Applications of an IT Tool, OMS, on Real Time Emission Inventory

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Lamar University

Paul Nix

PDC

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What is OMS?

? ? ?

Ozone Non-Attainment Areas in Texas

Houston-Galveston area (HGA) - Severe

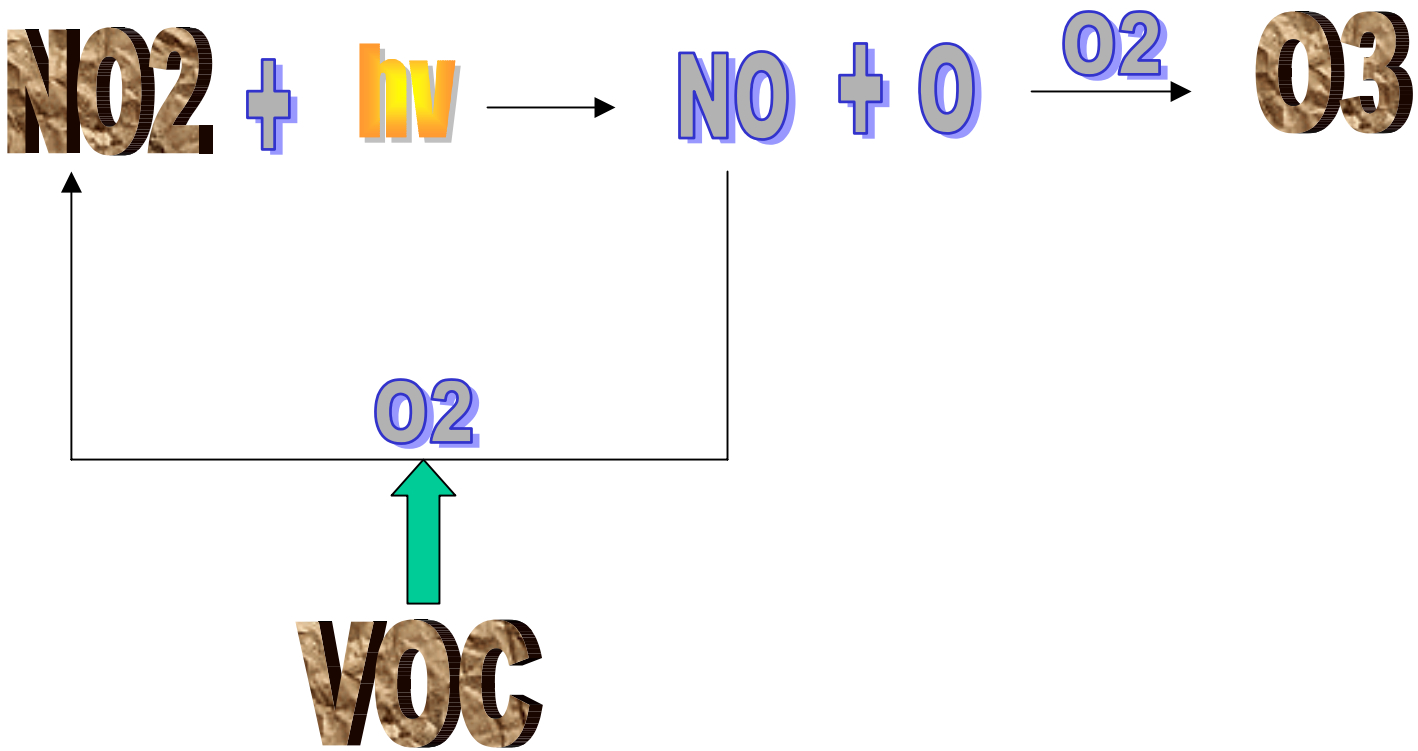
Beaumont-Port Arthur Area (BPA) - Moderate

El Paso (ELP) - Moderate

Dallas-Fort Worth (DFW) - Moderate

→ TAQS2000

Simplified Ozone Chemistry



Episodic Release Reduction Initiative (ERRI)

- An innovative voluntary effort (in 1999) among USEPA Region 6, LDEQ, TNRCC, and 13 petroleum/chemical plants to study the causes of air emission
- Final report (2001) indicated that more than 60% of emission are related to operation and maintenance in CPI

What is OMS?

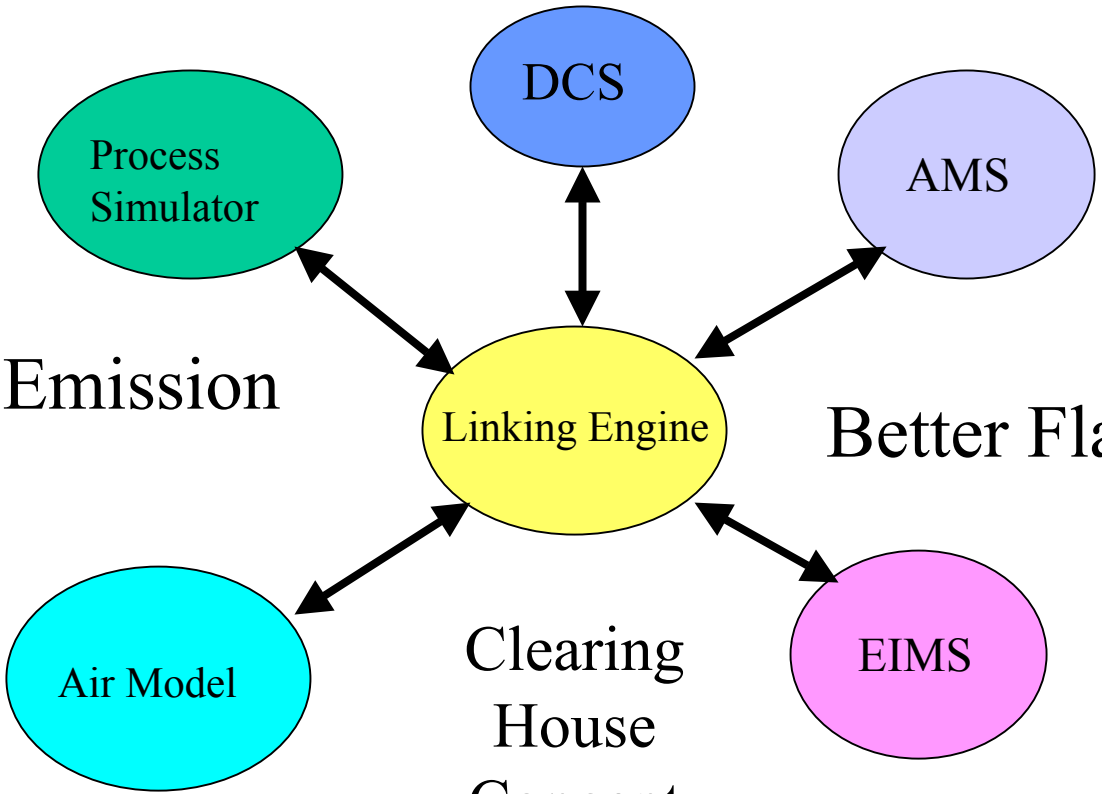
- OMS is a combining system to cover Operations, Maintenance, and EHS.
  - ERRI Final Report - Technical Exchange Seminars (www.utexas.edu/research/ozonespikes/episodicEmiss.RedRpt.pdf)

OMS - A Powerful IT Tool

OMS is an IT tool to help the management of plant operation, maintenance, and safety

- Operation, Maintenance, and EHS are linked by a linking engine
- Personnel in OMS will be on the same platform

OMS Lab at Lamar



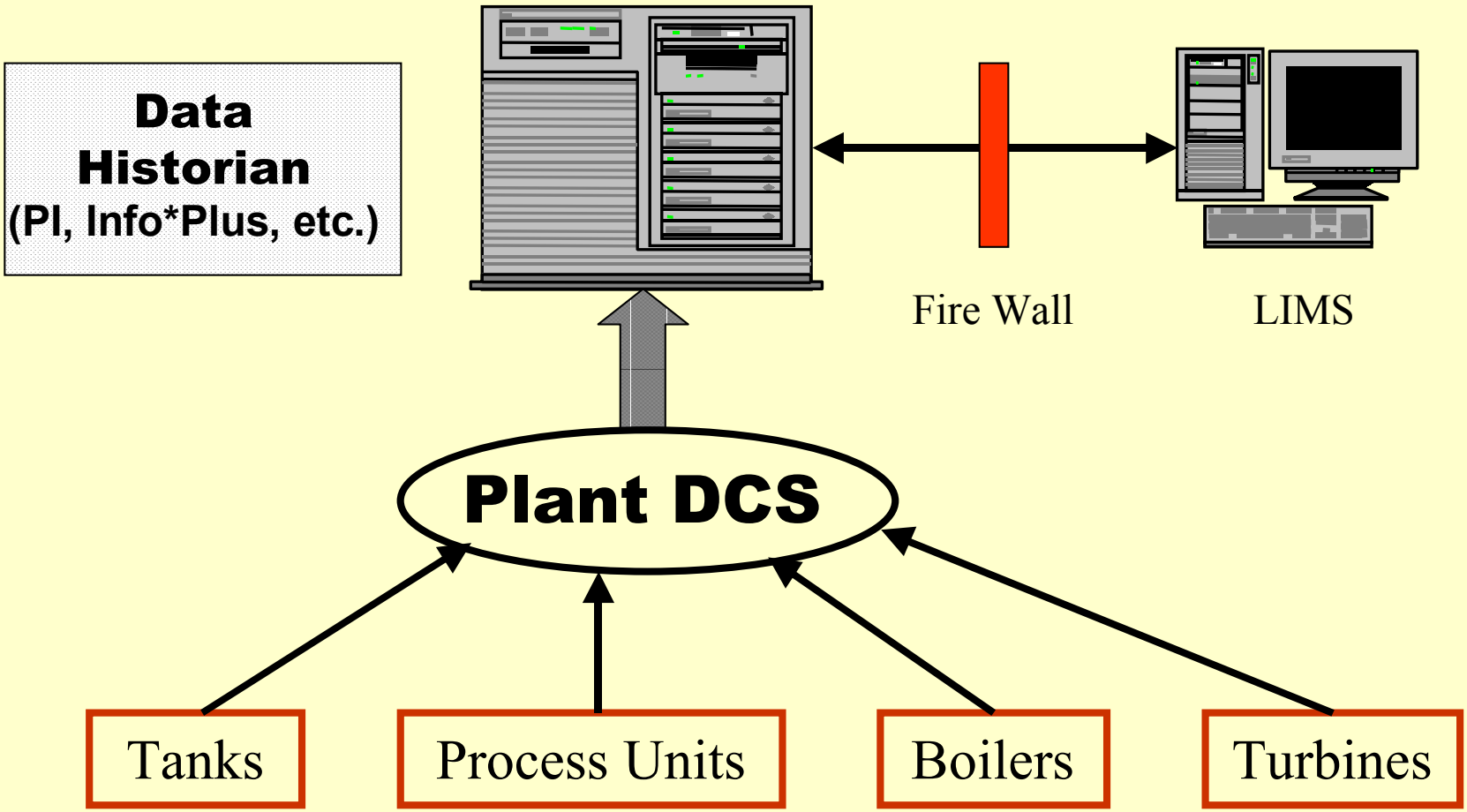
Real-time Emission Inventory

Better Flaring System

Clearing House Concept

Process Operation - DCS Control Room

DCS Information Flow Diagram



Need for Better Emission Inventory

- Recent study (TAQS 2000) have reported that all the VOC emissions are under estimated in the emissions inventory.
- Need IT tool to help the industry to report their emissions inventory effectively
- The software module can also help the facility to comply with Title V of Clean Air Act .

