

Emission Model of Industrial Sources (EMIS)

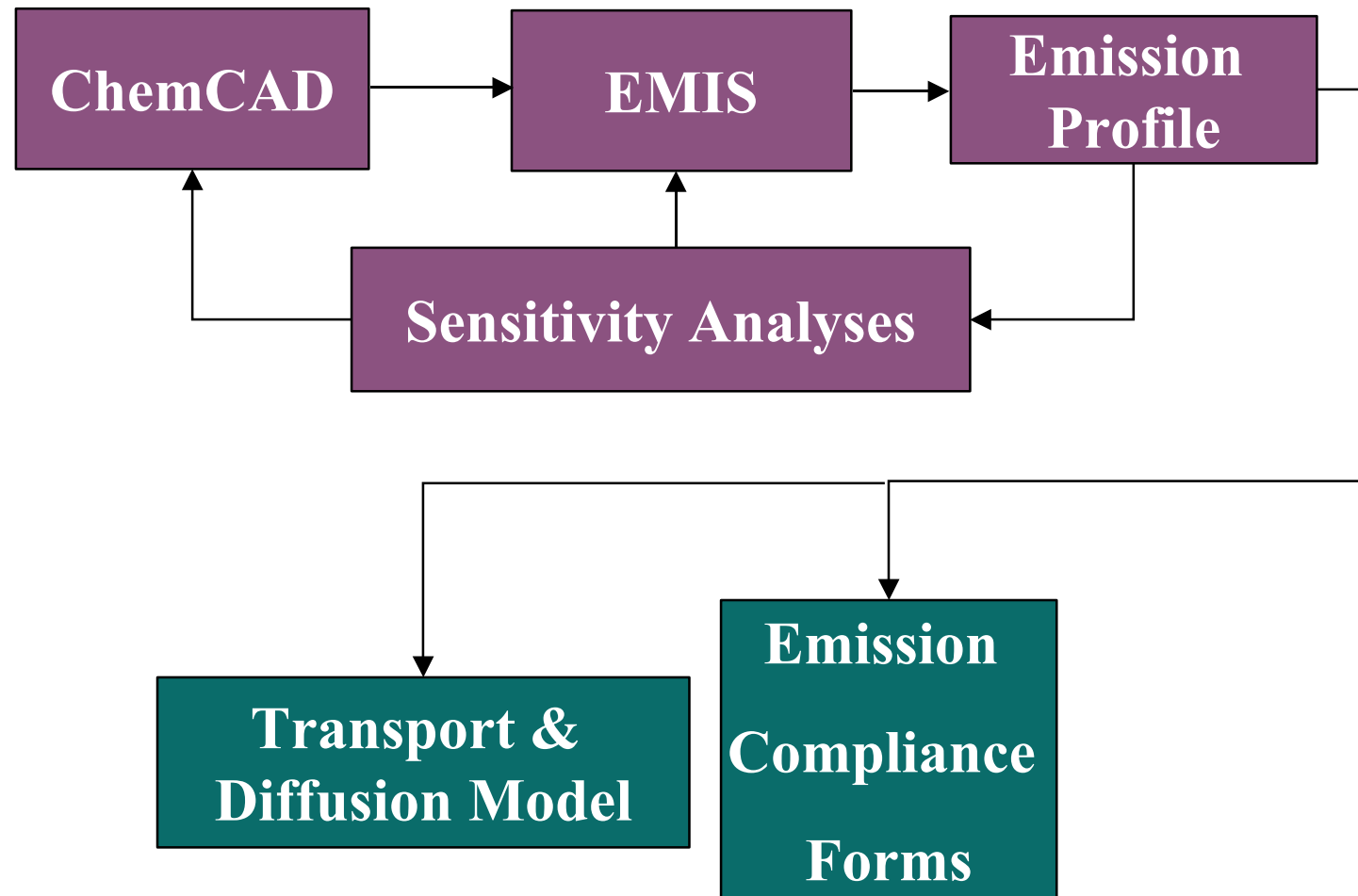
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Engineering • Science • Technology

