Emissions Characterization for Community-Scale Risk Assessments

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RAIMI Component Framework

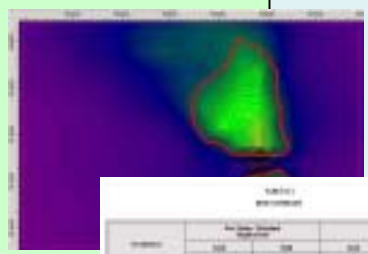
Risk - Management and Analysis Platform (Risk–MAP)

Project Database

Emissions Characterization Component
- Integrate primary emission databases (DataMiner)
- Review data quality and extract data (ACCESS)

Air Modeling Component
- Preprocess air modeling inputs (AMP)
- Execute air dispersion model (ISCST3)

Risk Modeling Component
- Assess site and process data input (Risk-MAP)
- Generate risk results and perform data analysis
- Map and report generation (Risk-MAP)
- Implement solutions and review performance



Background

Why Are Cumulative Type Risk-based Assessments Becoming So Popular?

- ***Reality*** – We are facing difficult questions?..Is the air I breath safe, Is the water I drink safe?, Is the food that I eat safe?

  - Permitting/enforcement actions often fail to consider bigger picture. **We narrowly focus on specific CAA or RCRA regulated units, often in a "forest" of other emissions sources.**

- ***Internal/External Agency Pressures*** – challenged to find mechanisms that support cross program cooperation and sharing of resources

Emissions Characterization

Example Objectives Specific to Emissions Characterization

- Obtain data inputs necessary to complete air and risk modeling;
- Designate level of resolution and data quality to support source-specific prioritization and decision making;
- Identify and track key source attributes to support trending analysis
- Support attribution profiling (source/contaminant/exposure pathway)

Emissions Characterization

Approach to Emissions Characterization

- **Utilize and cross reference all available emissions data sources (national, state, hard copy files) to obtain the most complete and accurate emissions characterization possible**

- **Thoroughly research emissions databases to gain a better understanding of their usability**
  - What are the reporting requirements and specifications?
  - What QC checks are performed, and who conducts them?
  - For what purpose is the data typically used?
  - How is missing data handled?

Emissions Characterization

Approach to Emissions Characterization

- **Digest available electronic emissions databases to evaluate if data meet completeness and quality requirements**
  - Data needs for source-specific air and risk modeling parameters
  - DQOs for source-specific air and risk modeling parameters
- **Effectively manage data to ensure integrity of modeled results that are traceable to unique modeled sources**
  - Link emissions data to GIS capabilities of air and risk modeling components
  - Track emission source attributes (e.g. permit status, source type, permit limits, enforcement history, etc.) to support trending analysis

Emissions Characterization

Emissions Data Needs

- **Source-Specific Parameter Values:** Required to support completion of air modeling component on a source-specific basis. Must comply with DQOs for air modeling inputs.

- **Speciated Emission Rates:** Required for accurate risk modeling, solution implementation, and attribution profiling. Generic contaminant groupings (total VOCs, gasoline, crude oil, etc.) may compromise project objectives.

- **Source-Specific Attributes:** Required to support trending analysis and possibly solution implementation.
  - Examples may include permit status, source type, control equipment, industry type, enforcement history, facility ID, SCC, etc.

Emissions Characterization

Emissions Data Needs

	Modeling	
	Air	Risk
Location (North American Datum 1983)	✔	
Source dimensions (diameter or area)	✔	
Elevation (base and release height)	✔	
Exit gas velocity	✔	
Exit gas temperature	✔	
Control device information	✔	
Particle size distribution and density	✔	
Contaminant name and CAS number		✔
Speciated emissions rate		✔

Emissions Characterization

Emissions Data Sources

Important Consideration for Use: Most, if not all, available emissions databases are not designed to support risk analysis

- **Emissions databases are designed to meet specific regulatory reporting requirements, and therefore, vary with respect to structure, content, and terminology.**

- **Data source formats**
  - **Digital**: large data sets can be readily incorporated into the study
  - **Hard copy**: individual regulatory files or facility records may provide critical missing data for some sources

