CEMS & STATISTICS

What could be worse?

Downs, John

From: Johnson.Travis@epamail.epa.gov
Sent: Wednesday, February 27, 2008 10:23 AM
To: Downs, John
Subject: Sooner, ORIS 6095 - CO2 Evaluation

Attachments: Sooner Probe Leak Notification.doc; Explanation of CO2 Control Chart Evaluation Report.doc; Sooner02112008.pdf

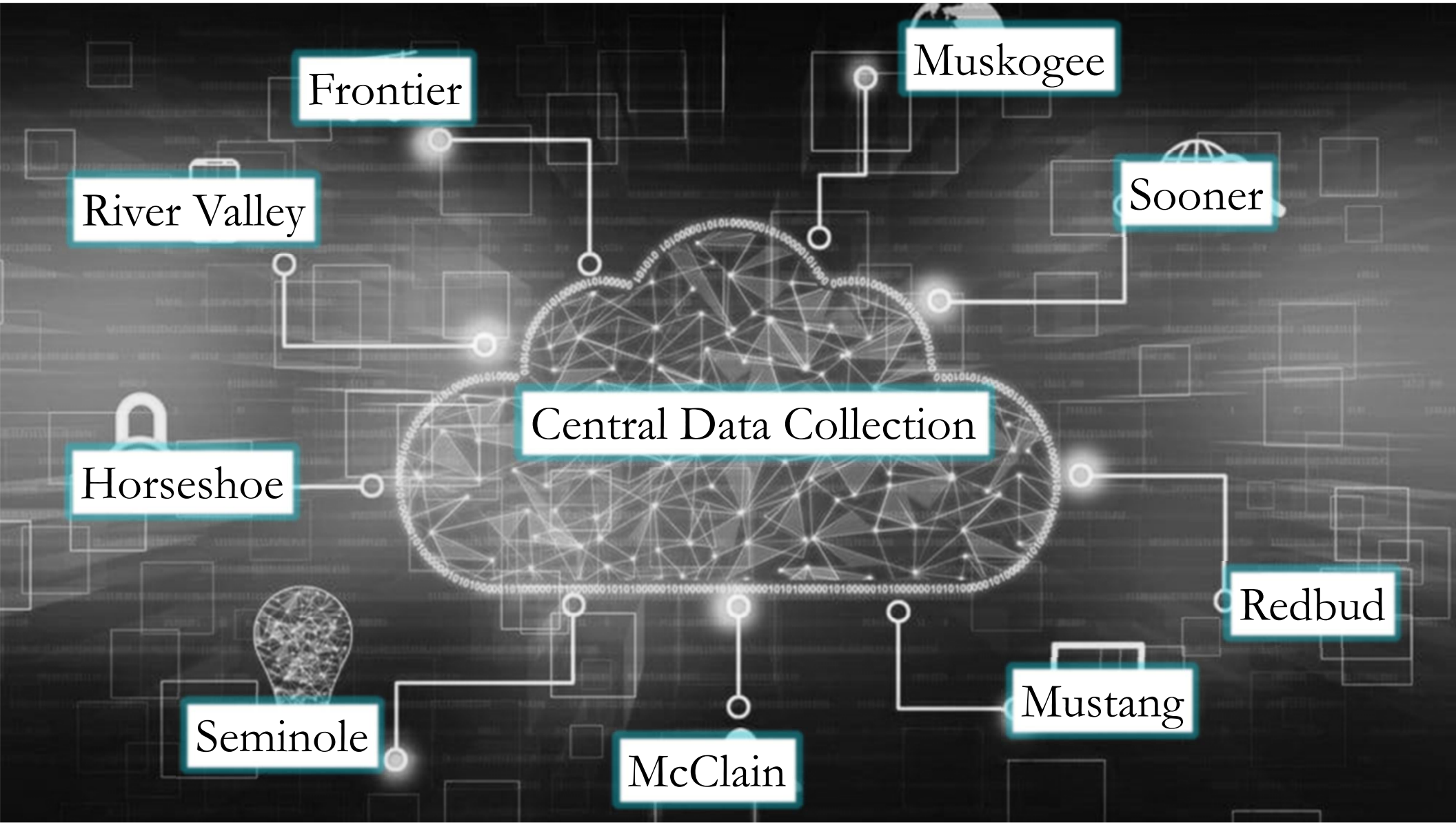
Sooner Probe Leak Notification... | Explanation of CO2 Control Cha... | Sooner02112008.pdf (17 KB)