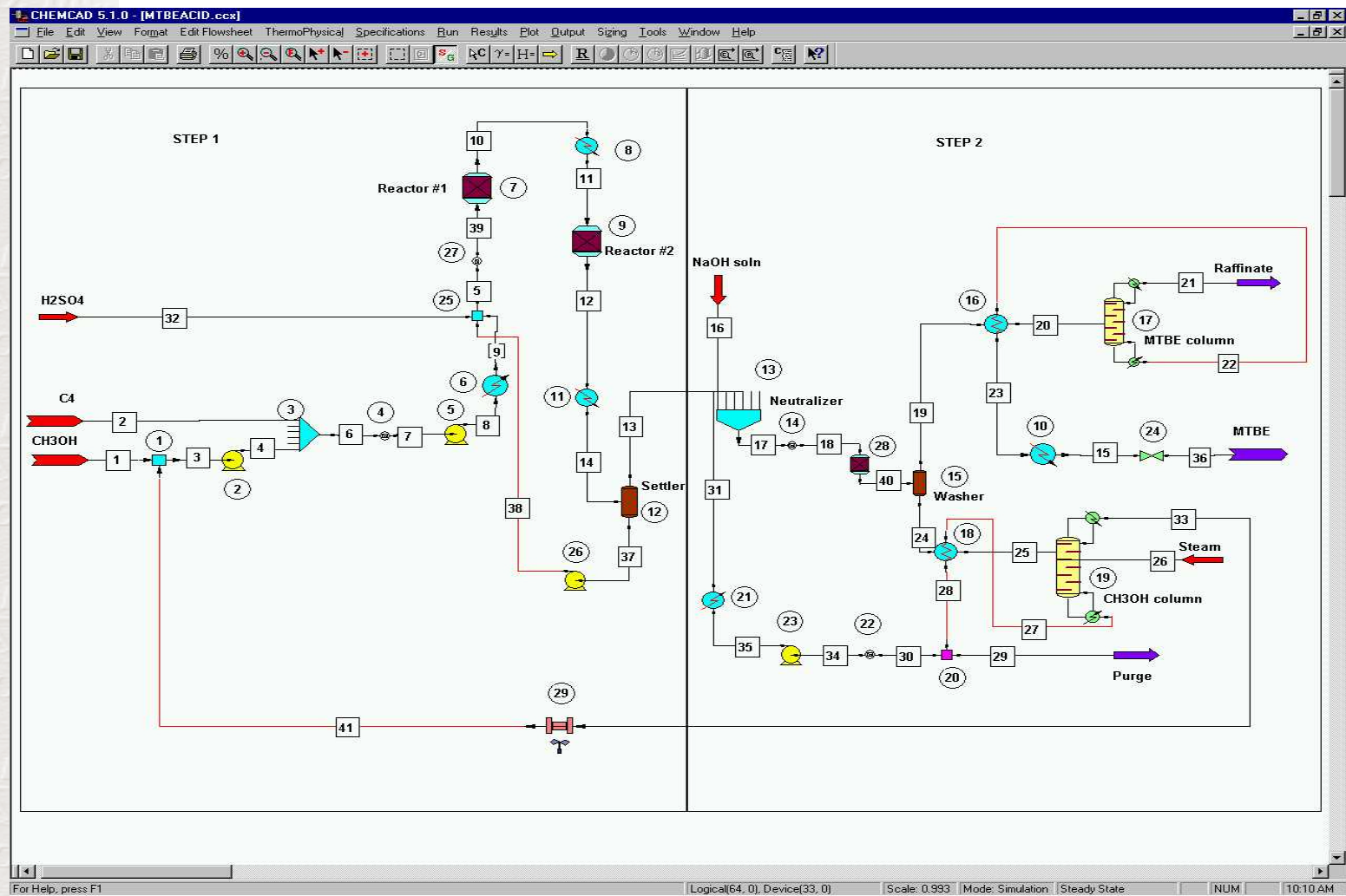
EMIS Flow Diagram



Chemical Production Facility



ChemCAD Process Flow Diagram



Importing Process Data

- Thermodynamic simulation software, such as ChemCAD™ or Aspen Plus™, outputs a report summarizing basic operating conditions for the process.
- EMIS reads the report and extracts the information necessary for the emission calculations.
- Any additional process specific information is noted by the user (entered as ChemCAD™ Parameters) and saved along with the process data.