Emissions Characterization

Emissions Data Sources

To combat terminology issues across data sources, the following definitions can be used:

- **Individual Sources**: those sources–generally industrial stack or fugitive sources–for which the available emissions inventories DO provide complete data sets to support source-specific air dispersion and risk modeling. (Typically subject to regulatory reporting requirements)

- **Grouped Sources**: those sources–generally small stack, fugitive, and mobile sources–for which the available emissions inventories DO NOT provide complete data sets to support source-specific air dispersion and risk modeling. (Typically not subject to regulatory reporting requirements)

Emissions Characterization

Emissions Data Sources

Potential Data Source	Maintained By	Format
National Toxics Inventory (NTI)	U.S.EPA	Digital
Toxic Release Inventory (TRI)	U.S. EPA	Digital
Aerometric Information Retrieval System (AIRS)	U.S. EPA	Digital
RCRA Hazardous Waste Files	U.S. EPA and State	Hard copy
RCRA Information System	U.S. EPA	Digital
State Point-Source Databases (PSDB)	State	Digital
New Source Review Permit Files	U.S. EPA and State	Hard copy
Title V Permit Applications Table 1(a) forms	U.S. EPA and State	Hard copy
Facility files and records	Facility	Hard copy

Emissions Characterization

Emissions Data Sources – Individual Sources

State - Texas Point Source Database (PSDB)

Repository for an annual survey of facilities that meet the TCEQ emissions inventory rule. 1997 PSDB data used in RAIMI Pilot Study.

- Contains the source-specific values necessary for air and risk modeling, meeting RAIMI requirements.
- Includes many other pertinent source attributes of interest (SCC, actual and allowable emission rates, emissions history).
- Reviewed/QA'd by State
- NTI incorporates a version of the Texas PSDB as its source of Texas point source emissions data.

Emissions Characterization

Emissions Data Sources–Grouped Sources

National Toxics Inventory (NTI) – Area/Mobile

- Incorporates emissions estimates of sources that are too small or diffuse to fall under CAA emissions reporting requirements (e.g., dry cleaners, gas stations)
- Organizes data by area and mobile source subcategories, which can be prioritized for evaluation on the basis of occurrence of the surrogate (e.g. railroad miles) within an assessment area
- Emissions factors used to develop estimates are well documented
- NTI data is reviewed by States, industry, and other federal agencies

Emissions Characterization

Emissions Data Sources

Other Sources

In addition to the State and NTI databases, emissions characterization data can be supplemented through other sources, including:

- **EPA files – Permit applications, trial burn reports, etc.**
- **State files – Check confidential files.**
  - **On Paper**: Emission rate data is public information
  - **In Reality**: Once a submittal is stamped "Confidential", the emissions rate **most likely does not make it into the database**
  - **Resolution**: Manual review of confidential files in State offices

Emissions Characterization

Database Tool – A Helping Hand

- **DATAMINER**: A large database client-server processing system that facilitates the assembly of multi-source emissions inventories for air and risk modeling by:
  - **Enabling the creation and editing of database table relationships** and views for complete access to all emissions attributes maintained in the database
  - **Linking source-specific parameters** necessary for air and risk modeling from multiple database tables through the Data Organizer function
  - **Extracting the source-specific data sets** through the construction and execution of simple or complex data queries in the Query Builder function

Emissions Characterization

Database Issues

- Generally will not prevent completion of a successful localized assessment
- Awareness of critical issues is important
- Maintain focus on project objectives
- Various options (e.g., bounding assessments) can be employed to evaluate the risk-based significance of certain parameters

Emissions Characterization

Database Issues

Inventory Completeness Example

- Different reporting requirements can result in substantially different content
- For example, the 1997 PSDB and TRI indicate the following:

Contaminant	TRI Emissions	PSDB Emissions
Benzene	71,501 pounds	172,422 pounds
1,3-Butadiene	241,099 pounds	495,624 pounds
Ethylene Oxide	52,000 pounds	89,002 pounds

- Do not conclude that PSDB is more complete than TRI!

Emissions Characterization

Database Issues

Inventory Completeness (cont.)