John

Re: Electronic Audit of 2007 Emissions Data

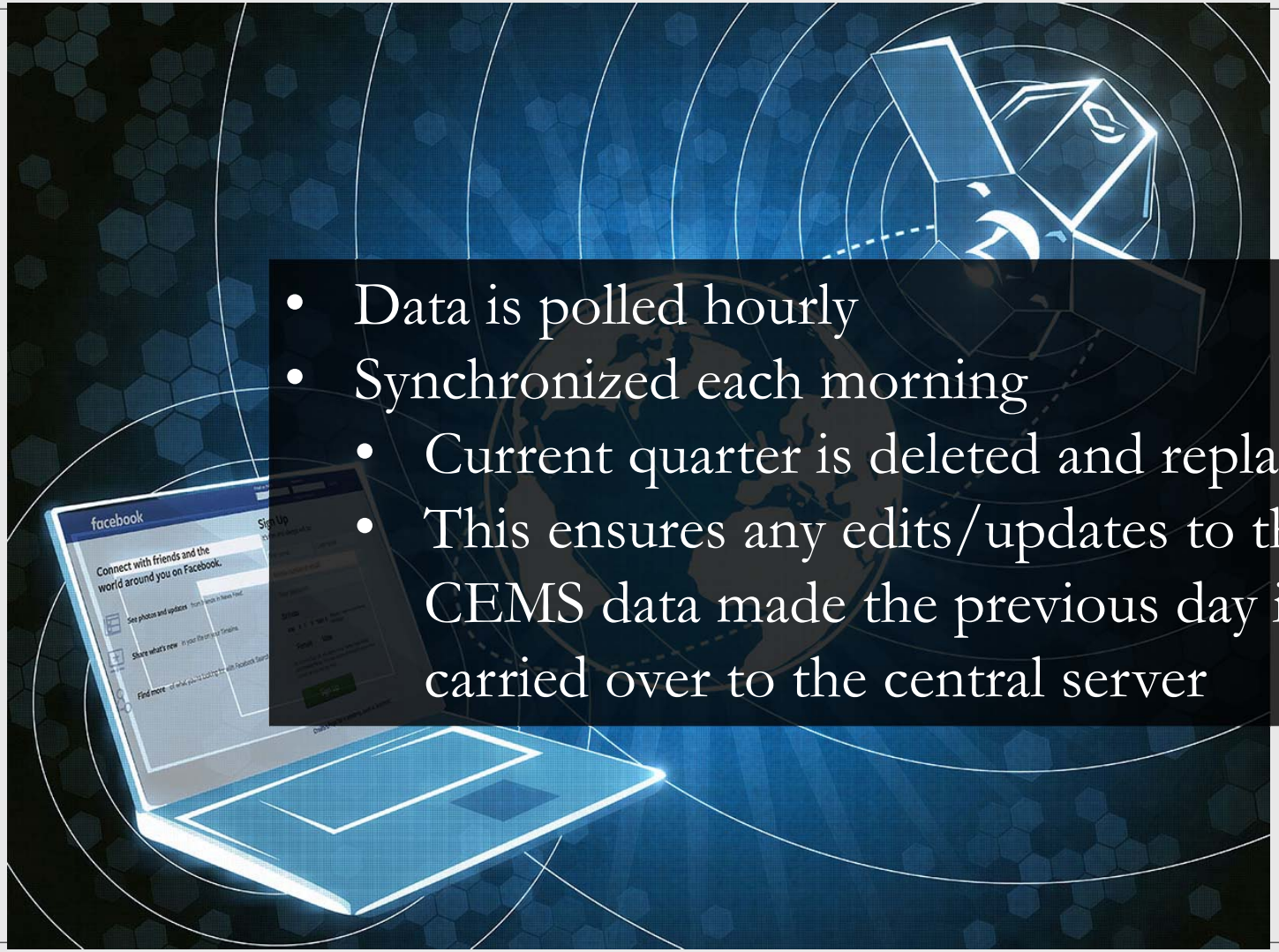
Dear Mr. Wendling:

This is to inform you that on February 27, 2008, the Clean Air Markets Division (CAMD) performed an electronic audit of the 2007 emissions data for Sooner (ORIS 6095), Unit 2, which indicates that the SO_2, NO_x, and CO_2 emissions from this unit or stack may have been under-reported in the 1st quarter 2007 due to a leak in the sample lines or probe of the continuous emission monitoring systems (CEMS).


Frontier
Muskogee
River Valley
Sooner
Central Data Collection
Horseshoe
Redbud
Seminole
Mustang
McClain

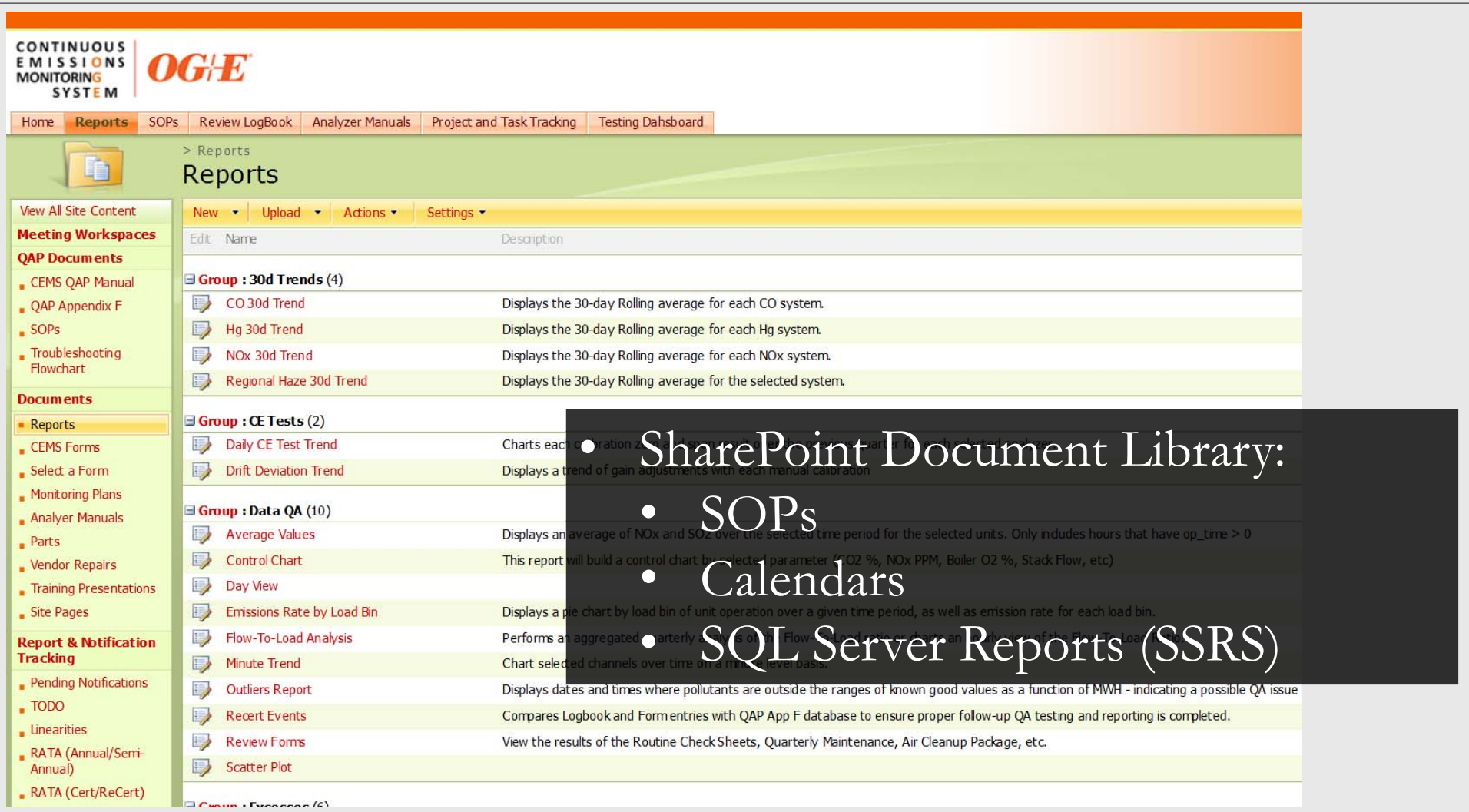
Benefits of centralization:

- Single logon for all sites
- Standard interface for each vendor
- Ease of use, customization
- Compare across sites easily
- Custom reports as needed by different sites/permits/programs

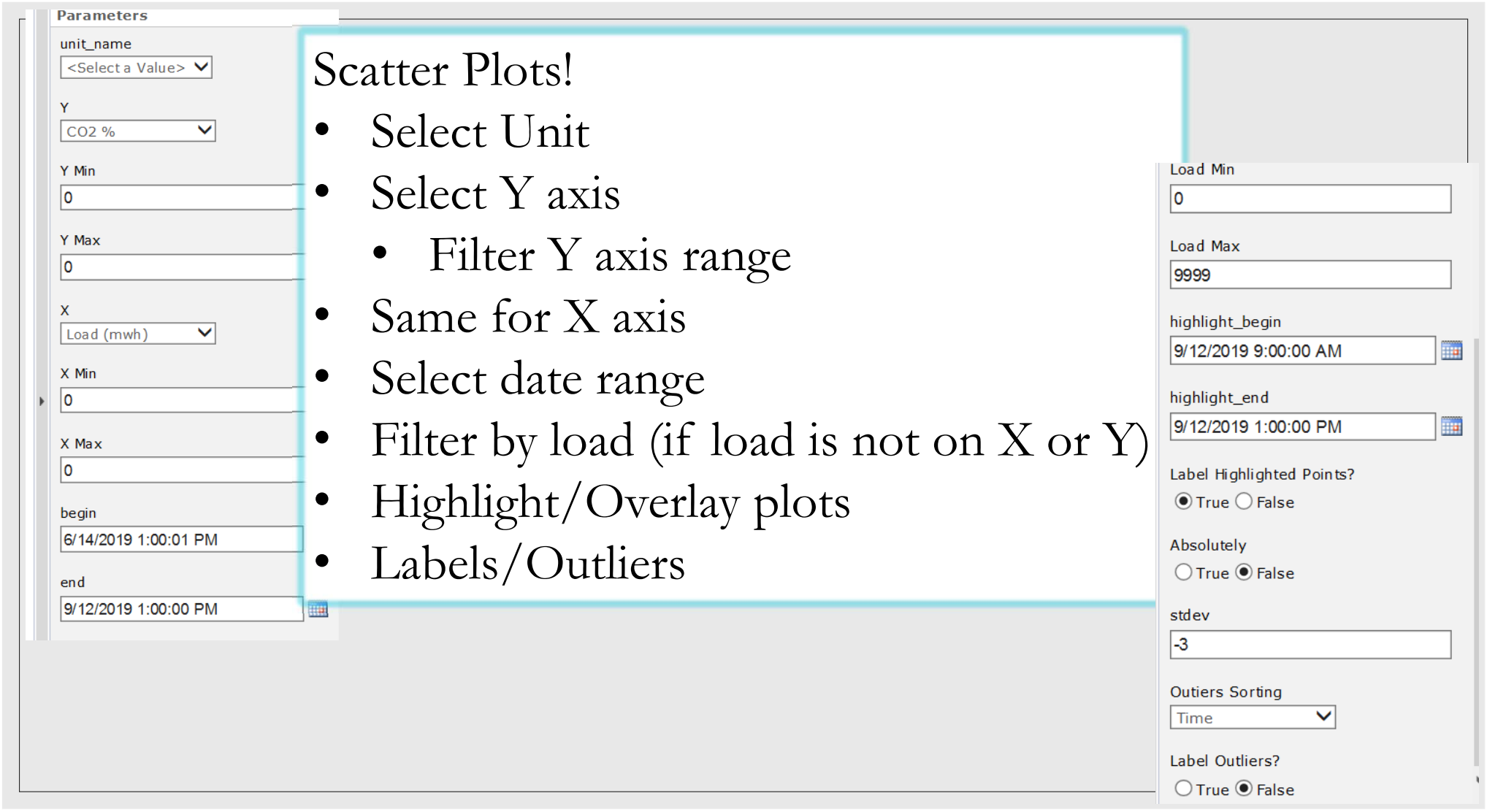


