuel Heating Value:  Btu/scf @ 60°F

Fuel Sulfur Content:  %

Fuel Quantity Fired:  m<sup>3</sup>

Calculate

Reset

#### Emission

Click Button to

Estimator

## Emissions Estimation Calculators

Click Button to Launch Desired Calculator

Close

# Mobile 6

- Min / Max Temperature
- Vehicle Speed
- Distributions
- Fuel RVPs

MOBILE View - [C:\MobileView\Example1\Examole1.MVP]

File Data Run View Tools Help

New Open Print Run Editor Graph Help

MOBILE6 Project

- Project Info
- Pollutants
- Output Options
- Run 1
  - Scenario 1.1
  - Scenario 1.2
  - Scenario 1.3
  - Scenario 1.4
  - Scenario 1.5

Run: Run 1 Scenario: Scenario 1.1

	Description	Status
<input checked="" type="checkbox"/>	Min/Max Temperature	60.0/93.0 °F
<input checked="" type="checkbox"/>	Hourly Temperature	not used
<input checked="" type="checkbox"/>	Absolute Humidity	75.0 gr/lb
<input checked="" type="checkbox"/>	A/C - Cloud Cover	off
<input checked="" type="checkbox"/>	A/C - Peak Sun	off
<input checked="" type="checkbox"/>	A/C - Sunrise/Sunset	off

	Description	Status
<input checked="" type="checkbox"/>	Min/Max Temperature	60.0/93.0 °F
<input checked="" type="checkbox"/>	Hourly Temperature	not used
<input checked="" type="checkbox"/>	Absolute Humidity	75.0 gr/lb
<input checked="" type="checkbox"/>	A/C - Cloud Cover	off
<input checked="" type="checkbox"/>	A/C - Peak Sun	off
<input checked="" type="checkbox"/>	A/C - Sunrise/Sunset	off
<input checked="" type="checkbox"/>	Calendar Year	2012
<input checked="" type="checkbox"/>	Altitude	low
<input checked="" type="checkbox"/>	Month	January

Environment Fuel Options Emissions Vehicle Information Vehicle Activity VM Programs Alternative Regulations

## MOBILE View

**Name:** EVALUATION MONTH

**Status:** Optional.

**Section:** Scenario.

**Description:** This command provides the option of calculating emission factors for January 1 or July 1 of the calendar year of evaluation.

**Default:** January or "1".

**Explanation:** MOBILE6 allows the choice of January 1 or July 1. The specified month will affect emission calculations in two ways:

1. by changing the composition of the fleet (July 1 emission factors will reflect an additional six months of fleet turnover, or replacement of older vehicles by

WRPLOT View - Lakes Environmental Software

File Edit Help

Display: Wind Speed, Stability Classes, Unit of Measurement: Knots, Meters/Second

Met Data Information Frequency Count Freq

Station #12960 - HOUSTON/INTERCONTINENTAL ARPT

North, South, West, East

Add Delete

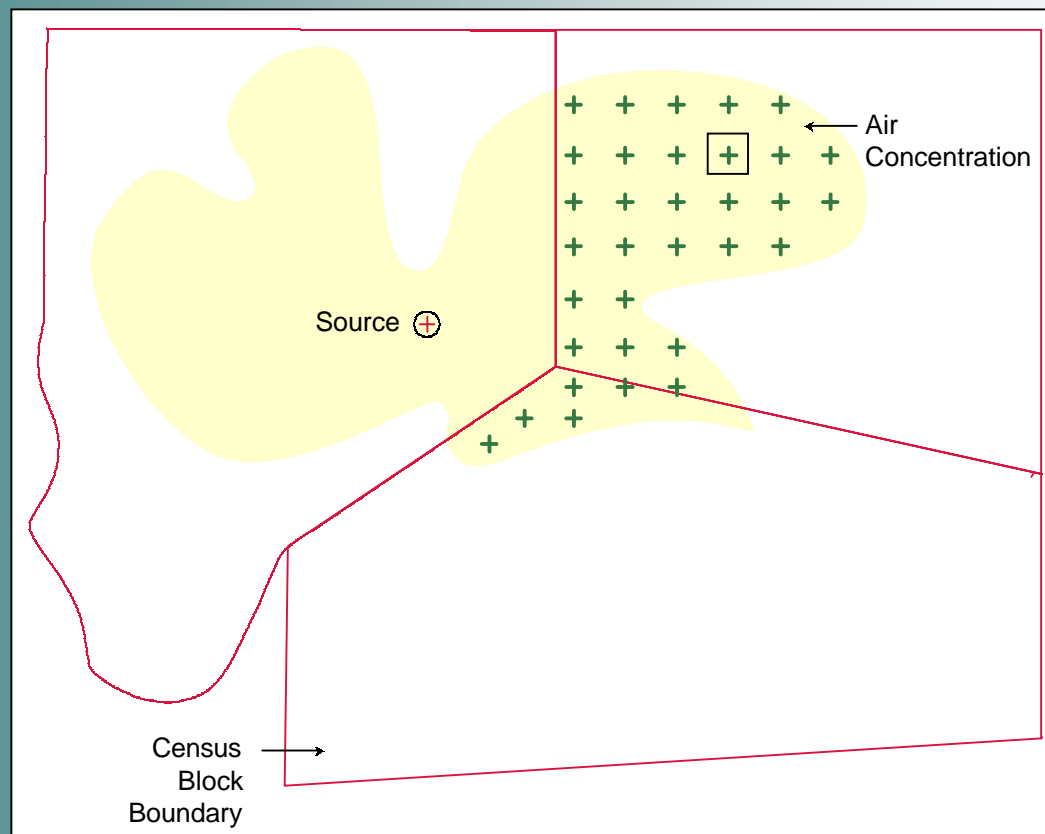
Lakes Environmental Software - Air Dispersion Modeling and Risk Assess

start 6 Windows Ex... Asmdata.d - Wo... MOBILE View 6:06 PM

# Area Source Allocations



- Polygon Intersection
- GIS Area Allocation



# DataMiner – Query Builder

The screenshot displays the DataMiner Query Builder interface. The main window is titled "Data Miner - [Actual History - Statewide]". It features a toolbar with icons for "Query Builder", "Legend", and "Save Data". Below the toolbar is a search bar with the text "Search by:" and a dropdown menu, followed by the word "for" and another dropdown menu.

The central area contains a "Query Builder - [Actual History - Statewide]" dialog box. This dialog has two columns: "Fields" and "Values".

Fields	Values
AC_ACCOUNT	AC_ACCOUNT
AC_FIRST_12	900029G
AC_LAST_24	900034N
FC_FIN	900094S
FC_SCC_CODE	900109H
PT_EPN	900121R
PT_POINT_NAME	900128D

Below the columns are logical operators: =, <>, AND, >, >=, OR, <, <=, NOT, and ().

The query text area shows the following query:

```
(AC_ACCOUNT = 'JE0168B')  
AND  
(ACH_ACTUAL >= '1')  
AND  
(CN_CONTAM_NAME = 'STYRENE')
```

Buttons for "Apply", "Close", and "Apply" are visible on the right side of the dialog box.