TAC 30 Chapter 101 - General Air Quality Rules

- Subchapter A: General Rules, include reportable quantity
- Subchapter F: Emissions Events and Scheduled Maintenance, Start up, and Shutdown Activities
  - Division 1: Emissions Events
  - Division 2: Maintenance, Start up and Shutdown Activities
  - Division 3: Operational Requirements, Demonstrations, and Actions to Reduce Excessive Emissions

TAC 30 §101.201. Emissions Event Reporting and Record keeping Requirements

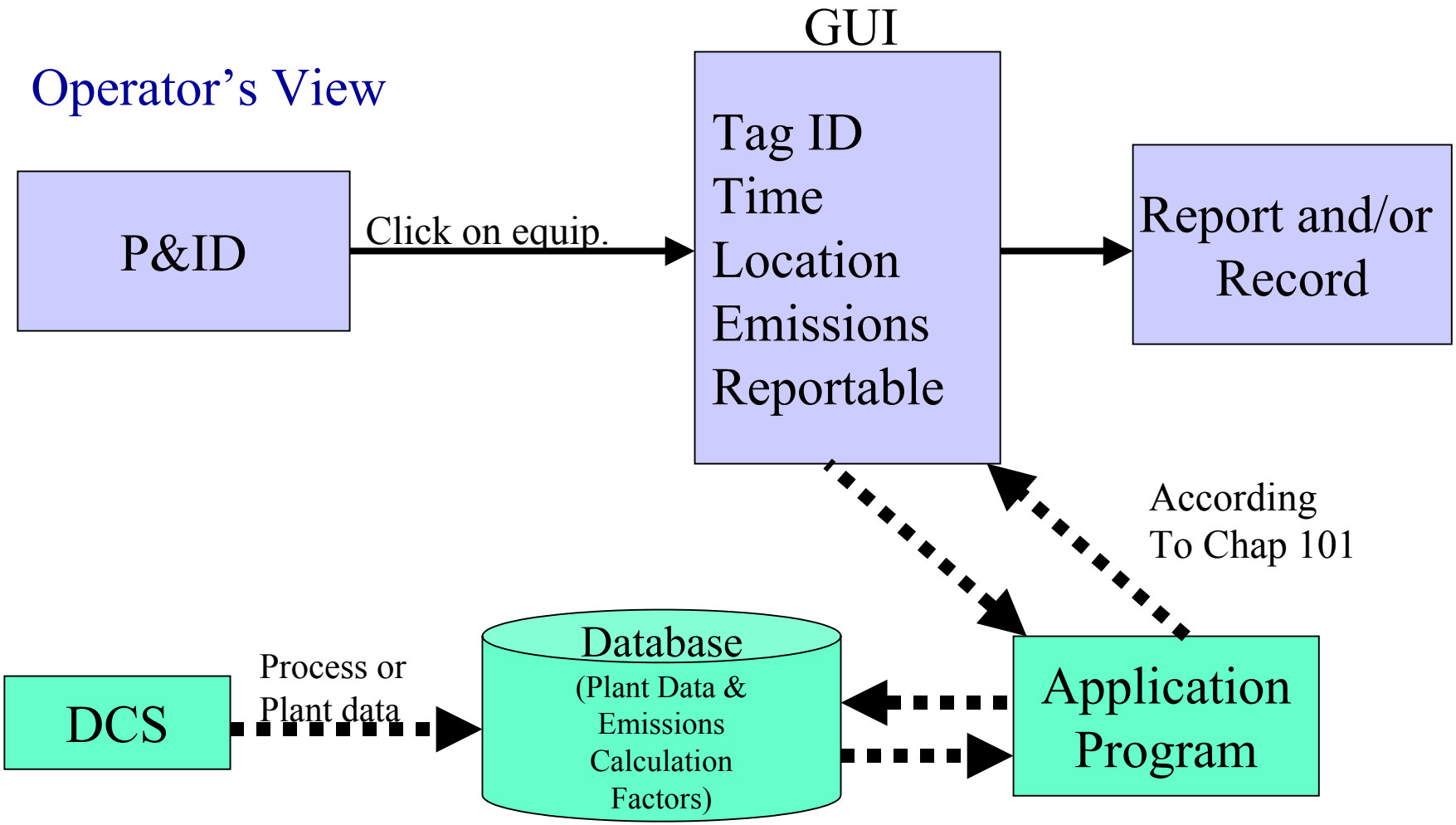
Emissions event – Any upset event or unscheduled maintenance, startup, or shutdown activity that results in unauthorized emissions from an emissions point

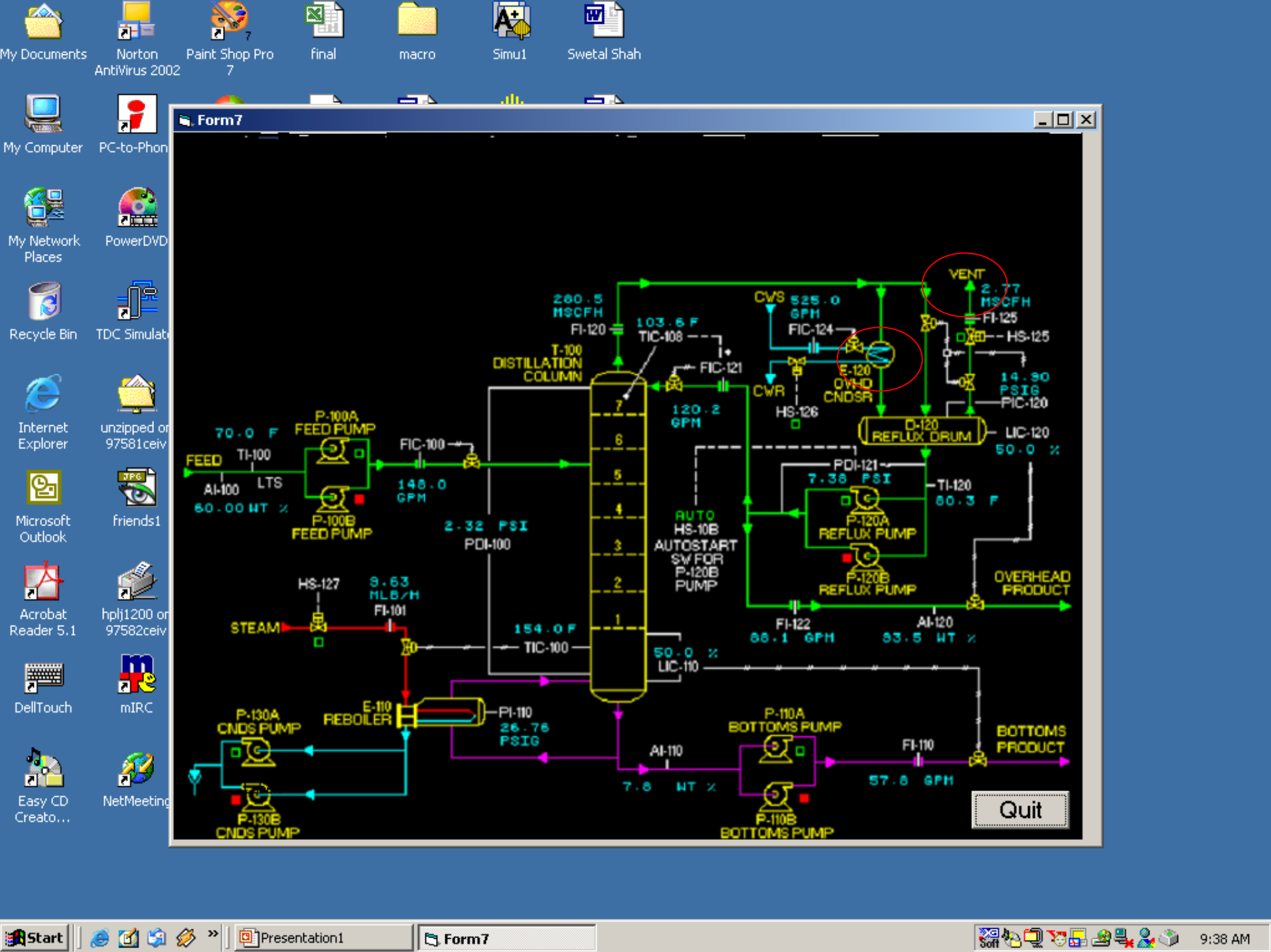
Reportable emission event – Any emissions event which, in any 24-hour period results in an unauthorized emission equal to or in excess of the reportable quantity.

TAC 30 Chapter 101 - Emissions Event Reporting & Recordkeeping

- No later than 24 hrs after the discovery of an Emission Event
    1. Determine if the emissions are reportable or not
    2. If reportable, submit the notification
- Final reports for all Emission Events within 2 weeks
- Jan. 1, 2003, electronic 2 week reports. Jan. 1, 2004, electronic notifications