Facility	TRI Emissions 1,3-Butadiene	PSDB Emissions 1,3-Butadiene
Ameripol Synpol	**18,500** pounds	**11,660** pounds
Dupont Dow Elastomers	8,599 pounds	7,508 pounds
Huntsman Corporation	214,000 pounds	476,456 pounds

- **PSDB butadiene emissions at Ameripol Synpol are less than the TRI emissions**
- **Applying the TRI emission value to the source(s) at Ameripol Synpol is one option for evaluating the risk-based significance of this data gap**

Emissions Characterization

Database Issues

Speciation Example

- 1997 PSDB reports in the RAIMI Pilot Study assessment area:
  - 5,668 tpy of speciated emissions (58%)
  - 4,135 tpy of unspeciated emissions (42%)
- Pilot Study results based on speciated emissions
- Not a Pilot Study objective to speciate emissions
- To determine significance of the data gap, the speciated emissions could be proportionately increased to account for the unspeciated emissions
- Applying this bounding emission rate to the risk model may help to establish the risk-based significance of unspeciated emissions.

Emissions Characterization

Database Issues

Speciation (cont.)

- TNRCC emissions inventory program instructs facilities to provide speciation data for 90 percent of HAP emissions for those sources with emissions rates greater than 1 tpy, or 0.1 tpy for any individual HAP.

Adherence to these instructions by facilities reporting emissions to the PSDB would significantly improve the speciation–and thus usability–of the PSDB for risk management purposes

Emissions Characterization

Source Selection

- **Identifying emissions sources for modeling**

Individual Sources

- **In Pilot Study, 113 of 1,529 individual sources were modeled (generally, sources with greater than 1 tpy of a speciated contaminant).**
- **Sources were prioritized based on mass of toxic emissions.**
- **Air and risk modeling was conducted in groups of 10-20 sources.**
- **Prioritization refined based on toxicity and proximity of receptor neighborhoods through iterative modeling of prioritized groups.**

- Based on pilot study, prioritization of individual sources discontinued in favor of using more robust modeling capabilities to evaluate all sources in the assessment area.

Emissions Characterization

Source Selection

Grouped Sources

- For each grouped source subcategory, construct a worst-case hypothetical emissions scenario that:
  - County-wide emissions estimates are allocated to the smallest census tract
  - Air and risk modeling is conducted specific to each subcategory
  - Those subcategories that exceed the screening threshold are prioritized for additional modeling

- For prioritized grouped subcategories:
  - Allocate emissions estimates to census tract-level estimates for each census tract, utilizing the appropriate allocation scheme
  - Prioritize these results based on air and risk modeling for each grouped emissions subcategory

Emissions Characterization

Special Topics

Actual vs. Allowable Emission Rates

- Modeling only **allowable** emissions will not provide a worst-case result, as most emissions sources are not permitted and allowable rates are generally not provided for grandfathered or exempt sources.

- Modeling only **actual** rates may underestimate potential risk in some cases by not including emissions from permitted sources identified in the PSDB known to be operating, but with no reported actual emissions

- **Actual and allowable** rates may be used to fill emission rate gaps.

- Modeling of **allowable rates** for permitted sources may provide important information to better support or assess regional permitting and cross-program permitting

Emissions Characterization

Special Topics

Accounting for Process Upsets & Maintenance

- **PSDB "Actual" emissions do not include Upset & Maintenance event emissions**

- **State may require U&M emissions to be reported, but as a separate emission rate**
  - In 1997 in Jefferson County, there were 38,605 tons of pollutants released during U&M events that are not listed as actual emissions in the State PSDB

- **Applying U&M emissions ….?**

Emissions Characterization

Special Topics

Sensitivity of Source Location on Modeled Impacts

- **Example:** Monitoring station T-136, located in the Port Neches/Nederland neighborhood, is located about 750 meters west of a modeled 1,3-butadiene source (wastewater pond).

- **Result:** A RAIMI modeling analysis of this source indicates that if the source location was actually adjusted by as little as 200 meters, the resulting impact at the T-136 location increases by a factor of two.