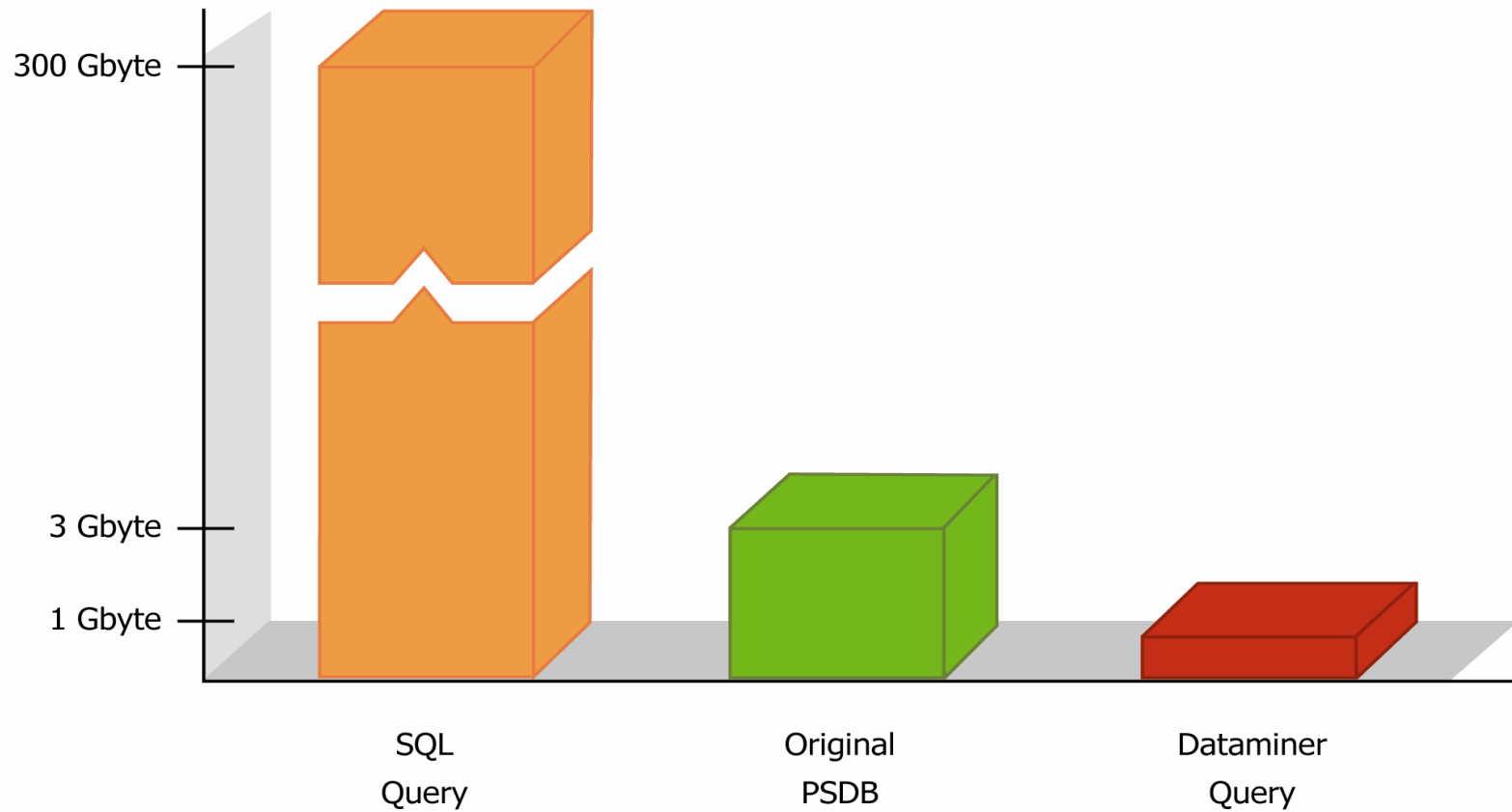
At the bottom of the main window, the same query text is displayed:

```
(AC_ACCOUNT = 'JE0168B')  
AND  
(ACH_ACTUAL >= '1')  
AND  
(CN_CONTAM_NAME = 'STYRENE')
```

The Windows taskbar at the bottom shows the Start button, several application icons (including Internet Explorer, Outlook, and Word), and the system tray with the time 7:45 PM.

# Data Miner

Data Mining  
Memory Restriction





# DataMiner – Saving Results

**Data Miner - [New PSDB View]**

Query Builder Legend Save Data

Search by: AC\_FIRST\_12 for

AC_FIRST_12	AC_LAST				CE_UPSET_EMIS	CE
ATOFINA PETR	OCEMICALS INC				0.2643	0
ATOFINA PETR	OCEMICALS INC				5.7667	0
ATOFINA PETR	OCEMICALS INC				3.5554	0
ATOFINA PETR	OCEMICALS INC				3.3186	0
ATOFINA PETR	OCEMICALS INC				1.2743	0
ATOFINA PETR	OCEMICALS INC				4.595	0
ATOFINA PETR	OCEMICALS INC				4.595	0
ATOFINA PETR	OCEMICALS INC				2.6664	0
ATOFINA PETR	OCEMICALS INC				1.7899	0
ATOFINA PETR	OCEMICALS INC				1.0148	0
ATOFINA PETR	OCEMICALS INC				1.1125	0
ATOFINA PETR	OCEMICALS INC				2.0832	0
ATOFINA PETR	OCEMICALS INC				2.855	0
ATOFINA PETR	OCEMICALS INC	PORT ARTHUR	JE0005H	0	2.4196	0
ATOFINA PETR	OCEMICALS INC	PORT ARTHUR	JE0005H	0	1.4734	0
ATOFINA PETR	OCEMICALS INC	PORT ARTHUR	JE0005H	0	2.4846	0

**Save Data in external File...**

Save in: Dataminer Screenshots

Actual gt allowable jefferson.csv

File name: Actual gt allowable jefferson.csv

Save as type: CSV Files (\*.csv)

Save Cancel

(CCD\_COUNTY\_NAME = 'JEFFERSON')  
AND  
(CE\_HAP = '1')  
AND  
(CE\_ACTUAL >= '1')  
AND  
(CE\_ACTUAL >= CE\_LONGTRM\_ALLOW)

Apply Close

Start | Inbox - Out... | Dataminer S... | untitled - Paint | Datamine... | WordPerfec... | 11:35 AM

# DataMiner – Excel Review

Microsoft Excel - Actual gt allowable jefferson.csv

File Edit View Insert Format Tools Data Window Help

A18 = SOUTHERN MAN

	A	B	D	E	F	G	H	J
	AC FIRST 12	AC LAST 24	CE_ACCO	CE_LONGTRM A	CE_ACTUAL	CE_UPSE	CE_PERMIT	CN_CONTAM NAME
5	EI DU PONT	DE NEMOURS &	JE0033C	1.92	2.7278	0	4351	NITROBENZENE
6	EI DU PONT	DE NEMOURS &	JE0033C	1.53	1.9633	0	4351	NITROBENZENE
7	EI DU PONT	DE NEMOURS &	JE0033C	0.18	3.6058	0	4351	NITROBENZENE
8	EXXON MOBIL	CHEMICAL CO	JE0065M	0	5.444	1.0126	6860	ETHYLENE
9	EXXON MOBIL	CHEMICAL CO	JE0065M	0	54.2199	0	6860	ETHYLENE
10	EXXON MOBIL	CHEMICAL CO	JE0065M	0.47	6.2184	0	6860	ETHYLENE
11	EXXON MOBIL	CHEMICAL CO	JE0065M	0.47	2.7009	0	6860	ETHYLENE
12	EXXON MOBIL	CHEMICAL CO	JE0065M	0	35.428	0.389	8758	ETHYLENE
13	THE GOODYEA	TIRE & RUBBER	JE0039N	0	7.23	4.4658	9481	HEXANE
14	THE GOODYEA	TIRE & RUBBER	JE0039N	0	227.0174	0	9481	HEXANE
15	PREMCOR REF	NING GROUP	JE0042B	0	1.2026	0	19404	CUMENE
16	HUNTSMAN CO	PORATION	JE0052V	0.3	2.1505	0	19949	BUTADIENE
17	OILTANKING B	EAUMONT PART	JE00100	6.36	7.6596	0	21356	METHYL TERT-BUTY
18	SOUTHERN MA	UFACTURING CC	JE0168B	20.02	43.9	0	27354	STYRENE
19	SOUTHERN MA	UFACTURING CC	JE0168B	20.02	43.9	0	27354	STYRENE
20	EQUISTAR CHE	MICALS L P	JE0011M	1.12	1.12	0	673B	ETHYLENE
21	EQUISTAR CHE	MICALS L P	JE0011M	11.19	20.23	0	673B	ETHYLENE
22	ATOFINA CHE	MICALS INC	JE0074L	0	1.057	0	865A	ETHYLENE
23	ATOFINA CHE	MICALS INC	JE0074L	0.03	1.0314	0	865A	HYDROGEN SULFID
24	EQUISTAR CHE	MICALS L P	JE0011M	0	21.68	0	4295A	ETHYLENE
25	PREMCOR REF	NING GROUP	JE0042B	1.72	2.98	0	8133A	HYDROGEN SULFID
26	NECHES RIVER	TREATMENT CC	JE0320T	0	5.4094	0		ACETALDEHYDE
27	AMERIPOL SY	NPOL CORP	JE0017A	0	1.619	0		ACETONE
28	THE GOODYEA	TIRE & RUBBER	JE0039N	0	8.8953	0		ACETONE
29	ENTERPRISE T	RANSPORTATION	JE0144V	0	1.25	0		ACETONE