Flow Diagram of Process Upset Emission Calculation/Reporting

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Norton AntiVirus 2002
Paint Shop Pro 7
final
macro
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Swetal Shah
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T-100
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HS-126
E-120
OVHD CNDSR
VENT
2.77 MSCFH
FI-125
HS-125
14.80 PSIG
PIC-120
D-120
REFLUX DRUM
LIC-120
50.0 %
120.2 GPM
70.0 F
P-100A
FEED PUMP
FEED
TI-100
AI-100
LTS
60.00 WT %
P-100B
FEED PUMP
FIC-100
148.0 GPM
2.32 PSI
PDI-100
PDI-121
7.38 PSI
TI-120
80.3 F
AUTO
HS-10B
AUTOSTART SW FOR P-120B PUMP
P-120A
REFLUX PUMP
P-120B
REFLUX PUMP
OVERHEAD PRODUCT
HS-127
STEAM
9.63 MLB/H
FI-101
154.0 F
TIC-100
FI-122
88.1 GPM
AI-120
53.5 WT %
50.0 %
LIC-110
E-110
REBOILER
PI-110
26.76 PSIG
P-130A
CNDS PUMP
P-130B
CNDS PUMP
AI-110
7.8 WT %
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BOTTOMS PRODUCT
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Presentation1
Form7
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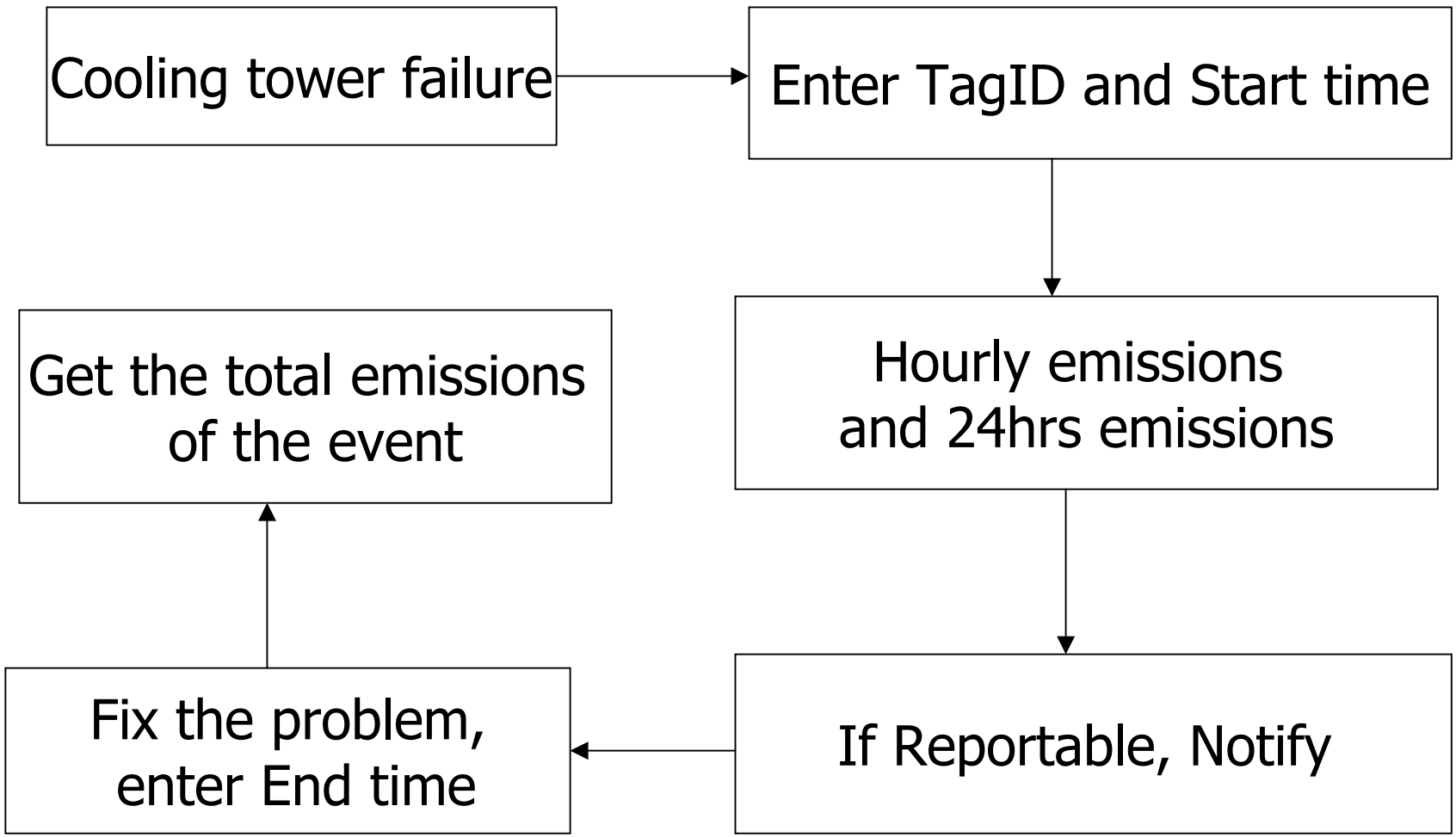
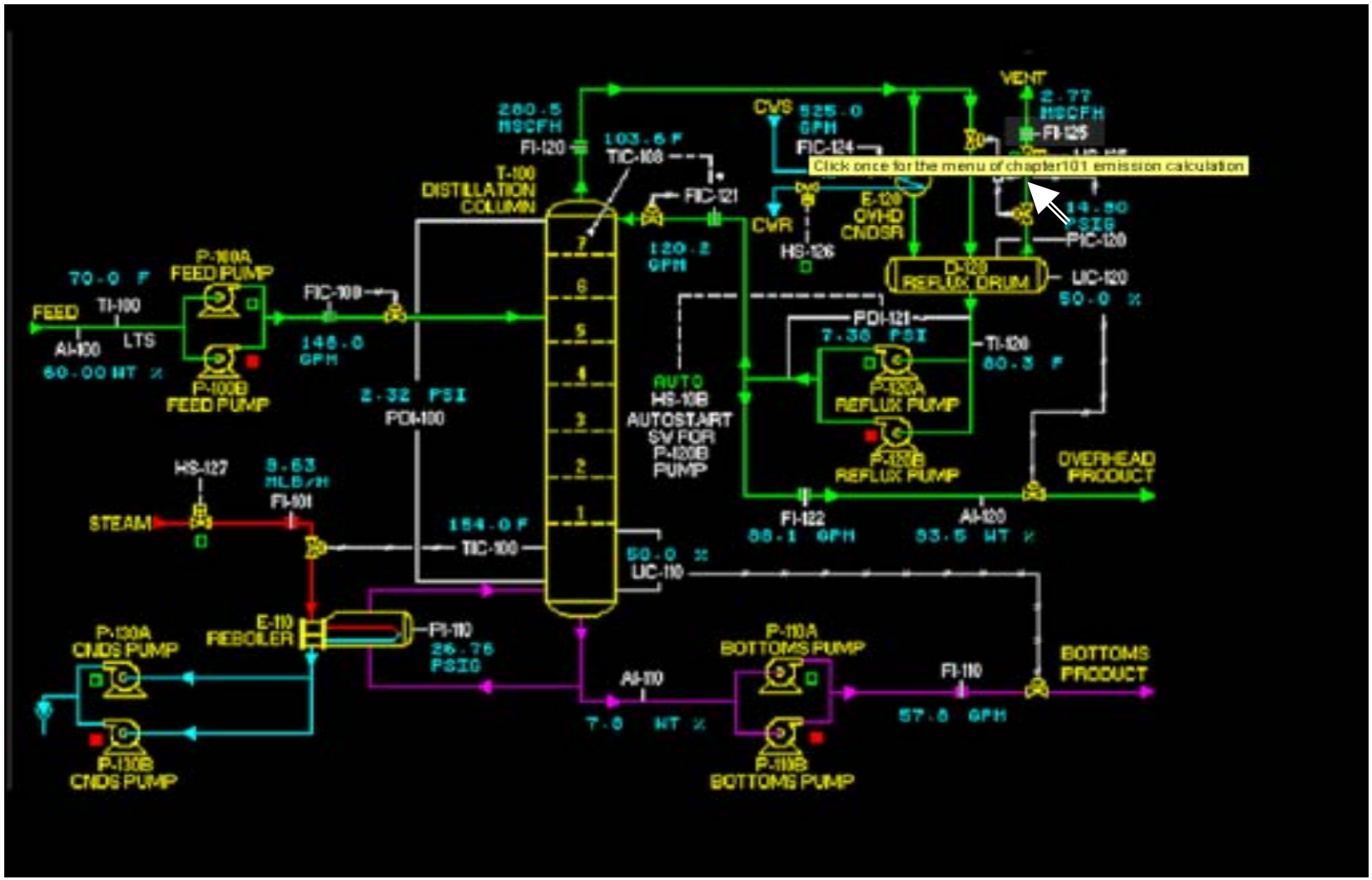
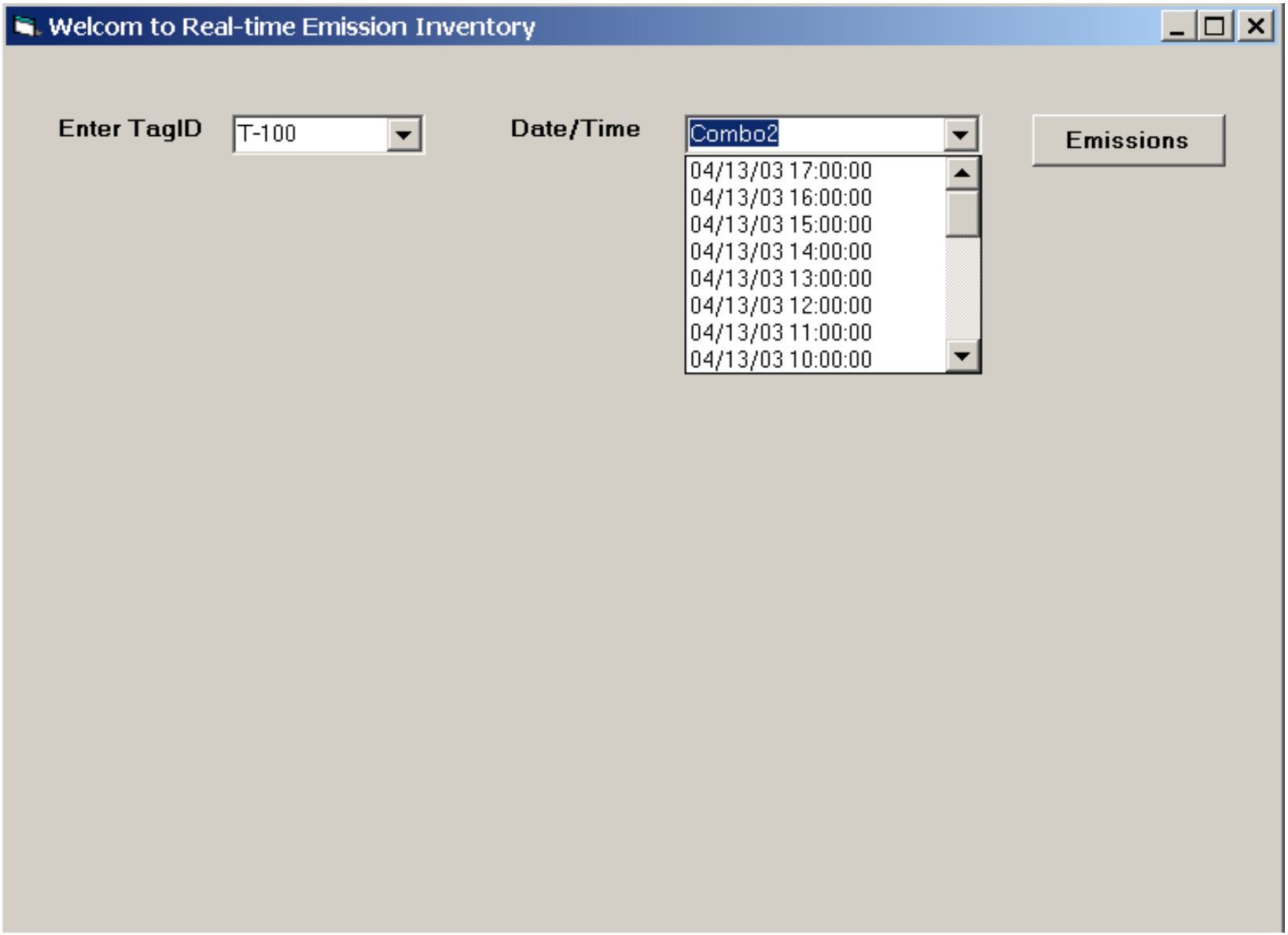
Case Study


Cooling tower failure
Enter TagID and Start time
Hourly emissions
and 24hrs emissions
If Reportable, Notify
Fix the problem,
enter End time
Get the total emissions
of the event

An Example:
PFD of Depentanizer

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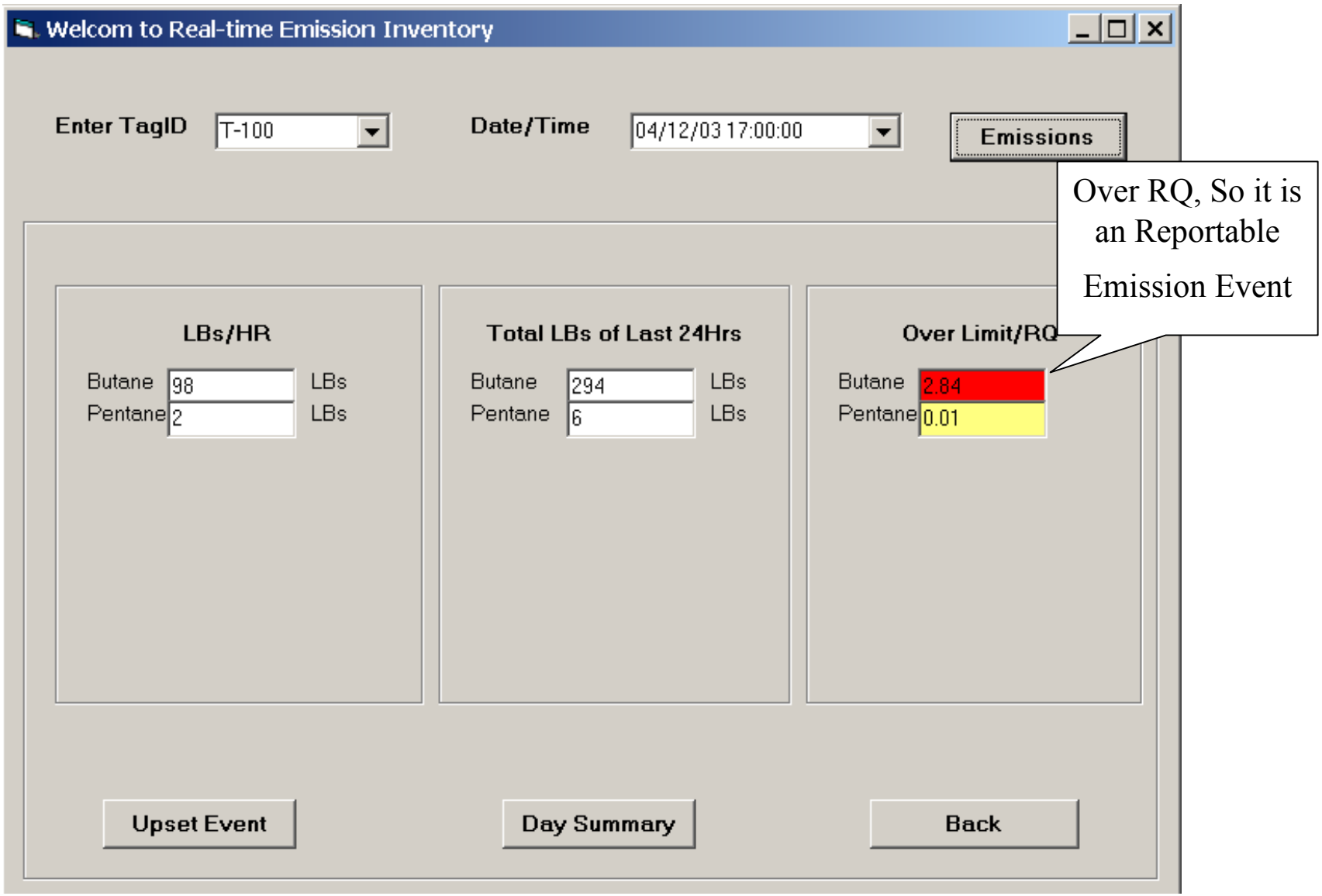
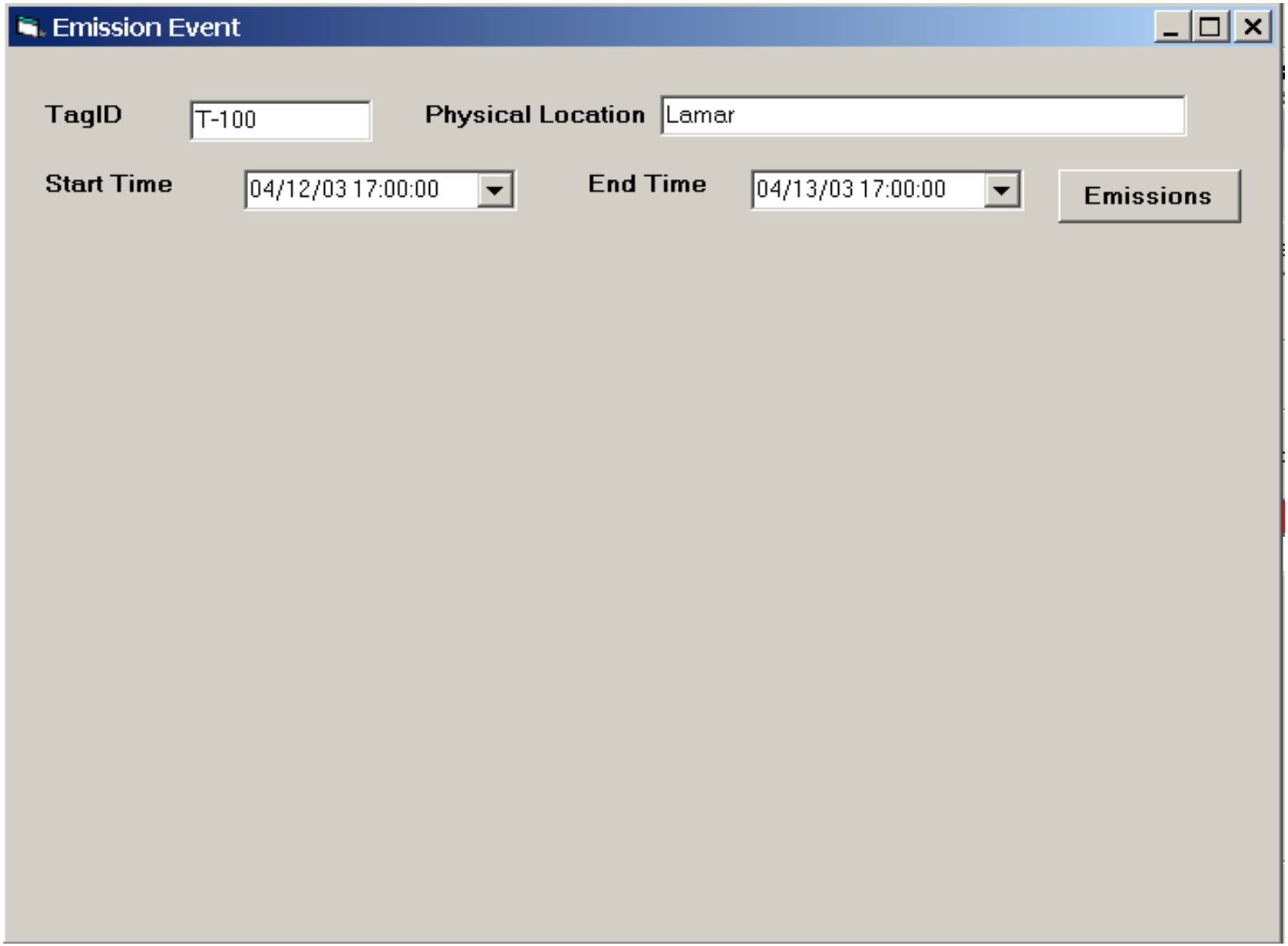
Enter TagID
T-100
Date/Time
Combo2
04/13/03 17:00:00
04/13/03 16:00:00
04/13/03 15:00:00
04/13/03 14:00:00
04/13/03 13:00:00
04/13/03 12:00:00
04/13/03 11:00:00
04/13/03 10:00:00
Emissions