Emissions Characterization

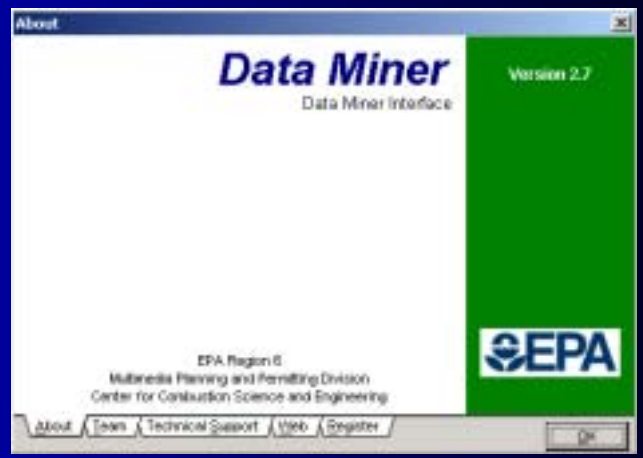
Special Topics

What if TRI is the only data available?

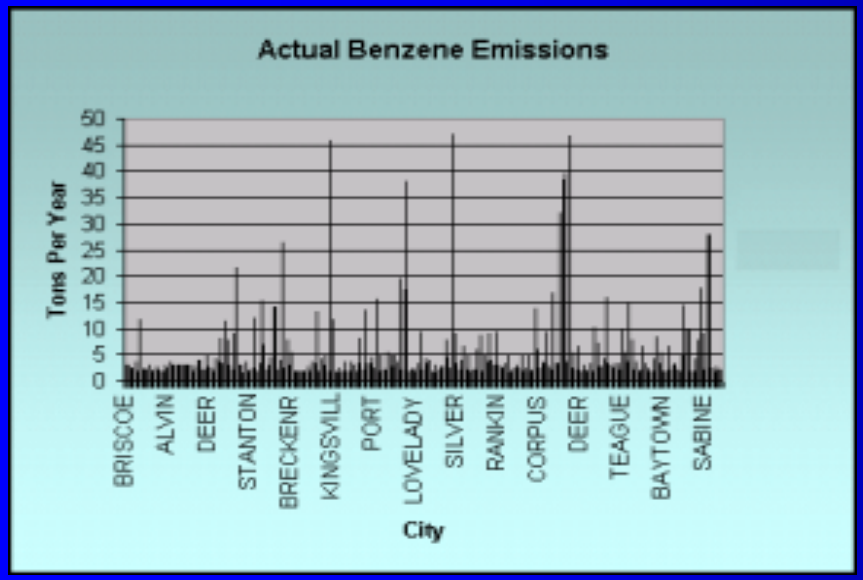
- TRI data is facility-specific as opposed to source-specific
  - Limiting assumptions must be made regarding source locations and source characteristics;
  - Receptor impacts are highly dependent upon correlation of source and receptor locations;
  - Potential for false negatives very high; and
  - Not possible to determine numerically reliable or source-specific risk.
- TRI data can be used in a generalized screen approach by assuming release point at facility boundary closest to target receptors
  - Useful to obtain better emissions data; and
  - Can be used as comparison or QC check of other emissions databases

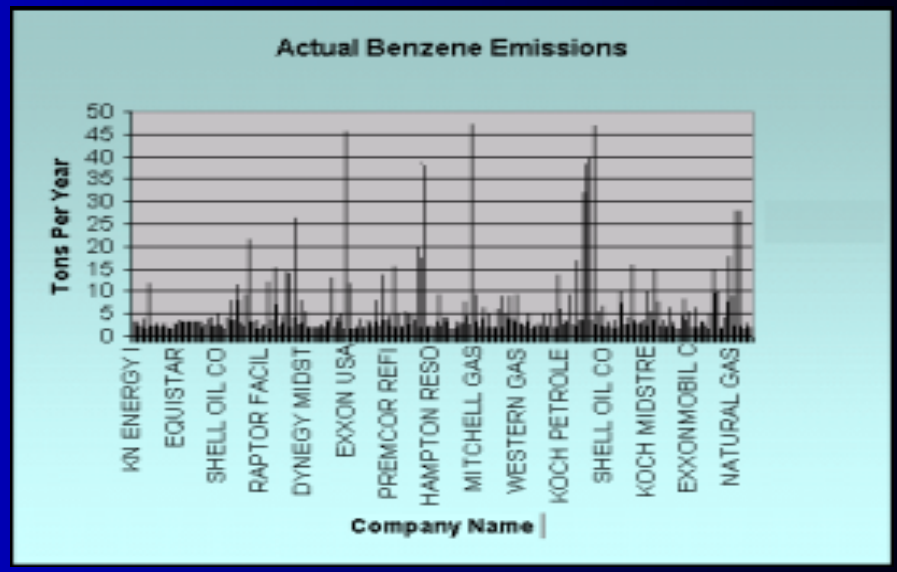
RESULTING ENHANCEMENTS
Data Miner – Database Mining Tool