Imported Process Data

ChemCAD File: Job Name:

of Streams:

#	CC#	Stream Name	Vapor Fraction	Mass Flow (lbs/hr)	Avg MW (mass)	Density (lbs/ft3)	Source Type	Storage Type	Emission Type	Case Name
1	1	CH3OH	0.00000	10,230.95020	32.04200	48.49070	Heavy Liquid ▼	External ▼	Transfer ▼	Heat reactants ▼
2	2	C4	0.00000	40,450.42190	57.19560	35.21650	Heavy Liquid ▼	None ▼	None ▼	Heat reactants ▼
3	3		0.00000	11,663.95120	32.32800	48.27400	Heavy Liquid ▼	None ▼	None ▼	None ▼
4	4		0.00000	11,663.95120	32.32800	48.26080	Heavy Liquid ▼	None ▼	None ▼	None ▼
5	5		0.00000	54,926.44920	50.00800	35.99890	Heavy Liquid ▼	None ▼	None ▼	None ▼
6	6		0.00000	52,114.37110	48.79480	37.48040	Heavy Liquid ▼	None ▼	None ▼	None ▼
7	7		0.00000	52,114.37110	48.79480	37.48040	Heavy Liquid ▼	None ▼	None ▼	None ▼
8	8		0.00000	52,114.37110	48.79480	37.34400	Heavy Liquid ▼	None ▼	Transfer ▼	Heat reactants ▼
9	9		0.00000	52,114.37110	48.79480	34.67160	Heavy Liquid ▼	None ▼	None ▼	None ▼
10	10		0.00000	54,926.74220	68.18620	38.43620	Heavy Liquid ▼	None ▼	Transfer ▼	Reaction ▼

“What-If” Parameters

- Emission controls

- Scrubbing

- global, per process step, or per source type

- Emission Factors

- EPA/CMA Average, Leak/No-Leak, Stratified
 - ECVI
 - Failed Devices
 - Industry specific
 - Equipment specific

Emission Factor Interface

EPA Emission Factors (lbs/hr)

Save for Emission Calc. **Reset**

☐ Average Factors

☒ **Leak/NoLeak Factors**

☐ Leak/NoLeak Average Factors

☐ Stratified Factors

Equipment	Gas	Light Liquid	Heavy Liquid
Valves (Leak)	0.09920	0.18740	0.00050
Pump Seals (Leak)	0.00000	0.96140	0.85470
Compressor Seals (Leak)	3.53760	0.00000	0.00000
Relief Devices (Leak)	3.72020	0.00000	0.00000
Flanges (Leak)	0.08250	0.08250	0.08250
Sampling Ports (Leak)	0.02630	0.02630	0.02630
Valves (No Leak)	0.00110	0.00380	0.00050
Pump Seals (No Leak)	0.00000	0.02640	0.02970
Compressor Seals (No Leak)	0.19670	0.00000	0.00000
Relief Devices (No Leak)	0.09830	0.00000	0.00000
Flanges (No Leak)	0.00010	0.00010	0.00010
Sampling Ports (No Leak)	0.00330	0.00330	0.00330

Emission Estimations

- Stack

- Mass flow taken directly from model simulation (ChemCAD) report.

- Fugitive

- Utilizes an equipment configuration designed by the user, consisting of valves, flanges, etc.