Ready Sum=54837.84 NUM

Start Inb... Da... unt... Da... W... M... Ho... 5:37 PM

# System Architecture



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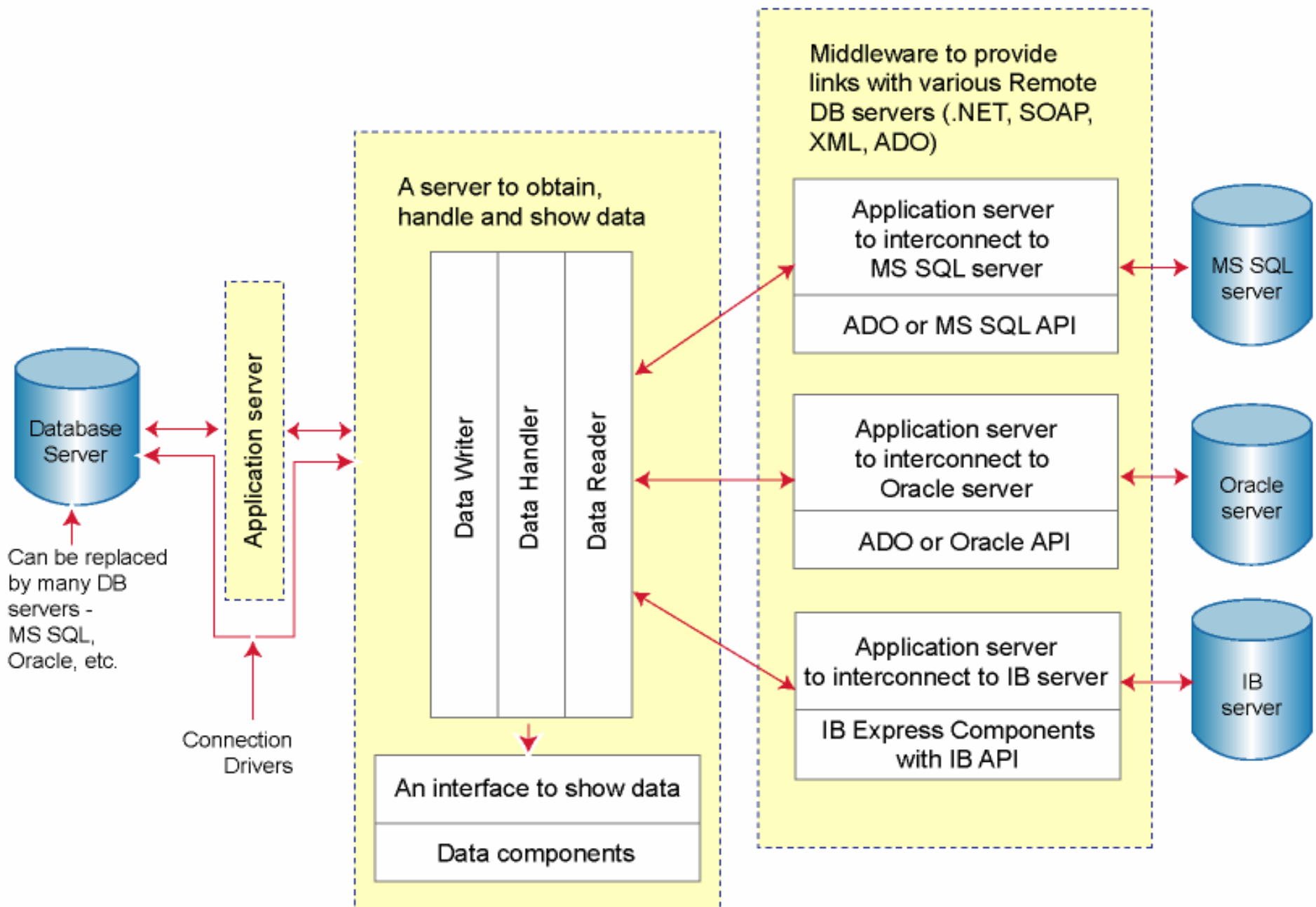
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Environmental

# Software Engineering

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- Integration Problem
- Modularity
- Cost
- Development Time
- Maintenance
- Changing Data Formats
- Scalability



# Lan / Web Based

- Spatial and Temporal Database
- 100% Arc View Compatible
- Thick and Thin Clients

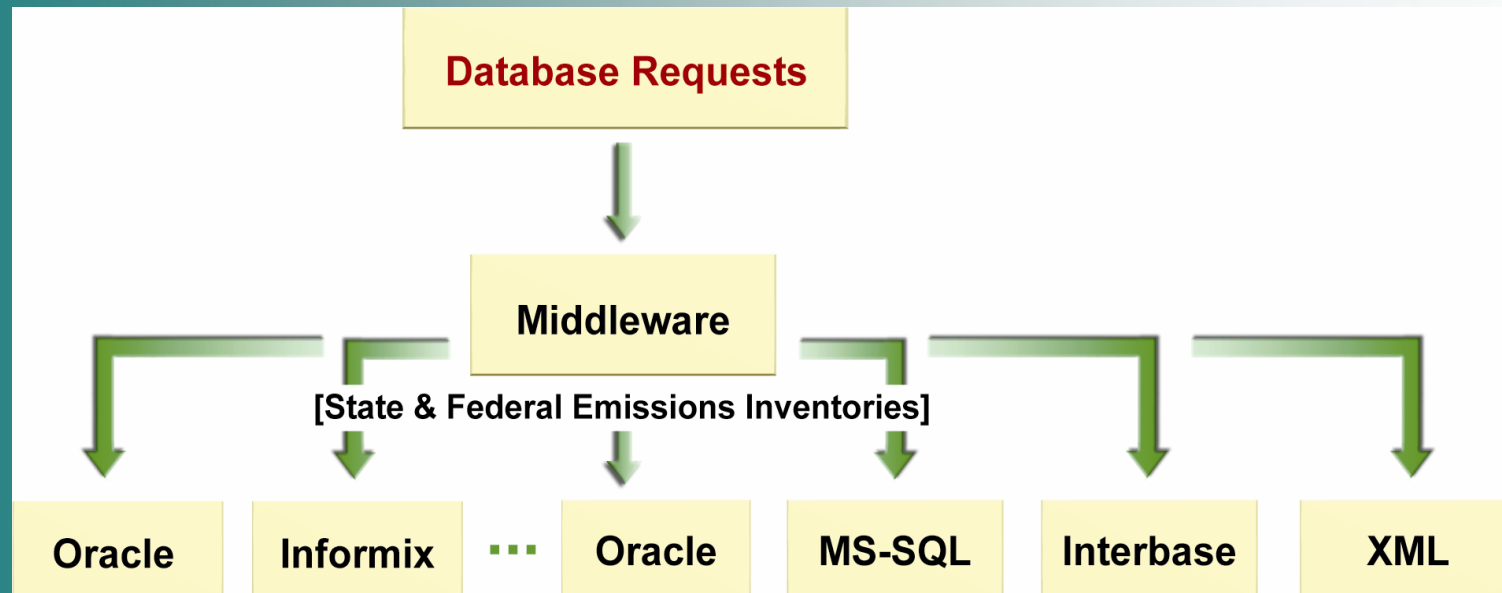
# Pause - Terminology

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- HTML
- XML
- SVG
- .NET
- Borland
- Middleware