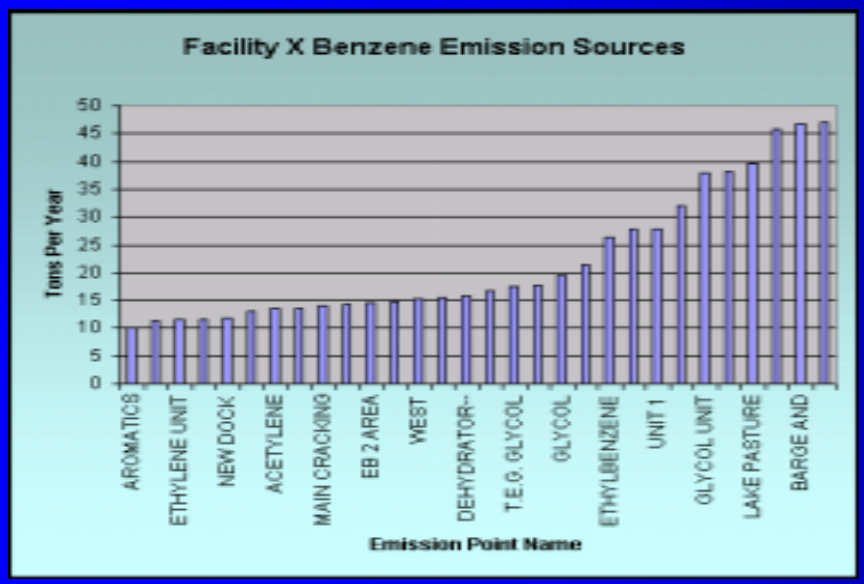
- Large capacity datasets (gigabytes)
- Multiple source attribute handling
- Ingest various database formats
- Sophisticated data exporting