Welcom to Real-time Emission Inventory
Enter TagID
T-100
Date/Time
04/12/03 17:00:00
Emissions
LBs/HR
Butane 98 LBs
Pentane 2 LBs
Total LBs of Last 24Hrs
Butane 294 LBs
Pentane 6 LBs
Over Limit/RQ
Butane 2.84
Pentane 0.01
Upset Event
Day Summary
Back
Over RQ, So it is an Reportable Emission Event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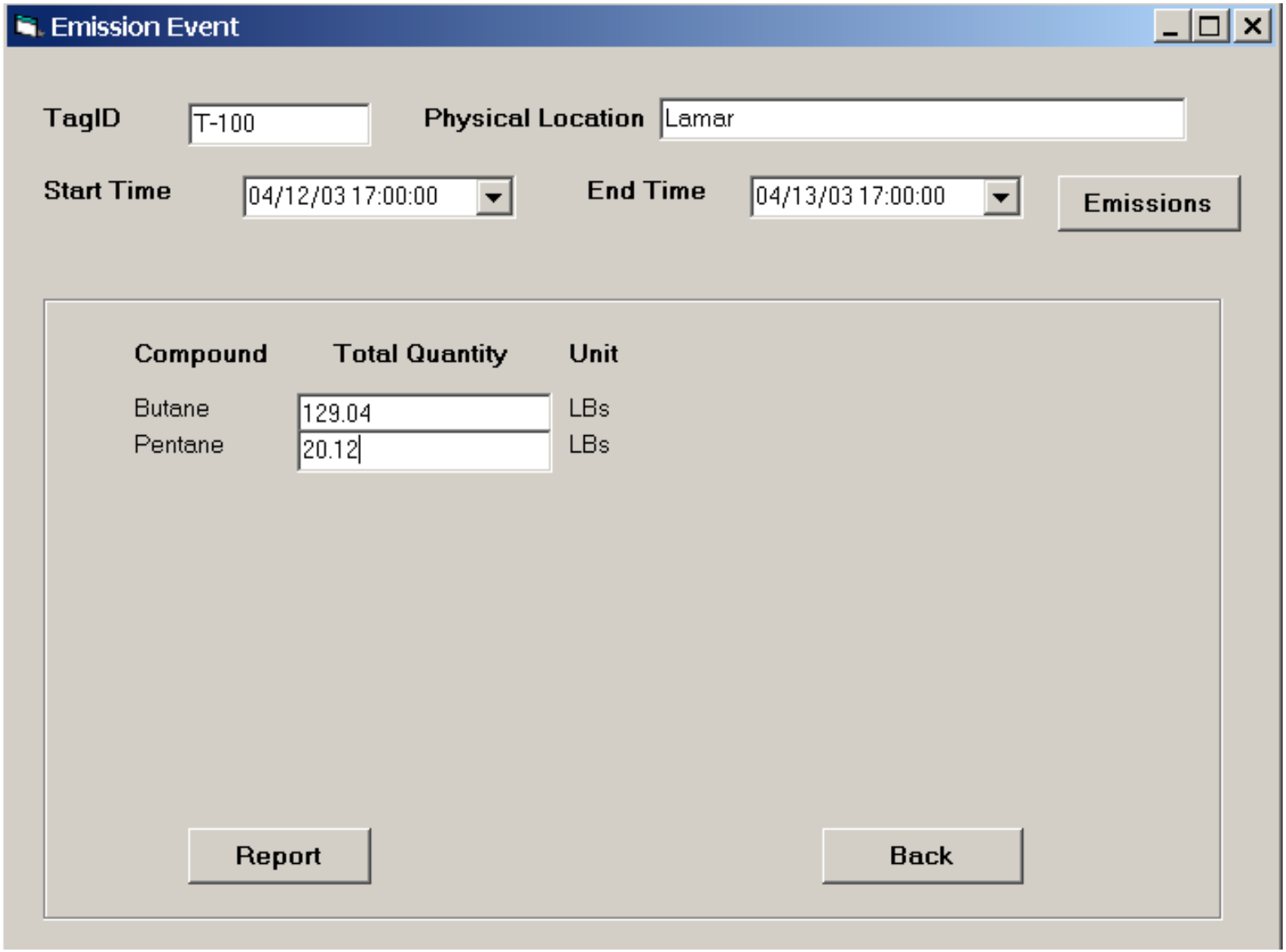
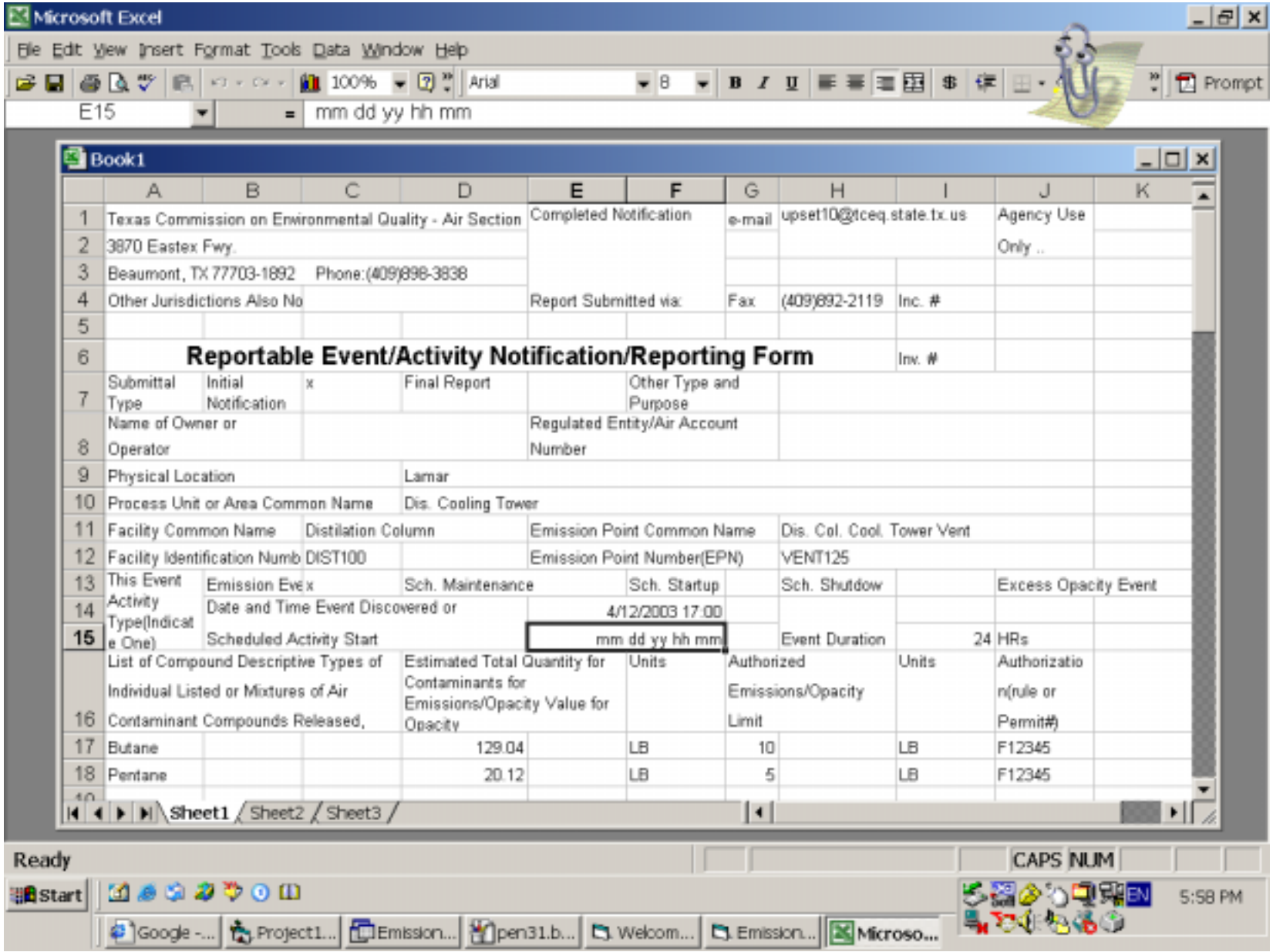
TagID
T-100
Physical Location
Lamar
Start Time
04/12/03 17:00:00
End Time
04/13/03 17:00:00
Emissions


Emission Event
TagID
T-100
Physical Location
Lamar
Start Time
04/12/03 17:00:00
End Time
04/13/03 17:00:00
Emissions
Compound
Total Quantity
Unit
Butane
129.04
LBs
Pentane
20.12
LBs
Report
Back


Microsoft Excel
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E15 = mm dd yy hh mm
Book1
Texas Commission on Environmental Quality - Air Section
3870 Eastex Fwy.
Beaumont, TX 77703-1892 Phone:(409)898-3838
Other Jurisdictions Also No
Completed Notification
Report Submitted via:
e-mail upset10@tceq.state.tx.us
Fax (409)892-2119
Agency Use Only ..
Inc. #
Inv. #
Reportable Event/Activity Notification/Reporting Form
Submittal Type Initial Notification x Final Report
Other Type and Purpose
Name of Owner or Operator
Regulated Entity/Air Account Number
Physical Location Lamar
Process Unit or Area Common Name Dis. Cooling Tower
Facility Common Name Distilation Column
Emission Point Common Name Dis. Col. Cool. Tower Vent
Facility Identification Numb DIST100
Emission Point Number(EPN) VENT125
This Event Activity Type(Indicate One)
Emission Eve x
Sch. Maintenance
Sch. Startup
Sch. Shutdow
Excess Opacity Event
Date and Time Event Discovered or Scheduled Activity Start
4/12/2003 17:00
mm dd yy hh mm
Event Duration 24 HRs
List of Compound Descriptive Types of Individual Listed or Mixtures of Air Contaminant Compounds Released,
Estimated Total Quantity for Contaminants for Emissions/Opacity Value for Opacity
Units
Authorized Emissions/Opacity Limit
Units
Authorization(rule or Permit#)
Butane 129.04 LB 10 LB F12345
Pentane 20.12 LB 5 LB F12345
Sheet1 Sheet2 Sheet3
Ready
CAPS NUM
Start
Google -... Project1... Emission... pen31.b... Welcom... Emission... Microso...
EN 5:58 PM