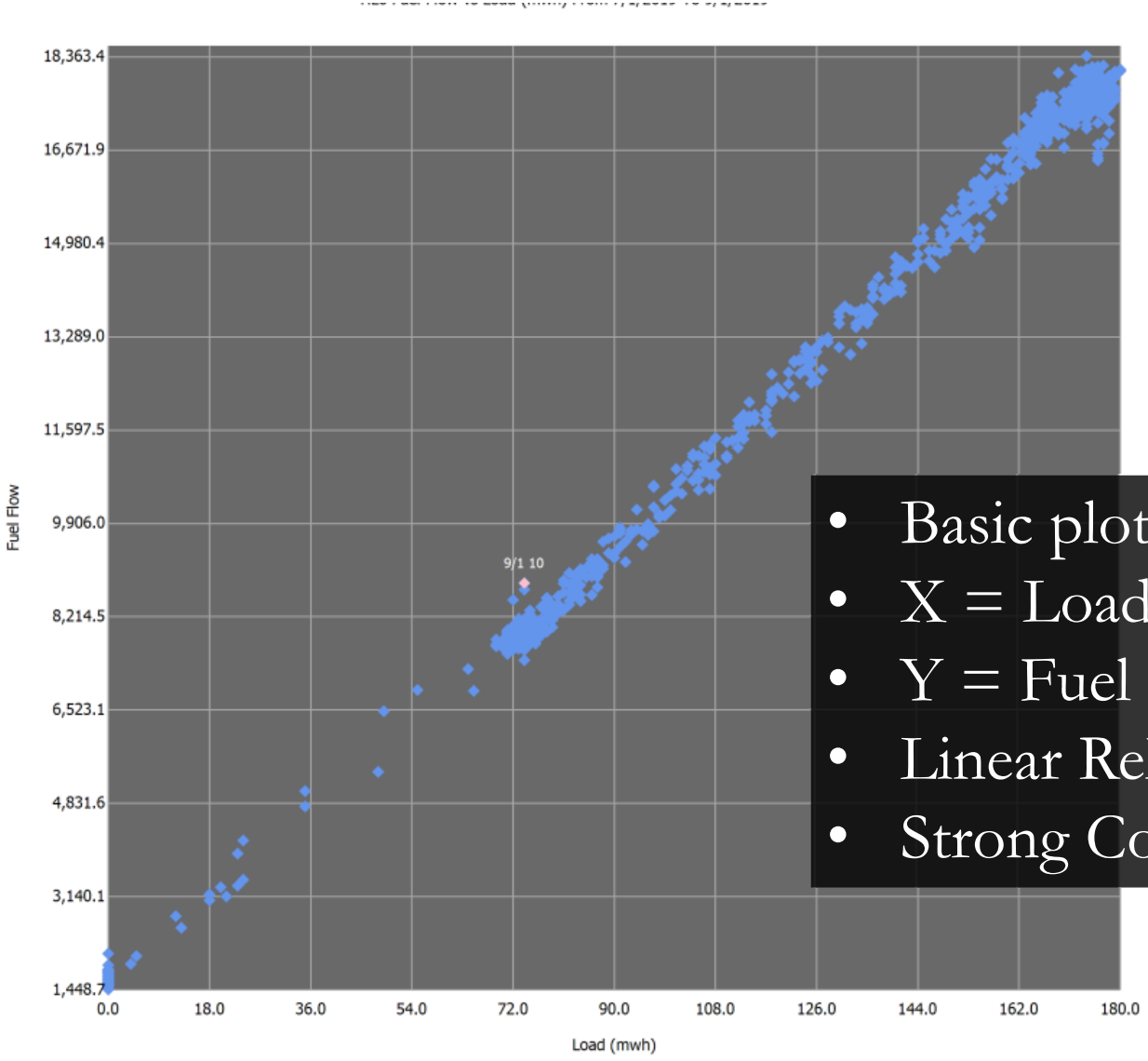
- Data is polled hourly
- Synchronized each morning
  - Current quarter is deleted and replaced
  - This ensures any edits/updates to the CEMS data made the previous day is carried over to the central server