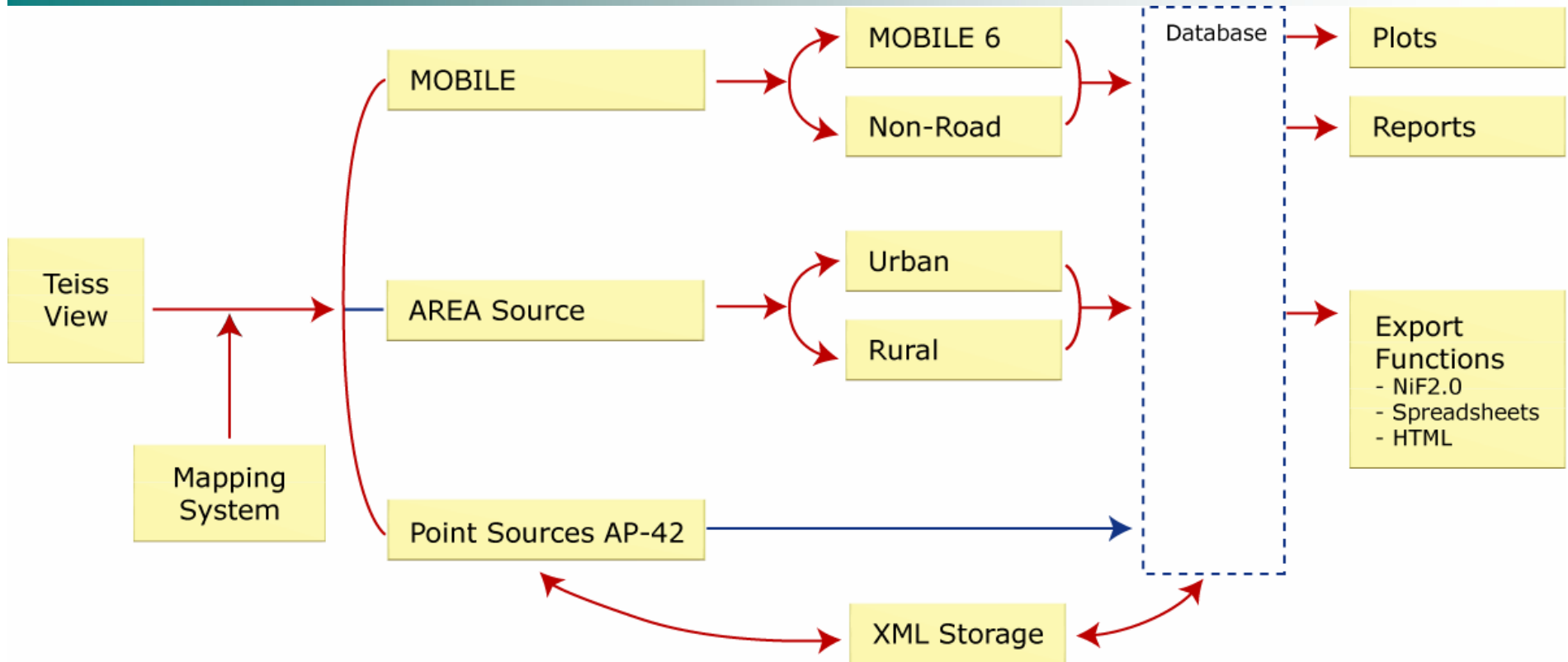
# Scalable Architecture

- Desktop / Stand-Alone App
  - Client / Server DBMS Independence
  - Web & .NET
  - XML