Highly-reactive volatile organic compound (HRVOC)

- Acetaldehyde; formaldehyde
- 1,3-butadiene; isoprene
- ethylene; propylene; butylenes; pentenes
- ethyltoluenes;
- toluene; xylenes
- trimethylbenzenes

HRVOC Emission Sources in CPI

- Division 1: Vent Gas Control 8%
- Division 2: Flares 30%
- Division 3: Cooling Tower
  - Heat Exchange Systems 7%
- Division 4: Fugitive Emissions 48%

Ref: TAC Title 30 Chapter 115, Subchapter H

Fugitive Emission

- Emissions that are not released through a stack, vent, duct pipes or other confined air stream are termed as fugitive sources

- These emissions include equipment leaks and area emissions

TAC 30 Chapter 115: Subchapter D
General VOC compounds : fugitive emission from Petroleum refining, Petrochemical, Natural Gas processing

- Applicability BPA, DFA, EP, HGA
- Control requirement
  - no component shall be allowed to have a VOC leak for more than 15 calendar days after the leak is found which exceeds 500 ppmv
  - first attempt to repair within 5 days
  - if unable to repair leak calculate mass flow rate & report.
  - Total cumulative mass emission from all the leaking component should be less than 50% of shut down emission
- Monitoring requirement
  - Monitor the leak in ppmv every quarter,
  - weekly inspection of flanges
  - Update every 12 months the records of all components
- Compliance
  - date Dec. 31 2003, (initial report by April 30 2003)

TAC 30 Chapter 115: Subchapter H (Highly reactive VOC compounds: fugitive emission)

- Applicability HGA
- Inspection requirement
  - all fugitive emission point should be identified
  - all components are required to be monitored quarterly & twice during third quarter,
  - first attempt to repair the leak within 24 hrs. & reported
- Record keeping
  - Maintain record of preventive measures, process hazard analysis for the releases through PRV & released event record
  - all non- repairable components record maintain & update every 3 months
  - Maintain & update electronic database for all the components at least every 12 months: 1) The name of the unit where the component is located. 2) Type of the component 3) ID number 4) type of service (HL,LL,GV) 5) response factor
  - record for 5 yrs
- Compliance date
  - Dec. 31 2003, (if equipment upgrade start from shutdown after Dec. 30, 2002)

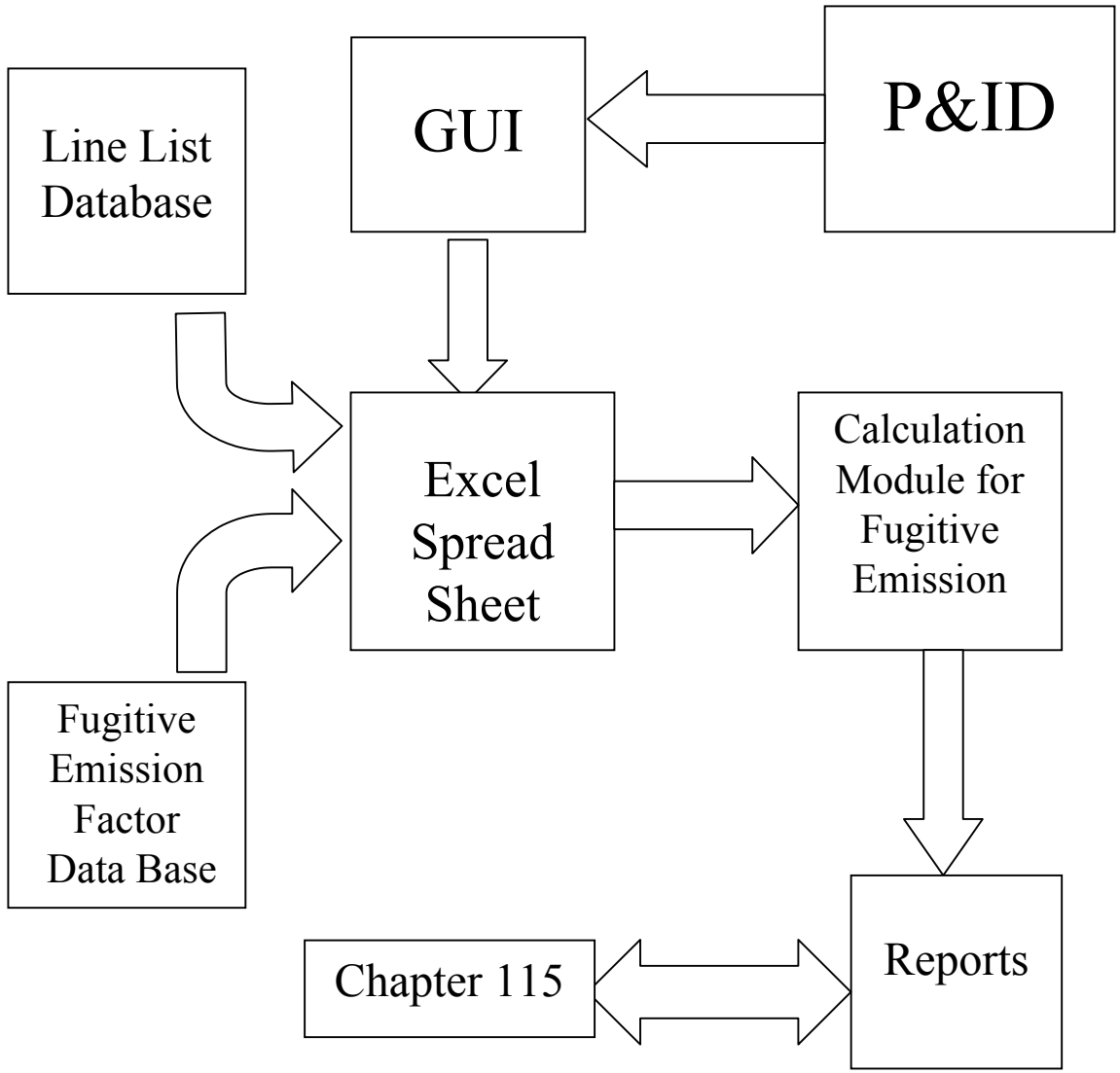
The Percentage of total Number of Non-repairable Components Allowed

Component	Total Number of Non-repairable Components Allowed (%)
Valves (Excluding Pressure Relief Valves)	0.5%
Pressure Relief Valves	1.0%
Pumps and Compressors	1.0%
Connectors	0.5%
All Other Components	0.5%

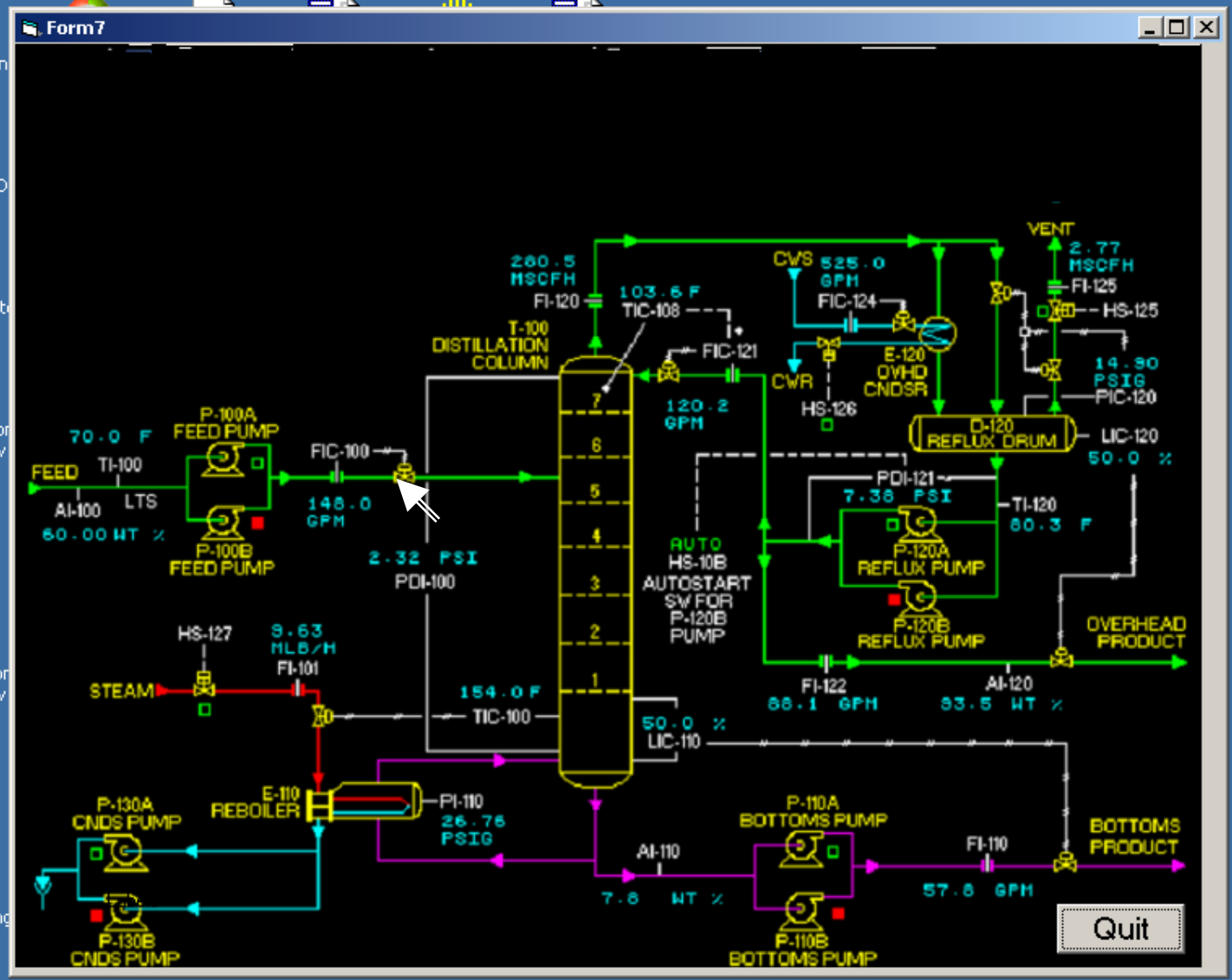
Fugitive Emission Calculation

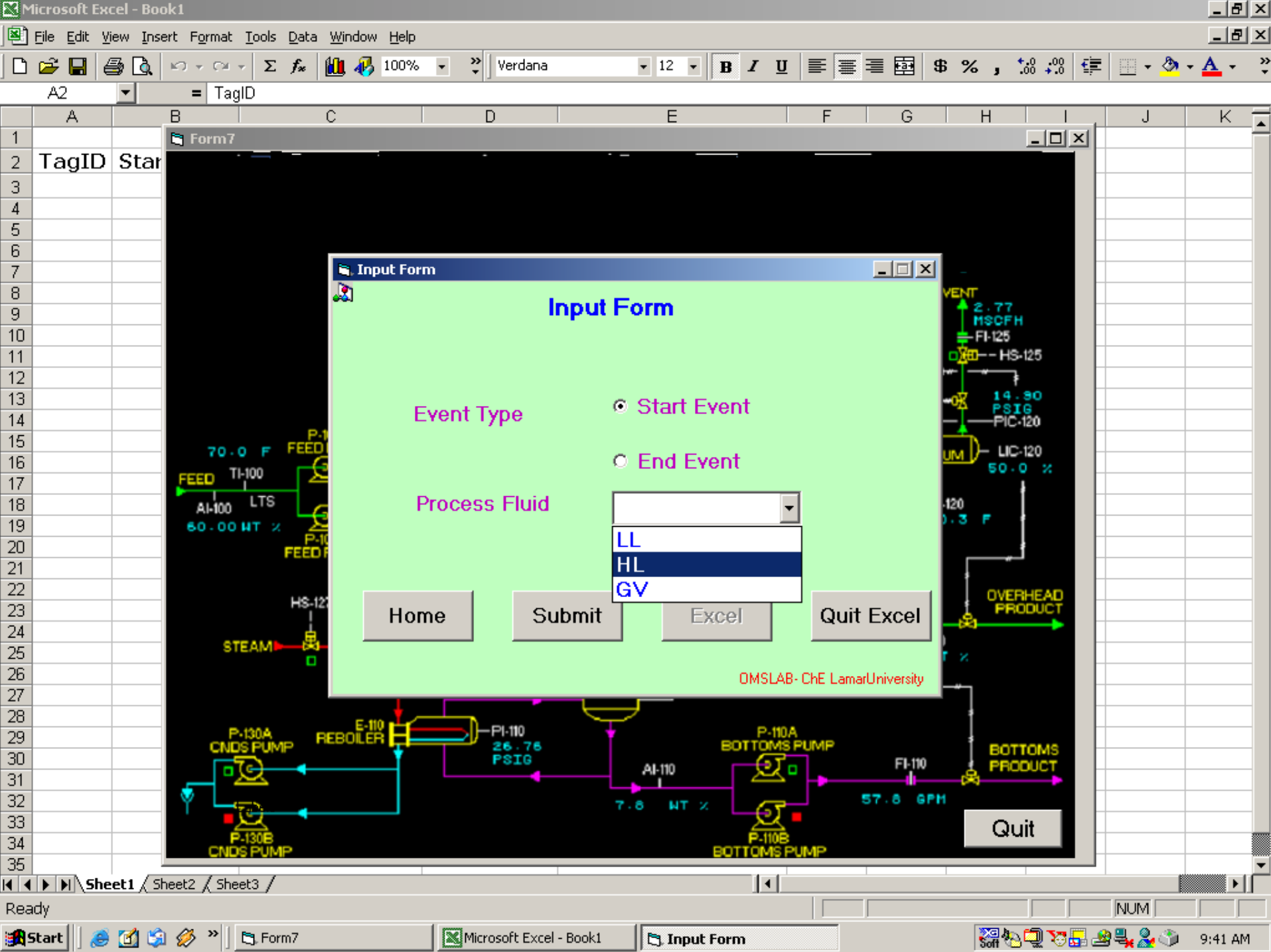
- Operator clicks the leaking component on the P&ID
- The application program queries Line List for the input data
- Input data is transferred to Excel spread sheet & fugitive emission (total cumulative emission from leaking components) is calculated using the Emission Factor & Process conditions.