TECHNOLOGIES USED:

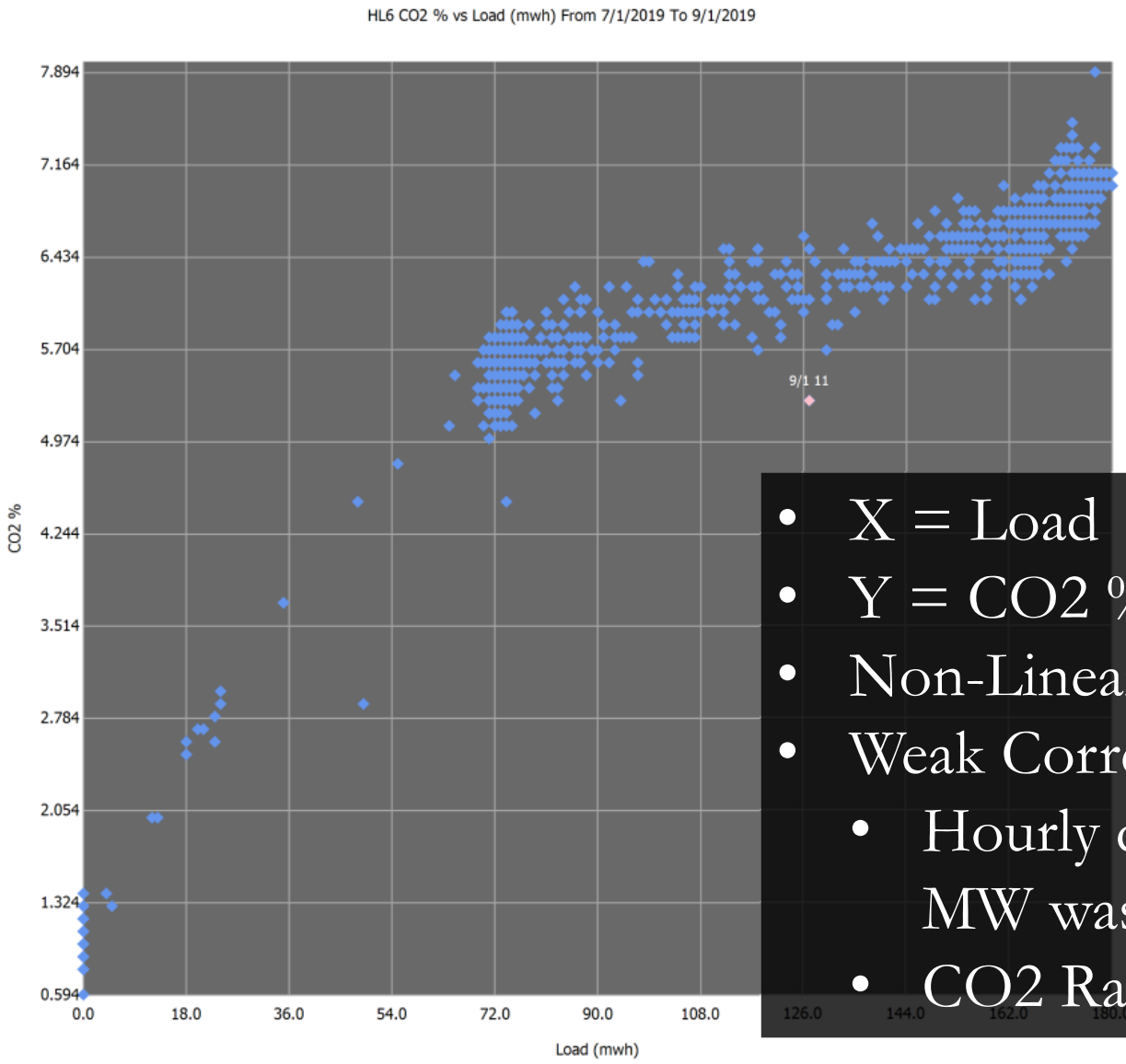


- SharePoint Document Library:
  - SOPs
  - Calendars
- SQL Server Reports (SSRS)