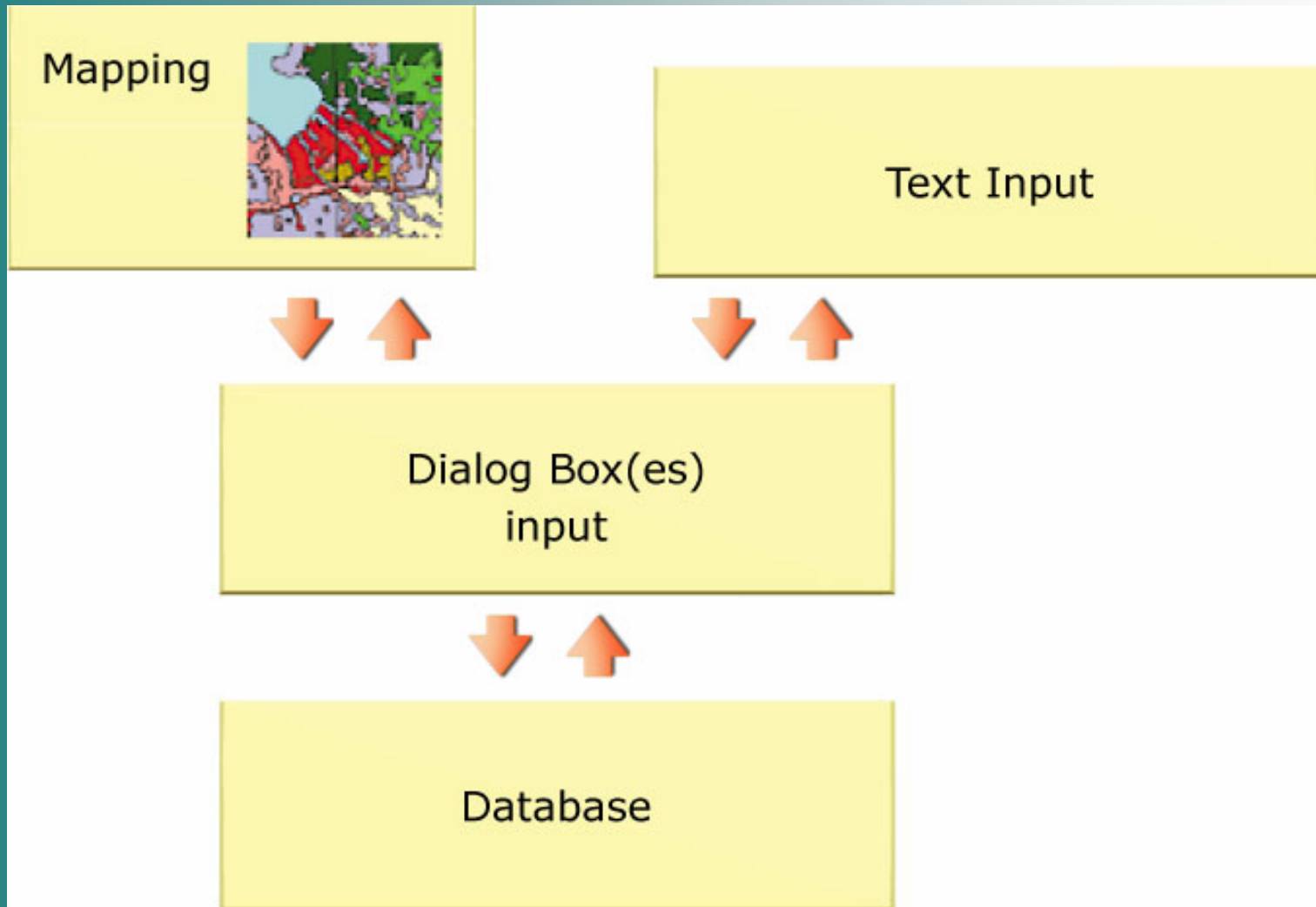




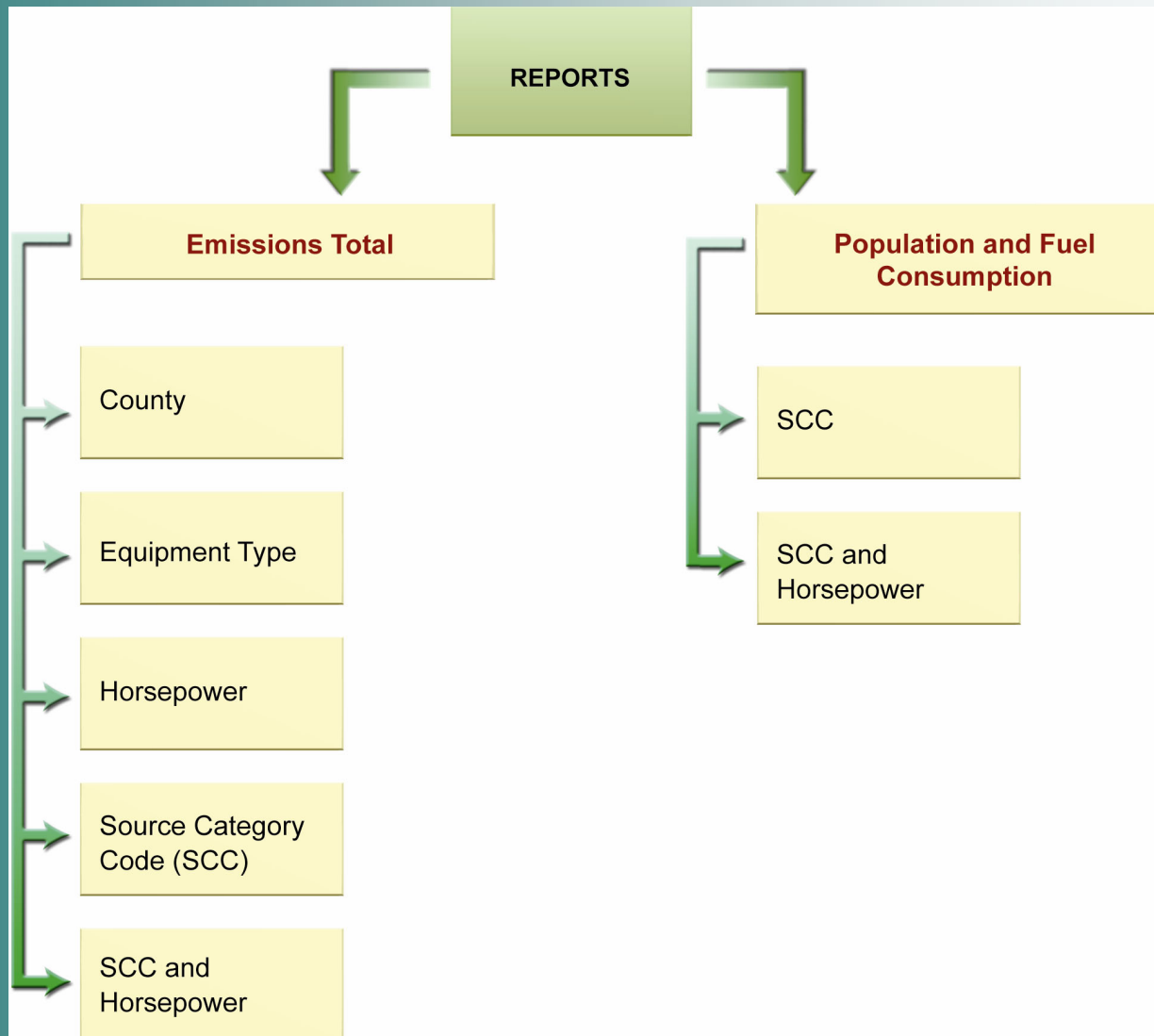
# TEISS Software Components



# GIS and text input integration



# Reports



# Database Structure



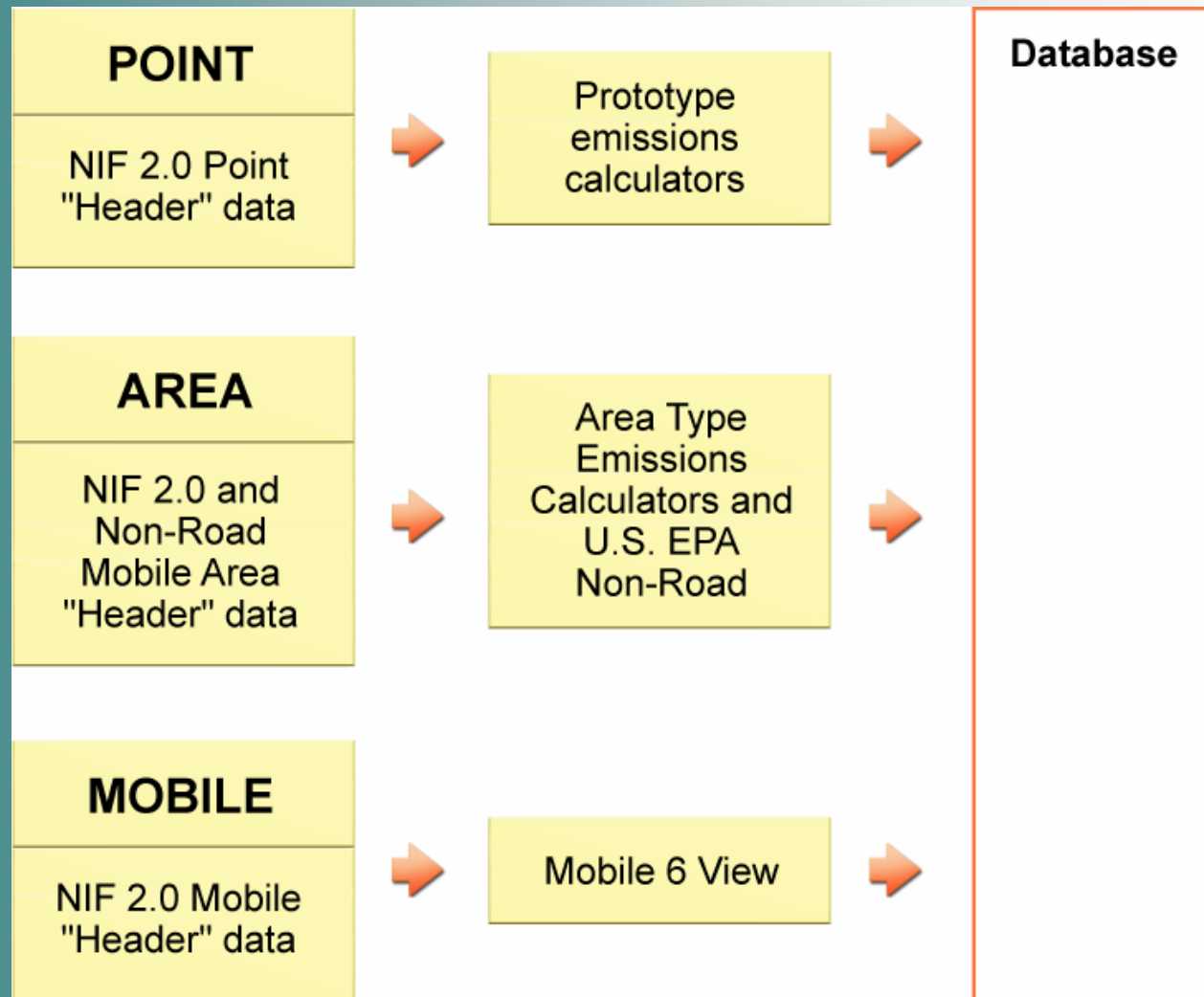
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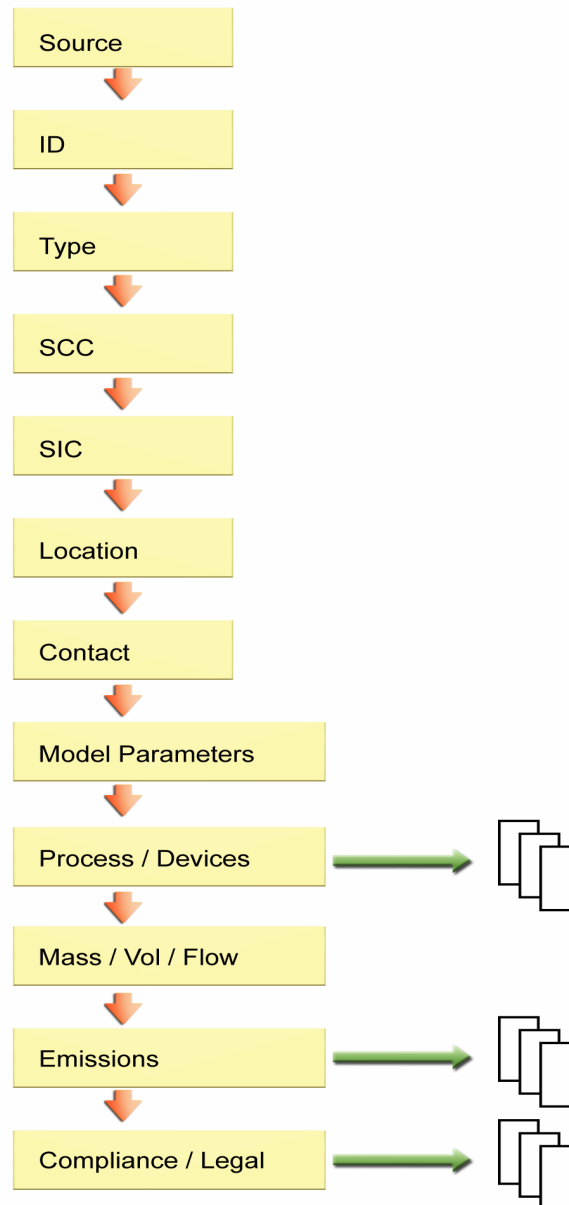
**Lakes**  
Environmental