Flow Diagram for Fugitive Emission



An Example: Fugitive Emission from a Valve on the Feed Stream

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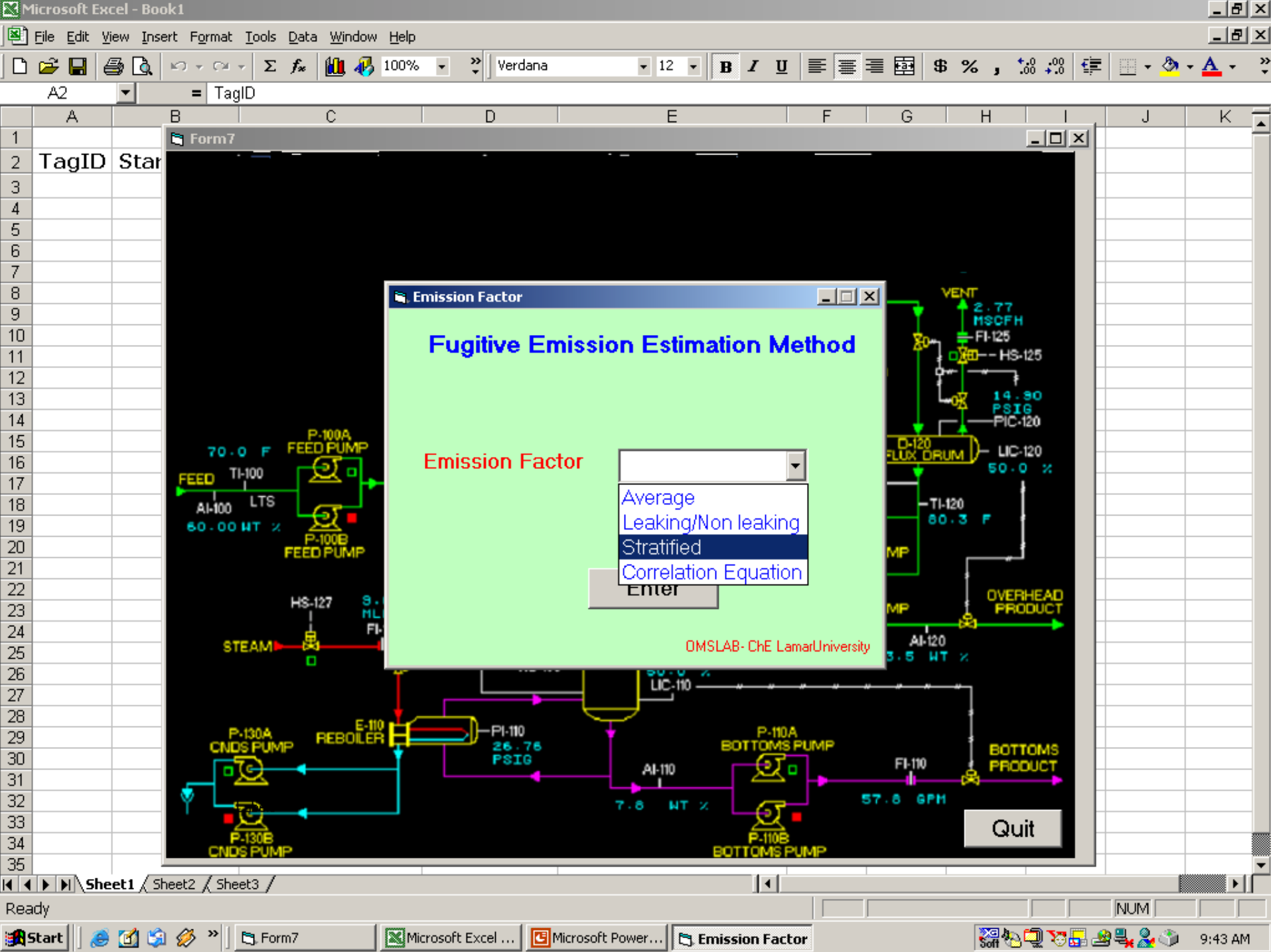
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Emission Factor
Fugitive Emission Estimation Method
Emission Factor
Average
Leaking/Non leaking
Stratified
Correlation Equation
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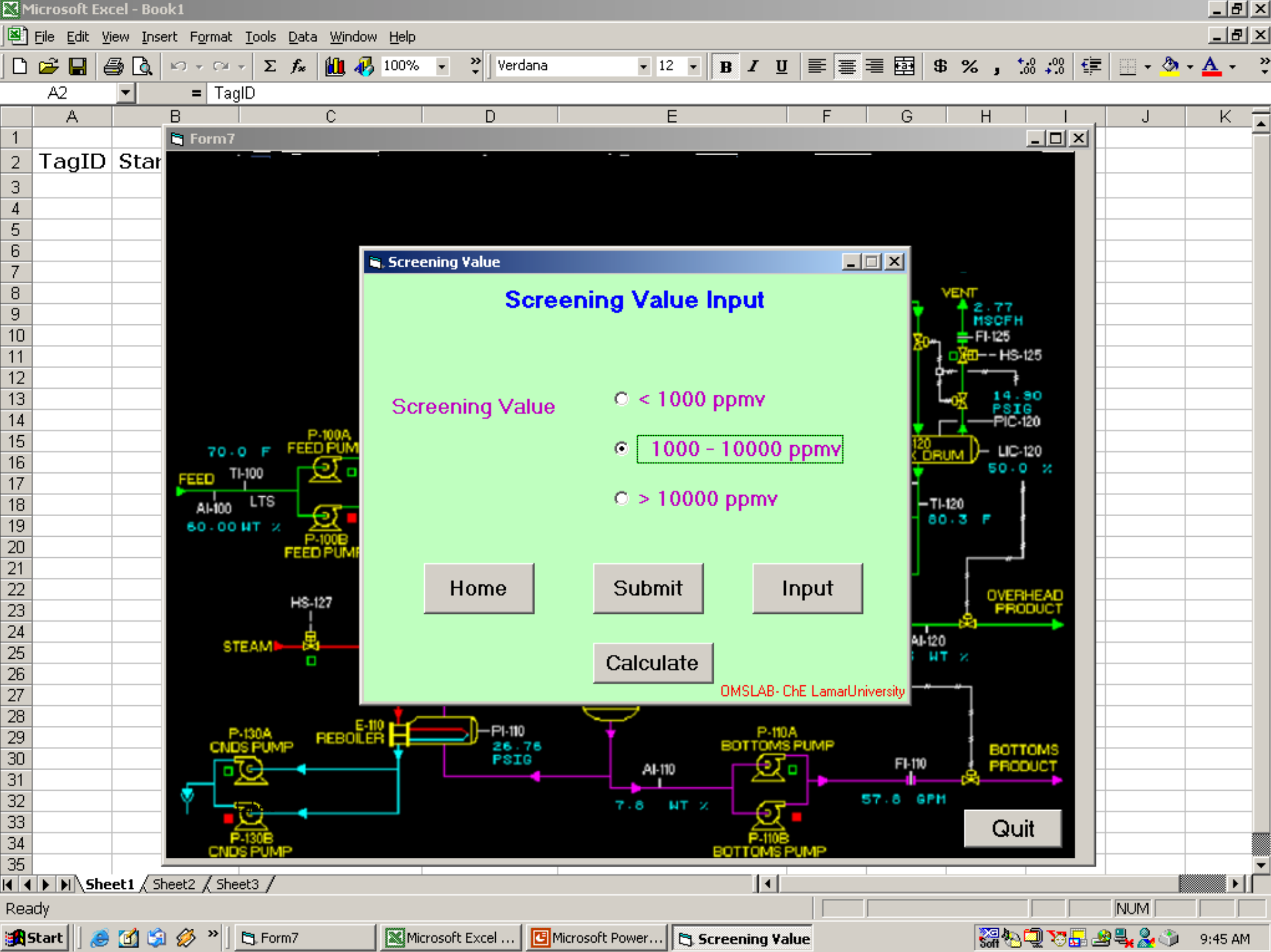