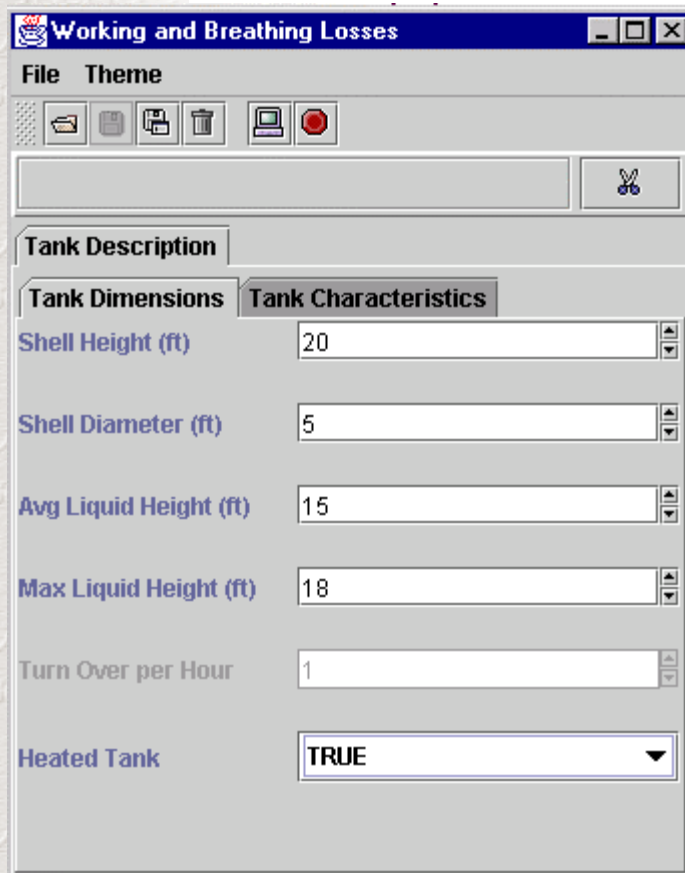
- Storage

- Minimal integration of the EPA's TANK algorithm.

Working & Breathing Loss Estimations

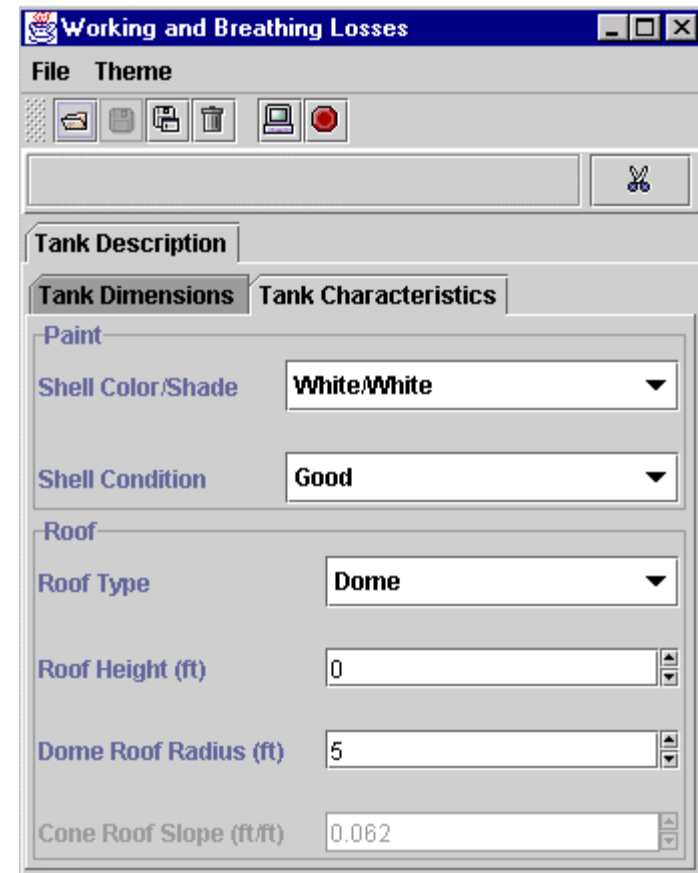
Site Information		Tank Parameters					
				Add Stream	Remove Stream	Save for Emission Calc.	
Step	Stream	Tank Type	Parameter File Name	Species	Stream Temp.	Location	Hour In Effect
1	1	Vertical Fixed Roof	VF10X10N9CRPP	Methanol	60.0	External	5
1	18	Vertical Fixed Roof	VF10X5Y0CWWG	SulfuricAcid	60.0	Internal	22
1	8	Vertical Fixed Roof	VF33X8N9DASP	N-Butane	60.0	Internal	15
1	13	Vertical Fixed Roof	VF10X5Y0CWWG	MTBE	60.0	Internal	0
2	23	Vertical Fixed Roof	VF33X8N9DASP	MTBE	60.0	Internal	8