# General Database Structure



# General Database Structure

## Data Model



# County Level Data Flowchart

**State FIPS**  
**County FIPS**  
**= Tribal ID**

Uses:

StrStateFIPS  
StrCountyFIPS



**Organization Name**  
**Contact Name**  
**Contact Type**  
**Phone #**  
**Alt Phone #**  
**Fax #**  
**E-mail**

Uses:

StrOrganizationName  
StrContactPersonName  
StrContactTypeCode  
StrContactPhoneNumber  
StrContactAlternatePhoneNumber  
StrContactFaxNumber  
StrContactEmailAddress

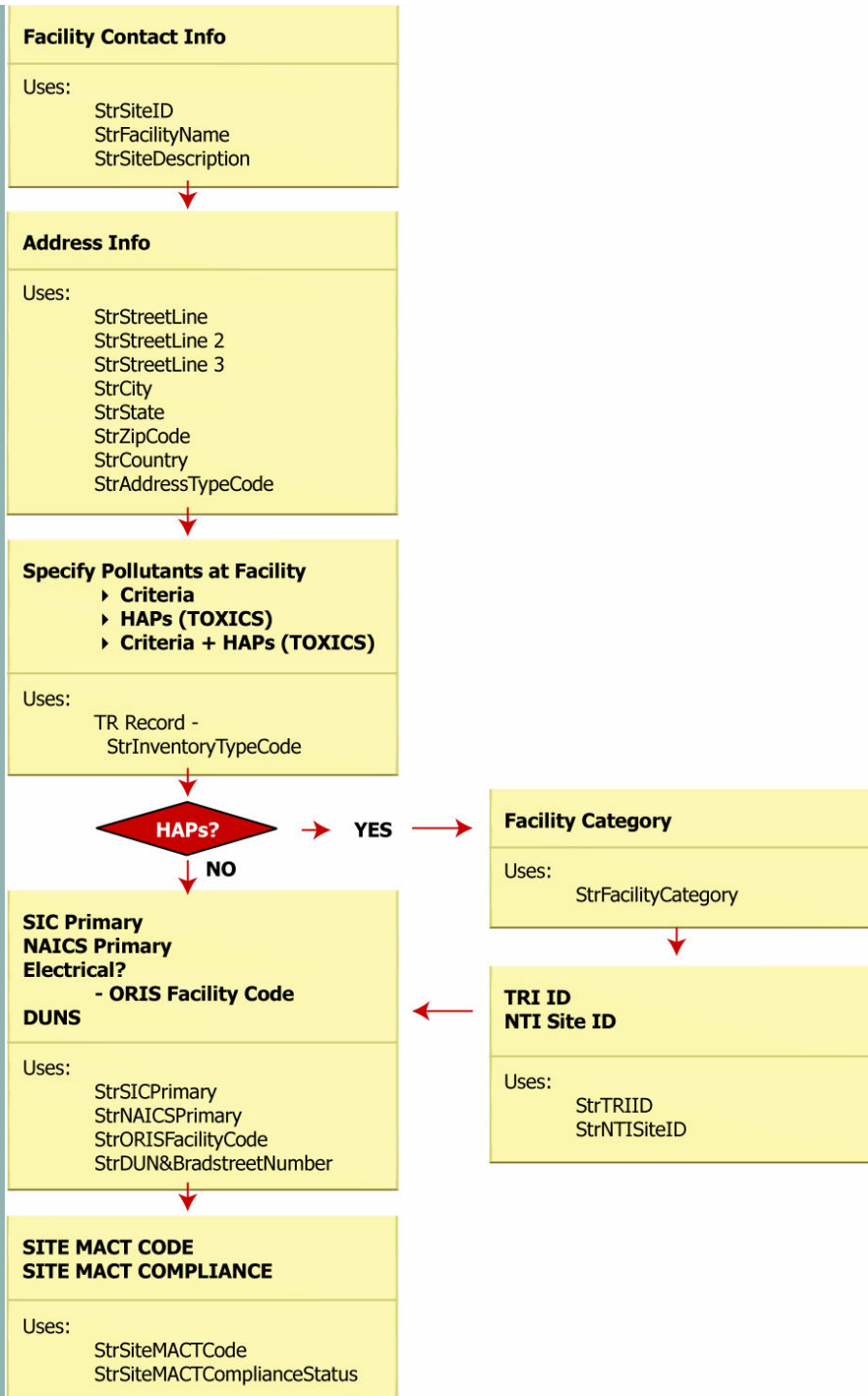


**SUMMARY OF CHOICES**

**At Transmit Time (see TR for more info):**

- MANDATORY
  - ▶ Transaction Type
  - ▶ Inventory Year
  - ▶ Inventory Type Code - Get From Facility Wizard?
  - ▶ Transaction creation date-auto?
  - ▶ Incremental Submission Number - auto
  - ▶ Source Type
  - ▶ Format Version
- OPTIONAL
  - ▶ Reliability Indicator
  - ▶ Transaction Comments

# Facility Data





# Emission Unit Data

## Emission Unit Info

Uses:

StrEmissionUnitID  
StrSICUnivLevel  
StrNAICSUnitLevel  
StrORISBoilerID  
StrEmissionUnitDescription



## Design Capacity

Uses:

SngDesignCapacity  
StrDesignCapacityUnitNumerator  
StrDesignCapacityUnitDenomenator  
sngMaxNamePlateCapacity

# Data Replication

- Synchronous and Asynchronous
- Dual System Increases Reliability
- Precedence:
  - Master-Slave / Priority based
  - Time-based
- Complete or Incremental
- System-wide Primary Key Generation

# QA / QC



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# QA / QC - Input

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- Range Checks
- Missing Value Checks
- Statistical Checks
- Referential Integrity Guarantee