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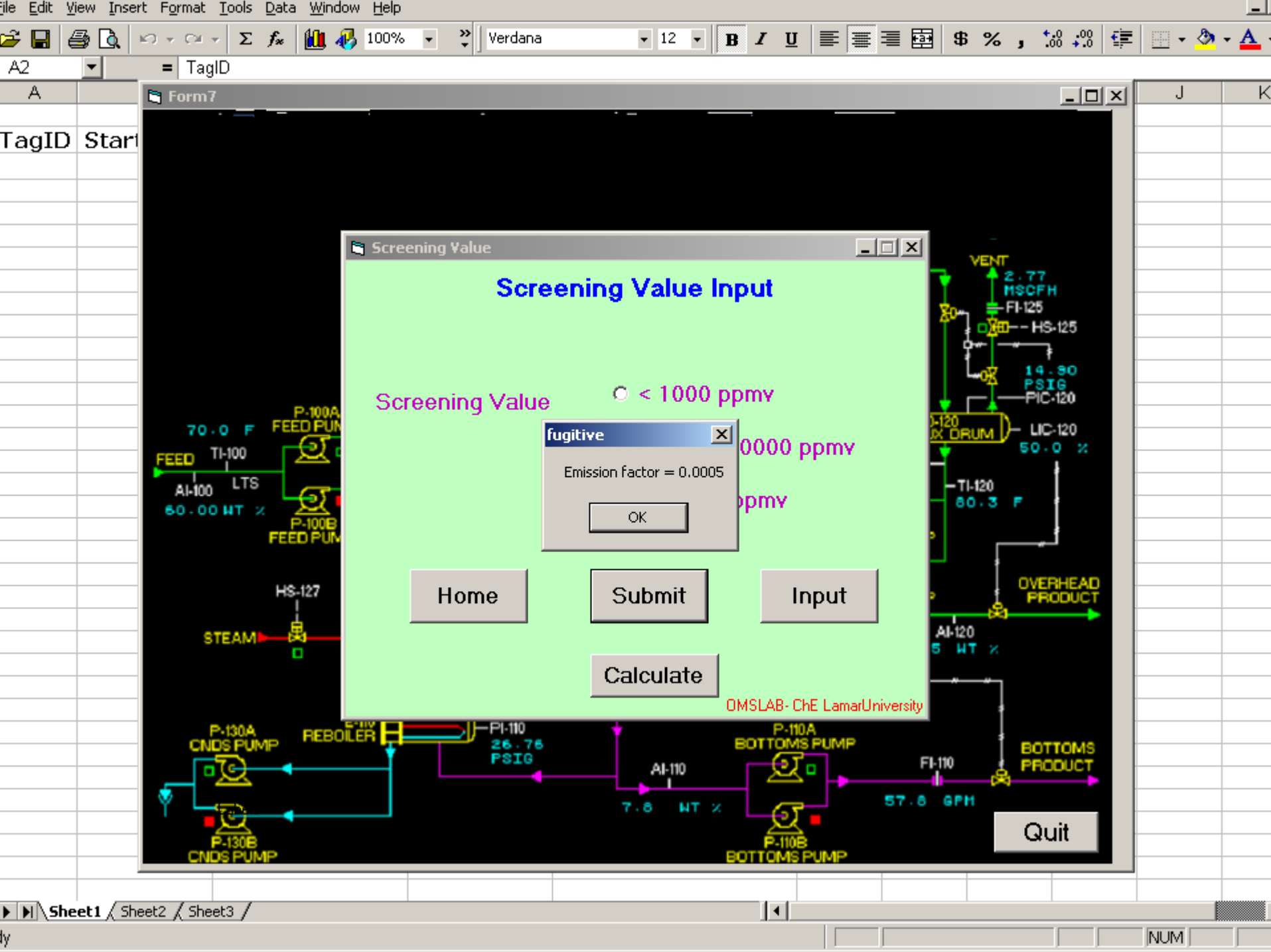
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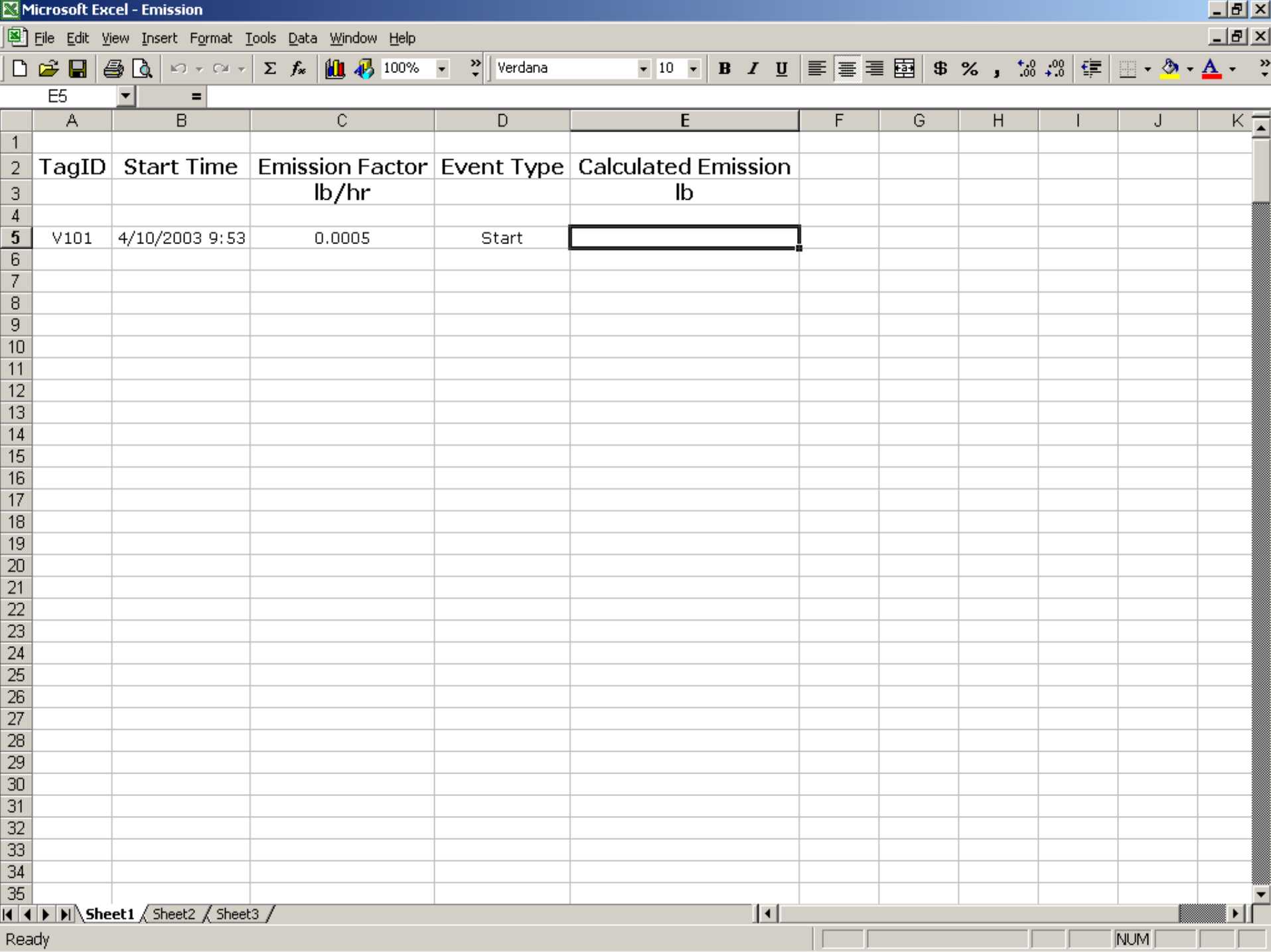
Microsoft Excel - Emission
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Start Time
Emission Factor lb/hr
Event Type
Calculated Emission lb
V101
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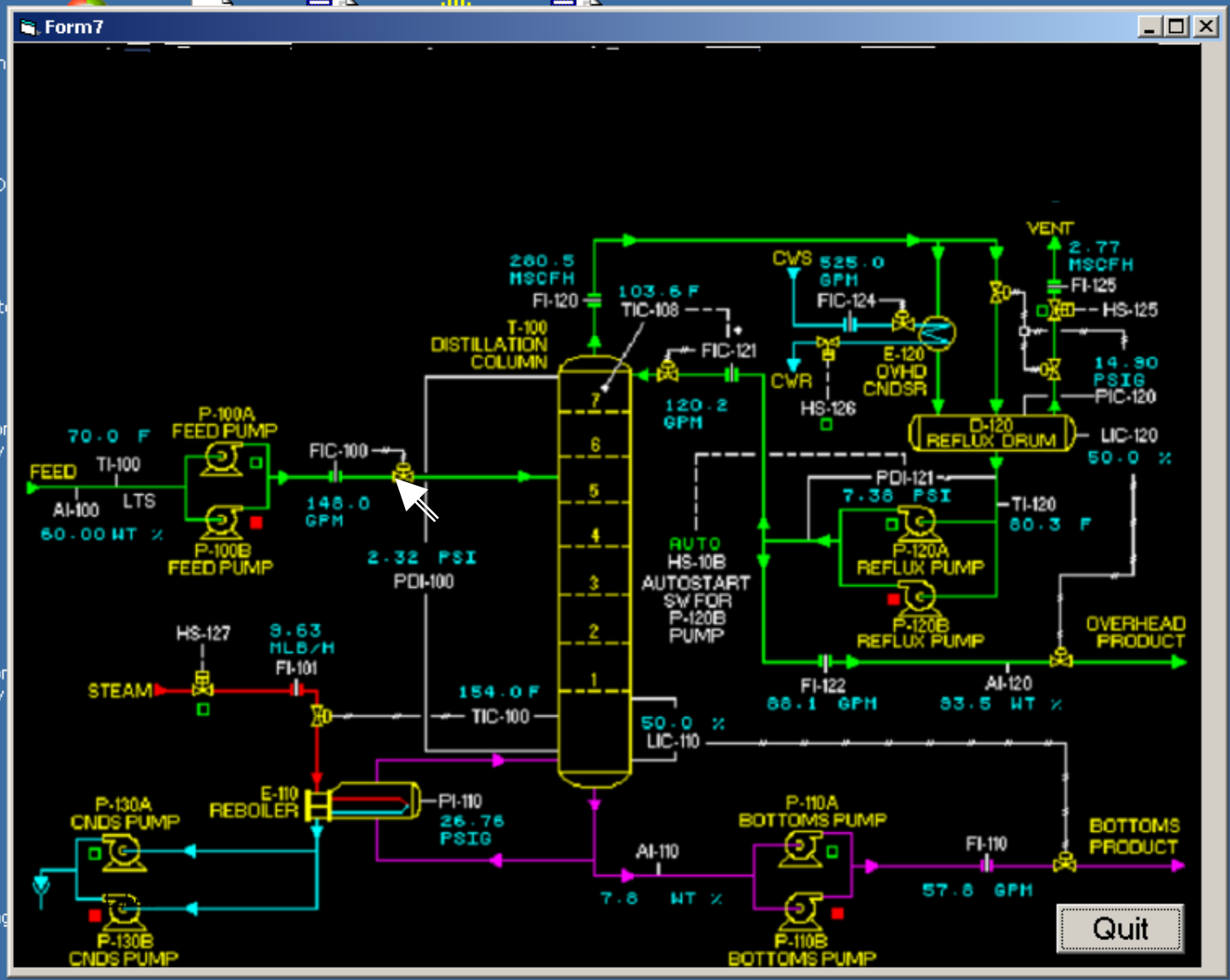
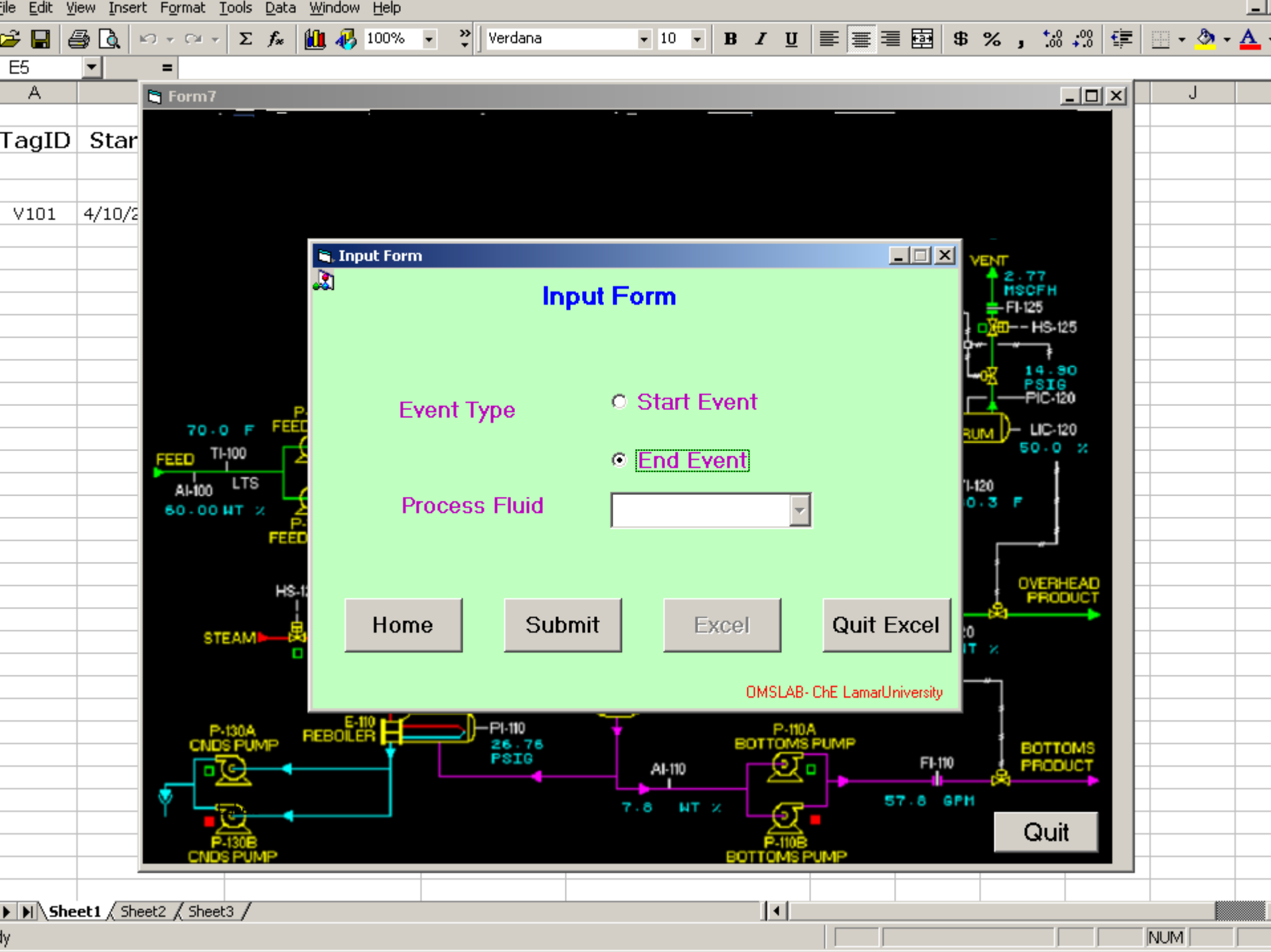
Ready
NUM