Working & Breathing Losses Tank Editor



The screenshot shows the 'Working and Breathing Losses' application window with the 'Tank Dimensions' tab selected. The window has a menu bar with 'File' and 'Theme', and a toolbar with icons for file operations and a red stop button. The main area contains several input fields for tank specifications.

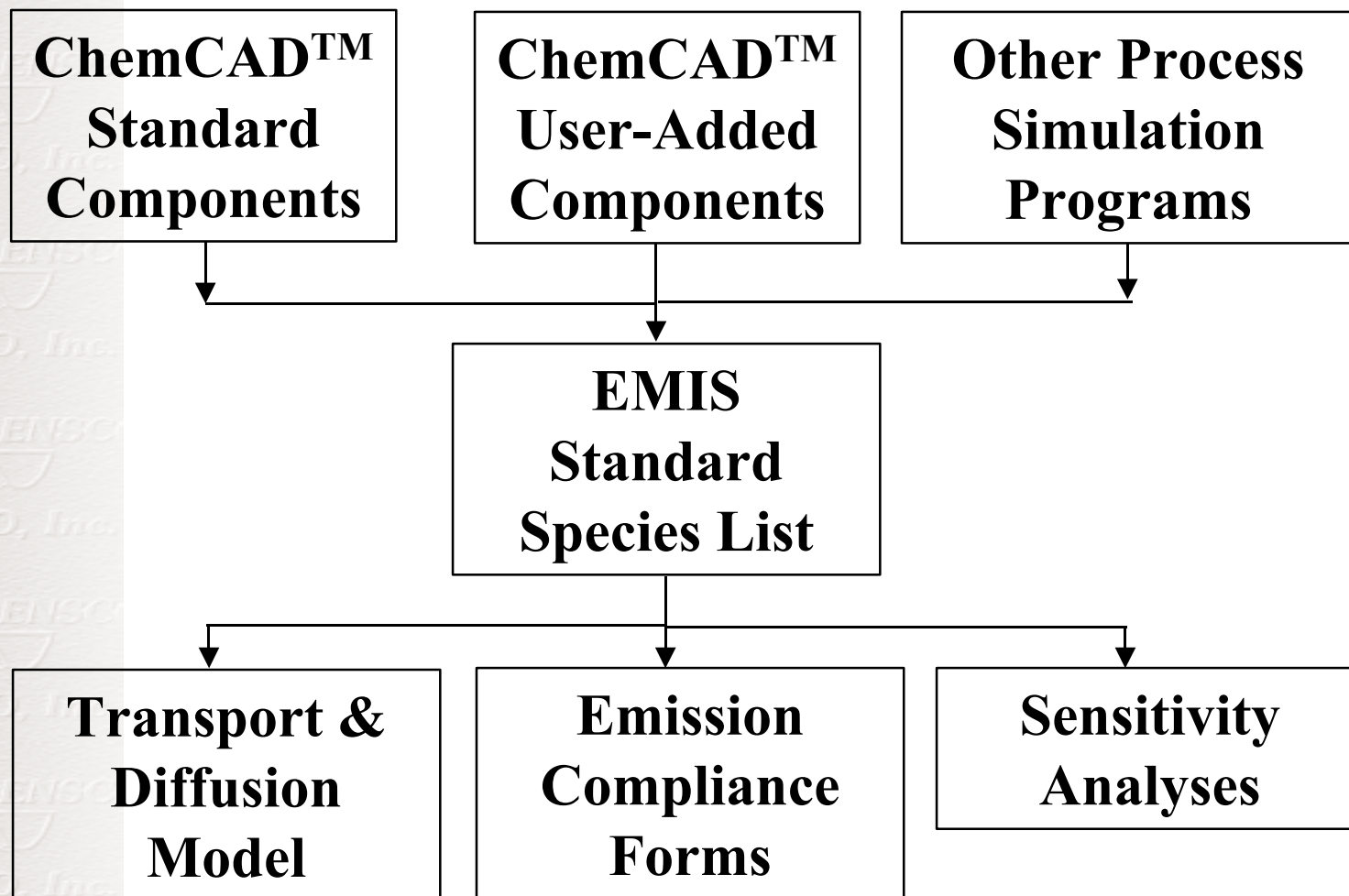
Parameter	Value
Shell Height (ft)	20
Shell Diameter (ft)	5
Avg Liquid Height (ft)	15
Max Liquid Height (ft)	18
Turn Over per Hour	1
Heated Tank	TRUE