# QA / QC - Code

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- Unit Testing – Automated
- Dedicated Software Testers
- Various “Code Checking” Products

# Data Entry Facilitation



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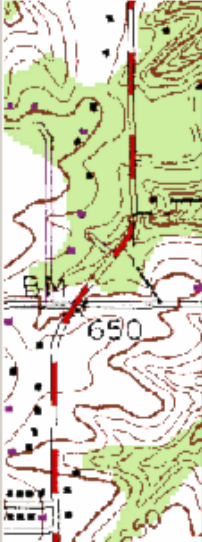
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# Tribal Land Wizard

**Data Wizard - Tribal Land**

**FIPS Information**



**State FIPS**  
Specify the Federal Information Processing Standards (FIPS) code for the State:

**Tribal ID**  
Specify the Tribal ID code and description for the desired Tribal Land.

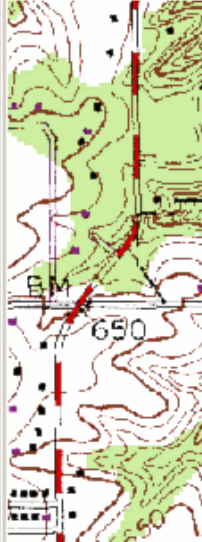
**Tip**

The Tribal ID code is specified in place of the County FIPS code. Both the State FIPS and Tribal ID codes are required to properly generate and submit to the National Emissions Inventory.

Help    Cancel    < Back    Next >    Finish

**Data Wizard - Tribal Land**

**Contact Information**



**Organization Name**  
Specify the name of the organization that will be submitting emission reports:

**Contact Person Name**  
Lead contact for organization transmitting emissions dataset:

**Contact Type**    **Contact Phone #**

**Alternate Phone # (Optional)**    **Contact Fax # (Optional)**


**Contact E-mail Address**  
Lead contact for organization transmitting emissions dataset:

Help    Cancel    < Back    Next >    Finish

# Facility/Site Data Wizard

Data Wizard - Facility Data

**Facility Contact Information**



**Site/Facility ID**  
Unique State/Local/Tribal ID for this facility that is reported consistently over time.

**Facility Name**  
Specify the name of the facility at this location:


**Facility Description (Optional)**  
Provide any comments /description for the facility:

Help    Cancel    < Back    Next >

Data Wizard - Facility Data

**Facility Contact Information**



**Street Address**

**City**                      **State**

**Country**                      **ZIP Code**

**Address Type Code**  
Indicates if specified address is the physical, mailing or parent address. Report the physical address if available.


Help    Cancel    < Back    Next >    Finish



# EMISSIONS UNIT WIZARD

**Data Wizard - Emission Unit Data** [X]

**Emission Unit Information**



**Emission Unit ID**  
Specify a unique state/local/tribal numeric identifier. This is used to distinguish each emission unit of a plant.

**Emission Unit Description (Optional)**

**SIC Unit Level**  
Specify the unit level Standard Industrial Classification System Code:

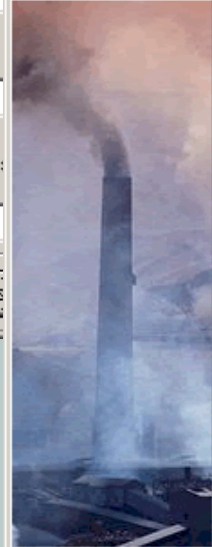
**NAICS Unit Level**  
Specify the unit level North American Industry Classification System Code:

**ORIS Boiler ID (Optional)**  
Unique identifier for electric generating units (primarily SIC=4911). This code is assigned by the Dept. of Energy - Energy Information Administration (EIA).

Help    Cancel    < Back    Next >    Finish

**Data Wizard - Emission Unit Data** [X]

**Design Capacity - Optional**



**Design Capacity (Optional)**  
Numeric value of average operational capacity for the Emission Unit. May be equal to the design capacity of control unit when reporting (secondary) emissions that result from operation of the control device itself. The Design Capacity should be reported if the Emission Unit is a boiler or a turbine.

**Design Capacity Unit Numerator (Optional)**  
The units of capacity for an Emission Unit (i.e., MW, KW, lbs/hr).

**Design Capacity Unit Denominator (Optional)**  
The units of capacity for an Emission Unit (i.e., MW, KW, lbs/hr).


**Max Nameplate Capacity (Optional)**  
Numeric value of rated design capacity at 100% (max) operation. The value reported should be in the same units as those reported for Design Capacity.

Help    Cancel    < Back    Next >    Finish

# EMISSIONS RELEASE POINT WIZARD

Data Wizard - Emission Release Point Data

**Emission Release Point Overview**



**Emission Release Point ID**  
Unique state/local/tribal numeric identifier used to distinguish geographic location where emissions are released to ambient air.

**Emission Release Point Description (Optional)**  
Provide an optional description of the Emission Release Point, up to 80 characters in length:


**Emission Release Point Type**  
Describes the physical configuration of the release point and whether it is a stack or non-stack:

Select Emission Release Point Type

Help Cancel < Back Next > Finish

Data Wizard - Emission Release Point Data

**Emission Release Location**



**Geocoordinates**

Lat/Long

	Degrees	Minutes	Seconds	
Latitude:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="radio"/> N <input type="radio"/> S
Longitude:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="radio"/> W <input type="radio"/> E

UTM

UTM Zone:

X-coord (km):

Y-Coord (km):


**Tip**  
The coordinates for the Release Point can be specified in either Latitude/Longitude or Universal Transverse Mercator system coordinates. The wizard will ensure that the geocoordinates are reported in the required geocoordinate system.

Help Cancel < Back Next > Finish

# EMISSIONS RELEASE POINT WIZARD

Data Wizard - Emission Release Point Data

**Stack Parameters**



Stack Dimensions

Stack Height [ft]:

Stack Diameter [ft]:

Stack Fencline Distance [ft]:

Exit Gas Parameters

Exit Gas Velocity [ft/s]:

Exit Gas Flow Rate [ft<sup>3</sup>/s]:


Exit Gas Temperature [F]:

Tip

Help Cancel < Back Next >

Data Wizard - Emission Release Point Data

**Non-Stack Parameters**



Non-Stack Data

Horizontal Area Fugitive:   
Horizontal area of fugitive emissions.

Release Height Fugitive:   
Release height (above terrain).

Fugitive Dimensions Unit:   
Unit of measure - same for area and height.


Tip

Help Cancel < Back Next > Finish

# EMISSION PROCESS WIZARD

Data Wizard - Emission Process Data

**Emission Process Overview**



**Emission Process ID**  
Unique state/local/tribal numeric identifier reported consistently over time.

**Emission Process Description (Optional)**  
Provide an optional description of the Emission Process, up to 78 characters in length:

**SCC Code (Required for Criteria Pollutants)**  
Select the appropriate EPA Source Category Classification Code for the Emission Process:

Help Cancel < Back Next > Finish

# Closure

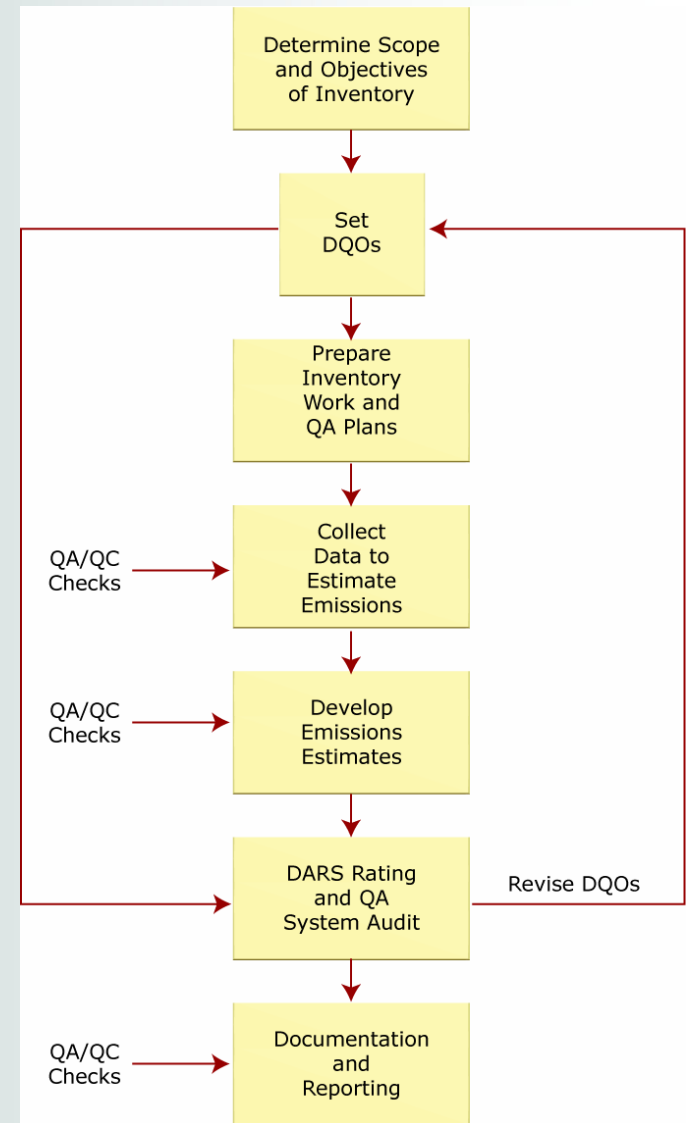
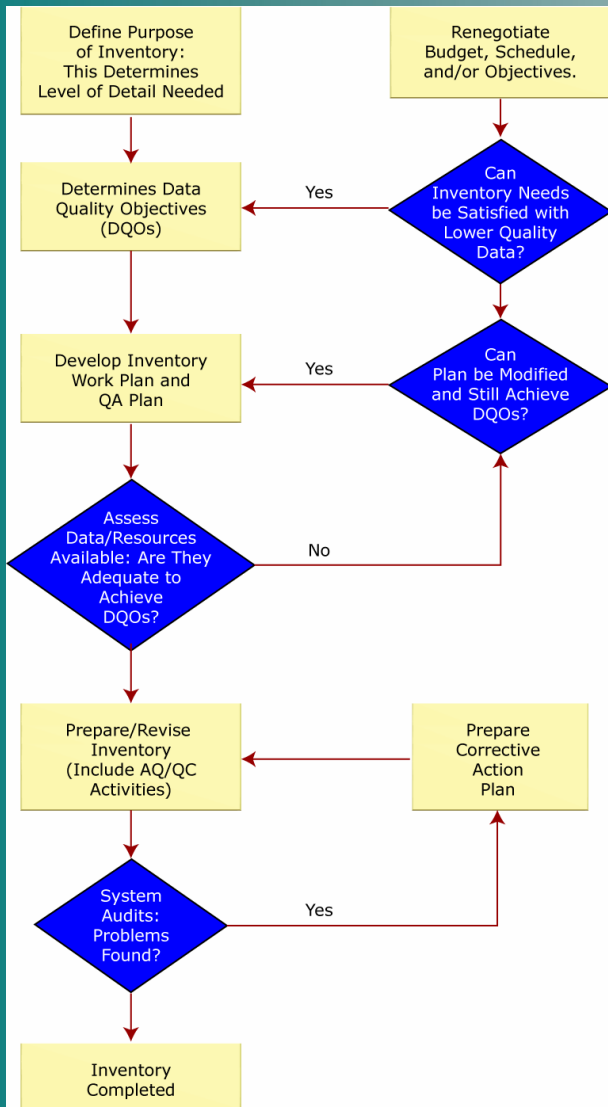


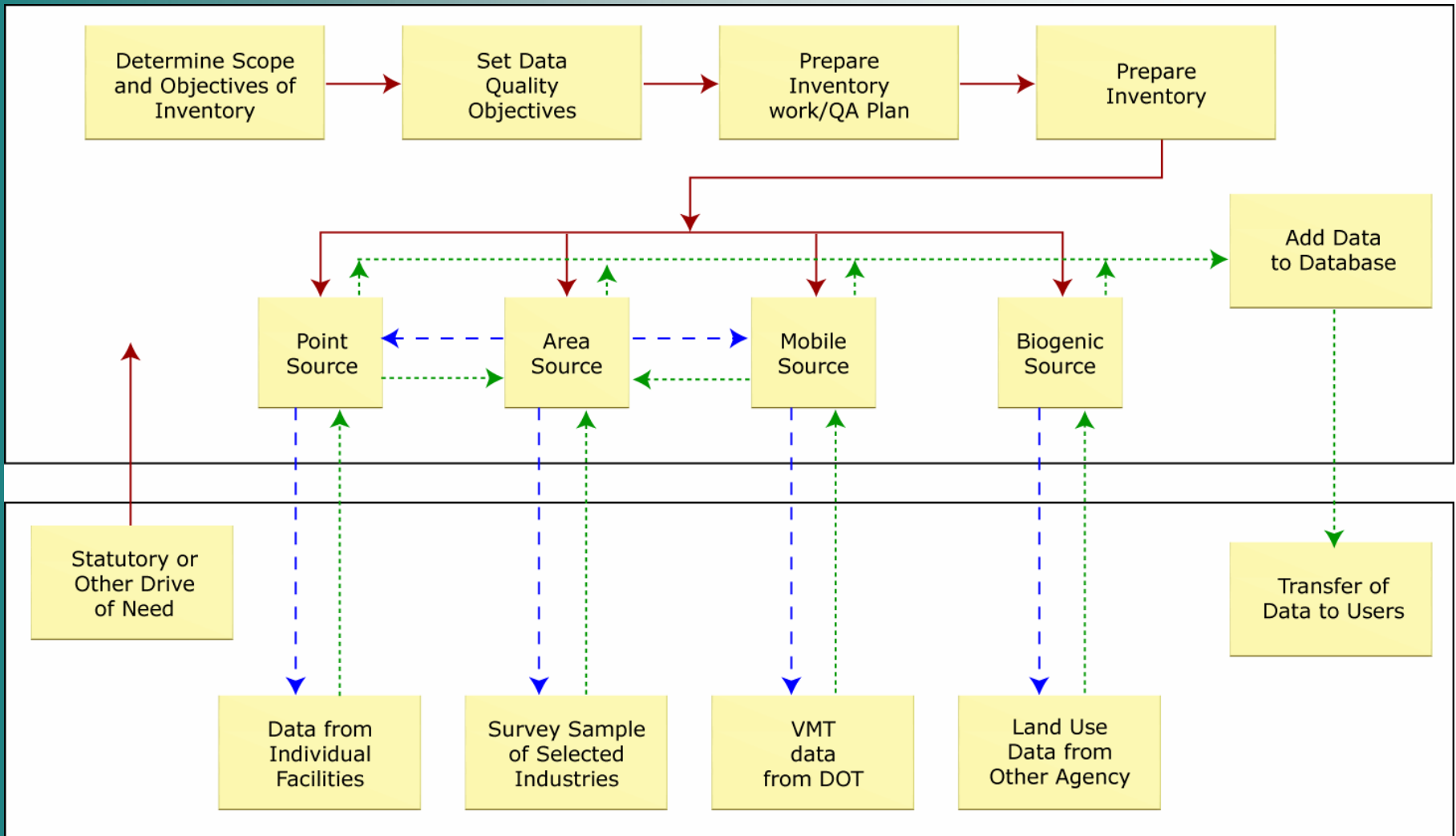
Austin, TX

Oct / 2003

**Prof. Jesse Thé, Ph.D., P.Eng.**

**Lakes**  
Environmental





# Closure

■ **Thank you for your time**

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