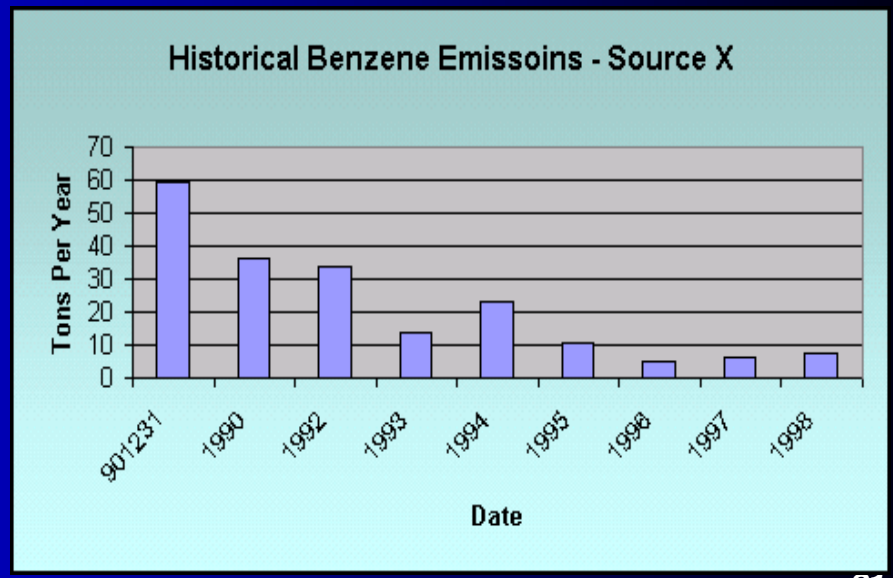


Data Miner – Example Capabilities

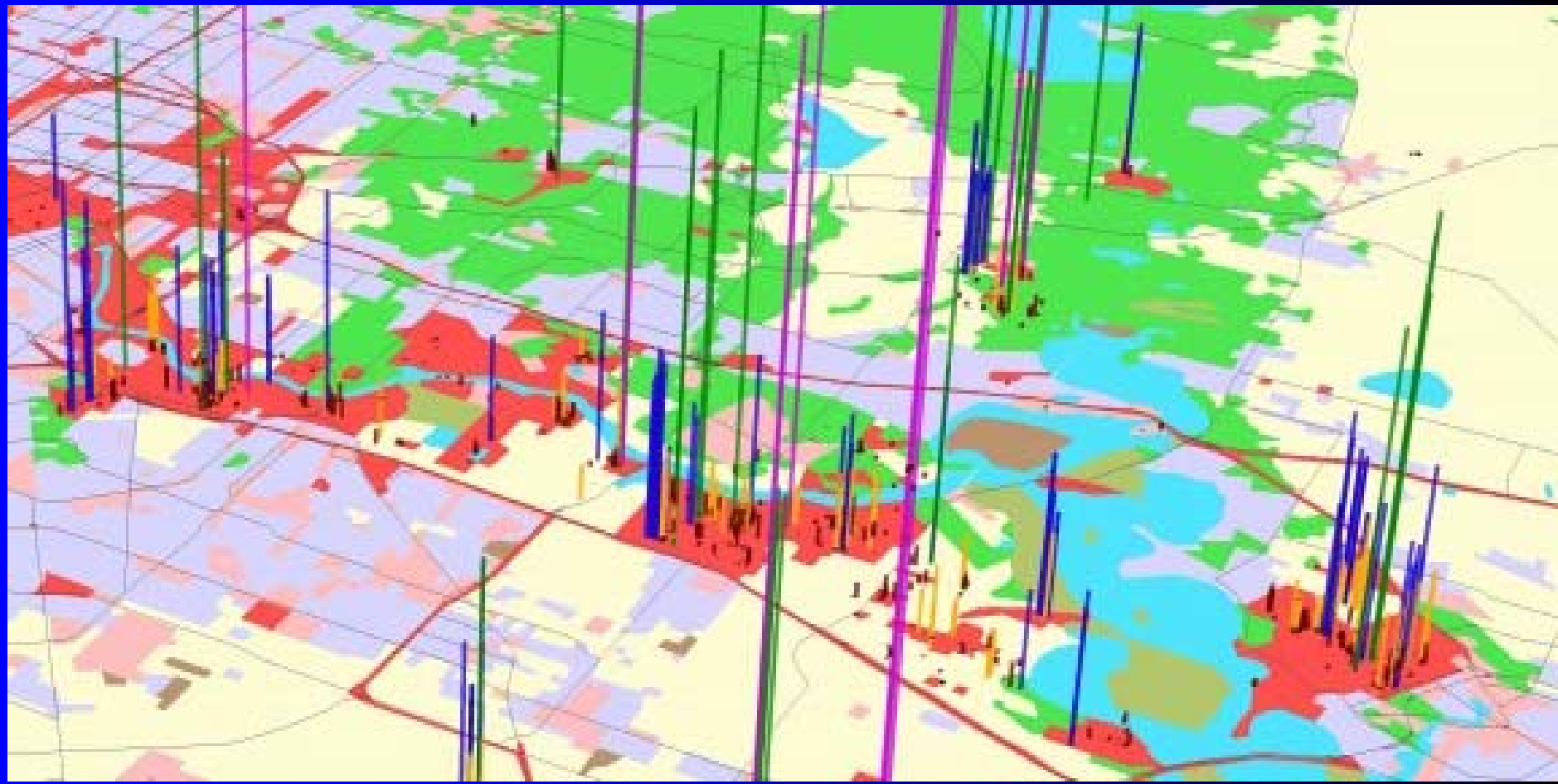








3D Representation of Emissions



Houston Ship Channel