The screenshot shows the 'Working and Breathing Losses' application window with the 'Tank Characteristics' tab selected. The window has the same menu bar and toolbar as the previous screenshot. The main area contains input fields for paint, shell condition, and roof specifications.

Parameter	Value
Shell Color/Shade	White/White
Shell Condition	Good
Roof Type	Dome
Roof Height (ft)	0
Dome Roof Radius (ft)	5
Cone Roof Slope (ft/ft)	0.062

Species Editor



Standardized Species List

- Built in tool for developing and maintaining a standard list of chemicals and properties including:
 - Name
 - Formula
 - Molecular Weight
 - CAS #
 - Alias (Other common names)
 - Link to chemical used in other programs, such as ChemCAD or T&D Model.
- Can be expanded to include additional physical properties or other relevant information.

Species List Editor

What-If? Data Analysis Database Admin Database Search **Species Editor** Import ChemCAD

New Species Show All Records

	ID	NAME	CAS	FORMULA	MW	OSL	CCNDX	ORIG_DATE	UPDATE_DATE
1	1	Hydrogen	1333-74-0	H2	2.02	138	1	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
2	2	Nitrogen	7727-37-9	N2	28.01	184	46	8/24/01 2:15:01 PM	8/24/01 2:15:01 PM
3	3	Oxygen	7782-44-7	O2	32	183	47	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
4	4	Chlorine	7782-50-5	Cl2	70.91	102	105	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
5	5	Aluminum	7429-90-5	Al	26.982	-1	-1	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
6	6	Sodium	7440-23-5	Na	22.99	-1	978	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
7	7	Sulfur	7704-34-9	S8	256.51	-1	-1	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
8	8	Methane	74-82-8	CH4	16.04	17	2	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
9	9	Ethane	74-84-0	C2H6	30.07	-1	3	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
10	10	Ammonia	7664-41-7	H3N	17.03	-1	63	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
11	11	Acetylene	74-86-2	C2H2	26.04	-1	-1	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
12	12	Ethene	74-85-1	C2H4	28.05	18	22	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM
13	13	Ethylene Oxide	75-21-8	C2H4O	44.05	-1	129	8/24/01 1:55:00 PM	8/24/01 1:55:00 PM