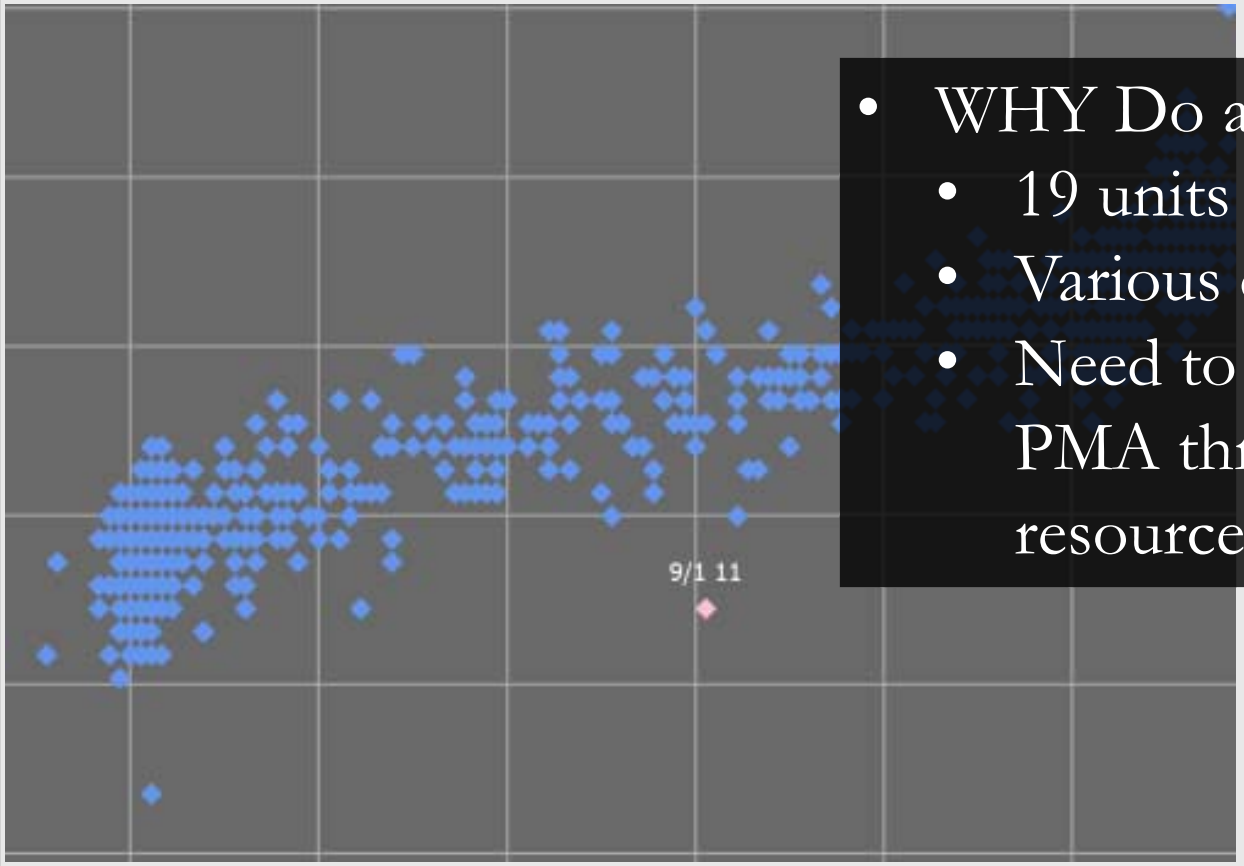

Parameters
unit_name
<Select a Value>
Y
CO2 %
Y Min
0
Y Max
0
X
Load (mwh)
X Min
0
X Max
0
begin
6/14/2019 1:00:01 PM
end
9/12/2019 1:00:00 PM
Scatter Plots!
Select Unit
Select Y axis
Filter Y axis range
Same for X axis
Select date range
Filter by load (if load is not on X or Y)
Highlight/Overlay plots
Labels/Outliers
Load Min
0
Load Max
9999
highlight_begin
9/12/2019 9:00:00 AM
highlight_end
9/12/2019 1:00:00 PM
Label Highlighted Points?
True
False
Absolutely
True
False
stdev