After the repair of the leak component




Form7
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Start Event
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LTS
60.00 WT %
STEAM
OVERHEAD
PRODUCT
E-110
REBOILER
PI-110
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P-130A
CNDS PUMP
P-130B
CNDS PUMP
AI-110
7.8 WT %
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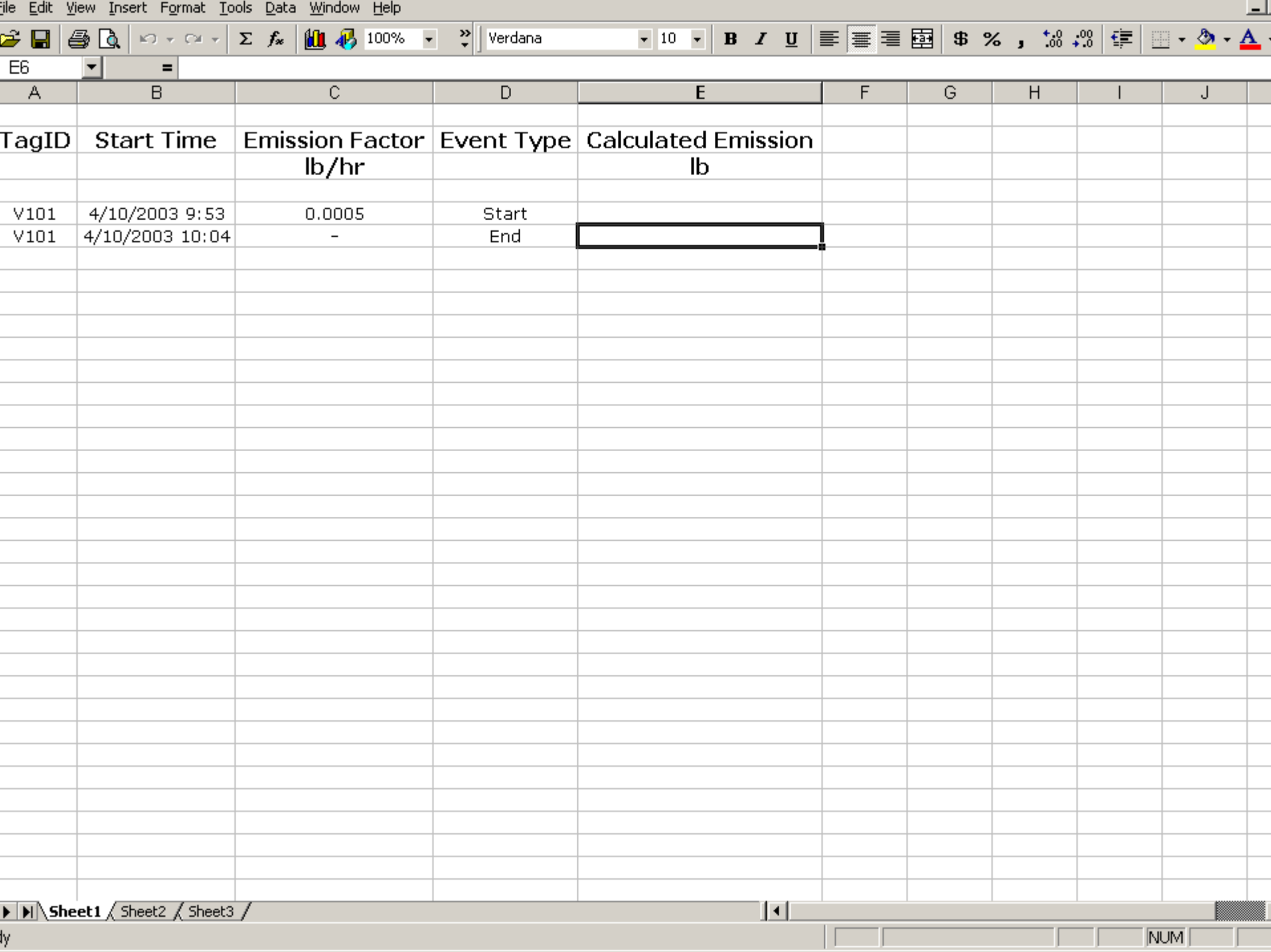

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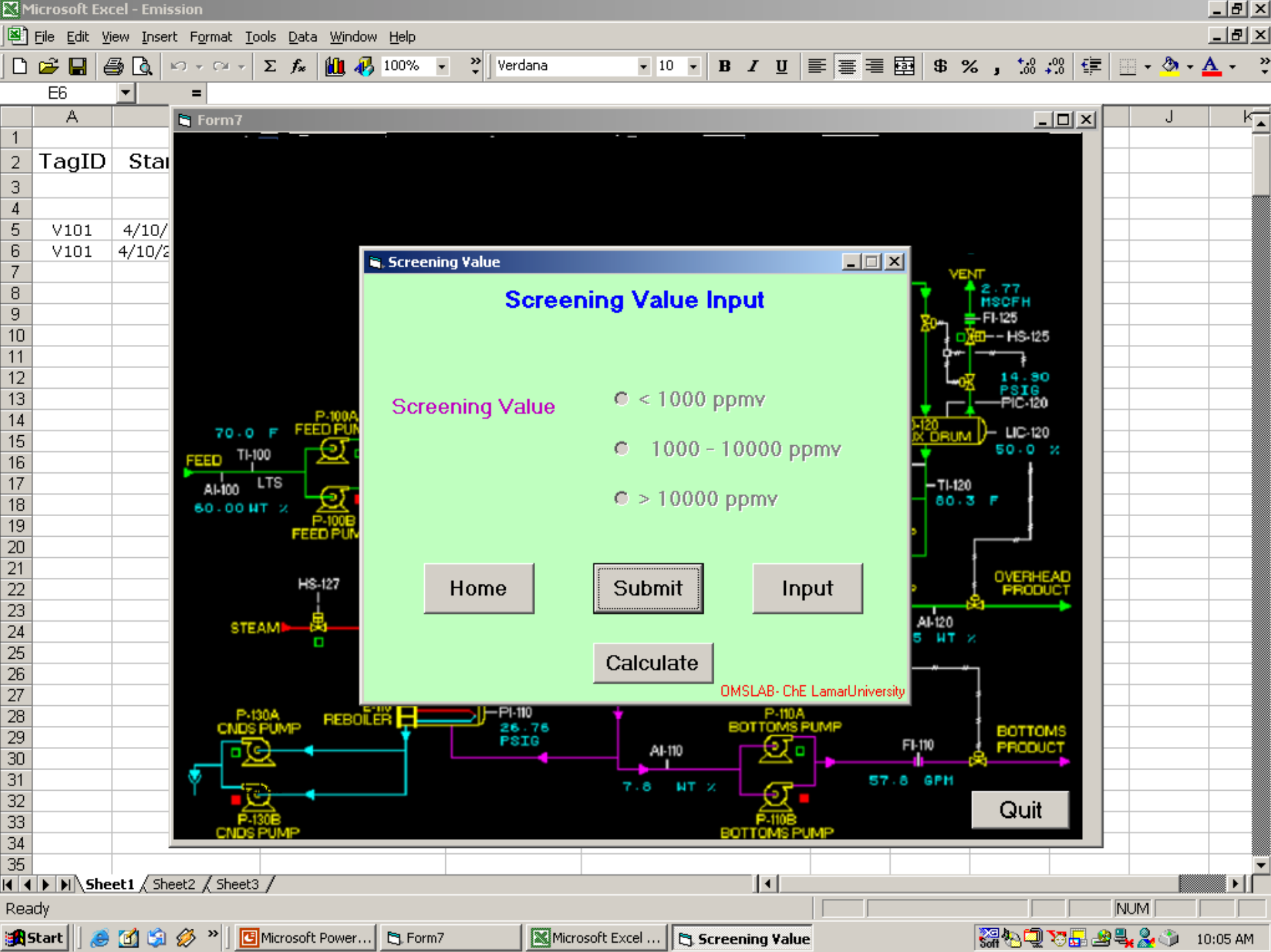
V101	4/10/2003 10:04	-	End	


Microsoft Excel - Emission
File Edit View Insert Format Tools Data Window Help
Verdana
10
100%
E6
TagID
V101
V101
Form7
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Screening Value Input
Screening Value
< 1000 ppmv
1000 - 10000 ppmv
> 10000 ppmv
Home
Submit
Input
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FI-125
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14.90 PSIG
PIC-120
LIC-120
50.0 %
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OVERHEAD PRODUCT
AI-120
5 WT %
70.0 F
P-100A FEED PUM
FEED
TI-100
AI-100
LTS
60.00 WT %
P-100B FEED PUM
HS-127
STEAM
P-130A CNDS PUMP
REBOILER
PI-110
26.76 PSIG
AI-110
7.8 WT %
P-110A BOTTOMS PUMP
FI-110
57.8 GPM
BOTTOMS PRODUCT
P-130B CNDS PUMP
P-110B BOTTOMS PUMP
Quit
Sheet1
Sheet2
Sheet3
Ready
NUM
Start
Microsoft Power...
Form7
Microsoft Excel ...
Screening Value
10:05 AM

File Edit View Insert Format Tools Data Window Help

E6 = 0.0000904166666732635

TagID	Start Time	Emission Factor lb/hr	Event Type	Calculated Emission lb
V101	4/10/2003 9:53	0.0005	Start	
V101	4/10/2003 10:04	-	End	9.04167E-05

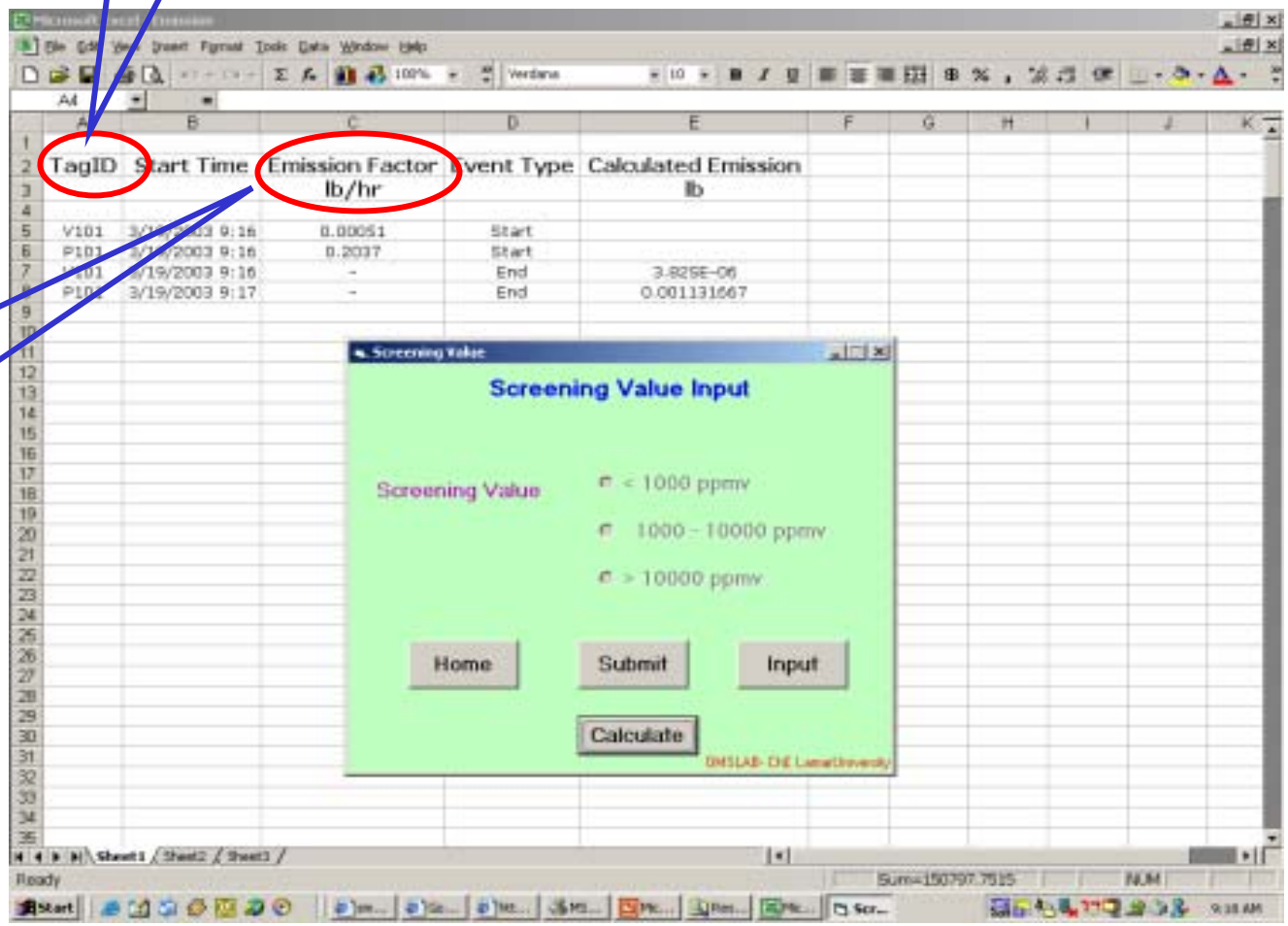
Sheet1 Sheet2 Sheet3

NUM

Fugitive Emission Calculation Module

The leaking component

Emission Factor Obtained from EPA-453/R-95-017,November, 1995*



*Ref: "Protocol for Equipment Leak Emission Estimates," (EPA-453/R-95-017, November, 1995).