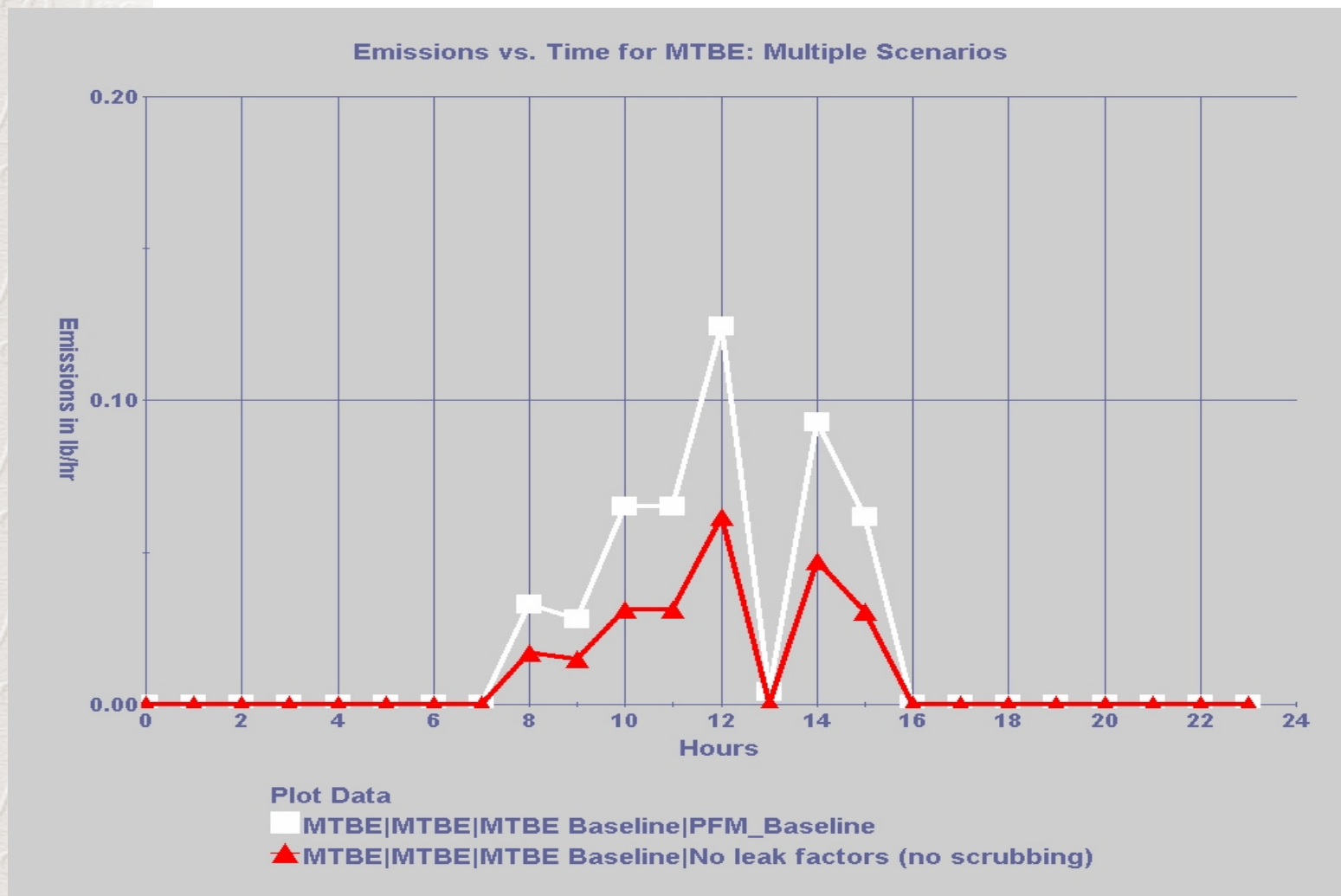
Name: **Molecular Weight:** g/mole
Formula: **ChemCAD ID:**
CAS Number: **OSL ID:**
Alias:

Record 12 of 167

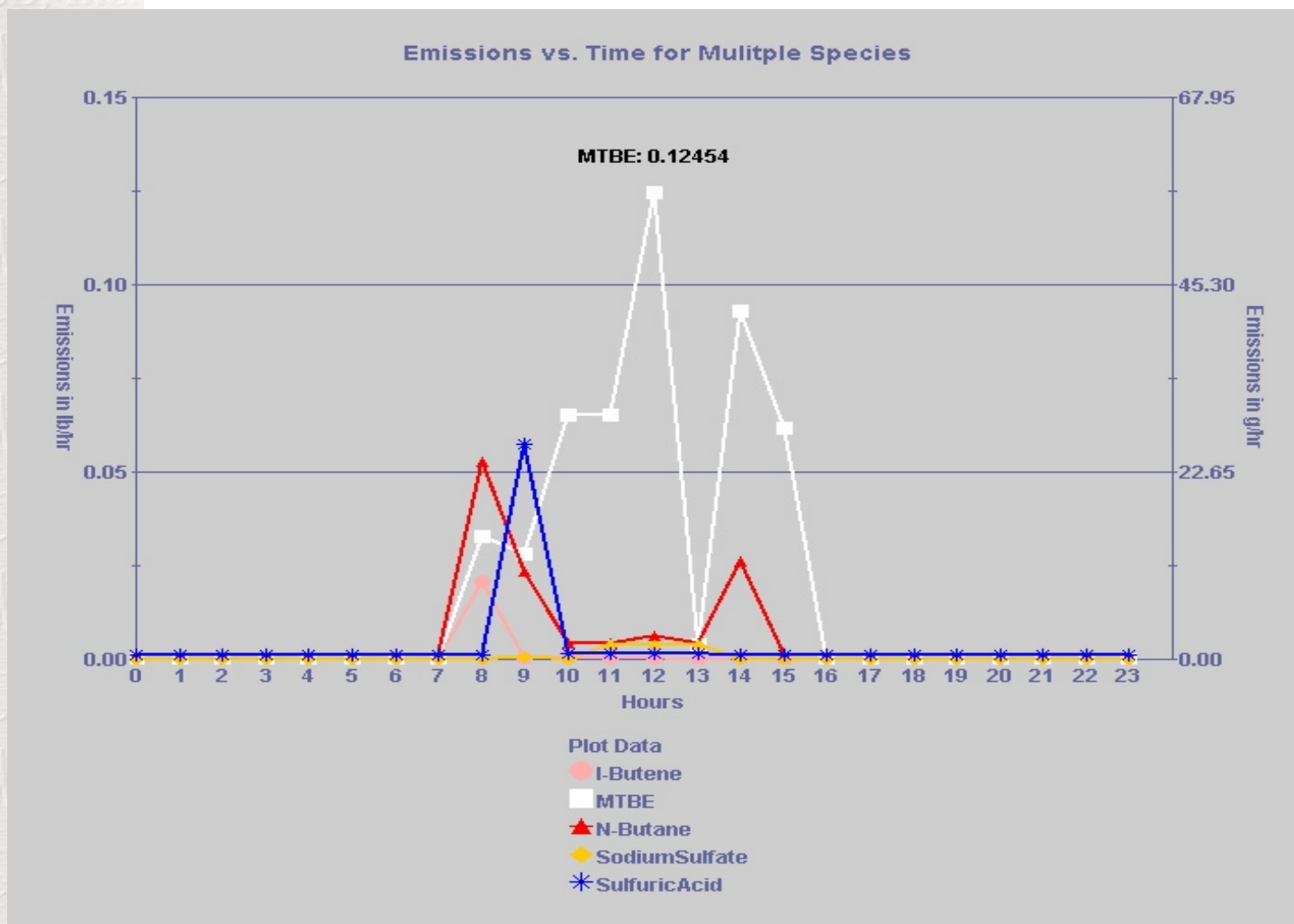
Flexible graphical analysis tools

- Several displays were developed for specific analyses.
- Moving towards a more generic wizard format to increase flexibility.
- Current development includes break down of emissions by source type (point, fugitive, storage).

Sensitivity Analysis: Emission Factors



Hourly Emissions of MTBE Production



Export Emission Profiles

- Transport & Diffusion Model
- Federal and state regulation forms for emission inventory compliance.

Software Requirements

- Java - platform independent
- Oracle (limited functionality with Microsoft Access)

Current Capabilities

- Stack, fugitive, and storage emission estimations
- Import of process data from thermodynamic simulation software
- “What-if” parameters for emission controls and emission factors
- Standard species list
- Flexible graphical analysis tools
- Export of hourly emission rates to Transport & Diffusion Model

Future Development

- Automate export of emission profile to federal and state regulation forms for emission inventory compliance.
- Expand emission factors to include equipment & process specific factors.
- Expand emission estimation to include additional sources, such as waste ponds and research facilities.
- Enhance database management and query functionality.