-3
Outiers Sorting
Time
Label Outliers?
True
False



- Basic plot
- X = Load
- Y = Fuel
- Linear Relationship
- Strong Correlation (Expected!)



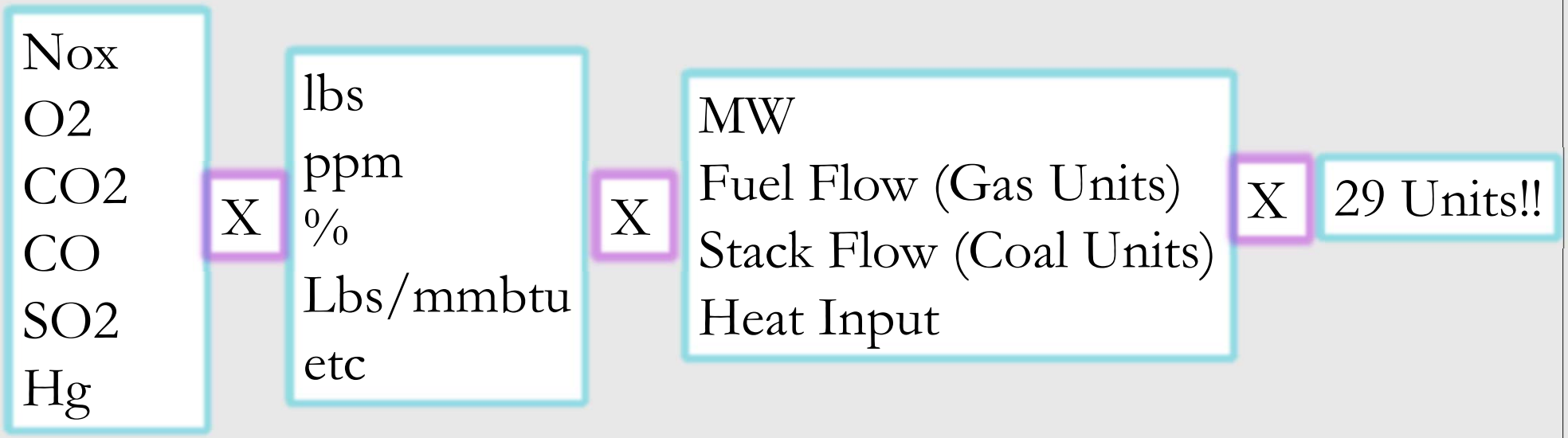
- X = Load
- Y = CO2 %
- Non-Linear Relationship
- Weak Correlation – BUT There is one!
  - Hourly data – no valid hours where MW was > 126 and CO2 was < 5.7
  - CO2 Range: 5.7 – 6.3



- WHY Do all this?
  - 19 units
  - Various operating characteristics
  - Need to be able to maintain high PMA through appropriate use of resources

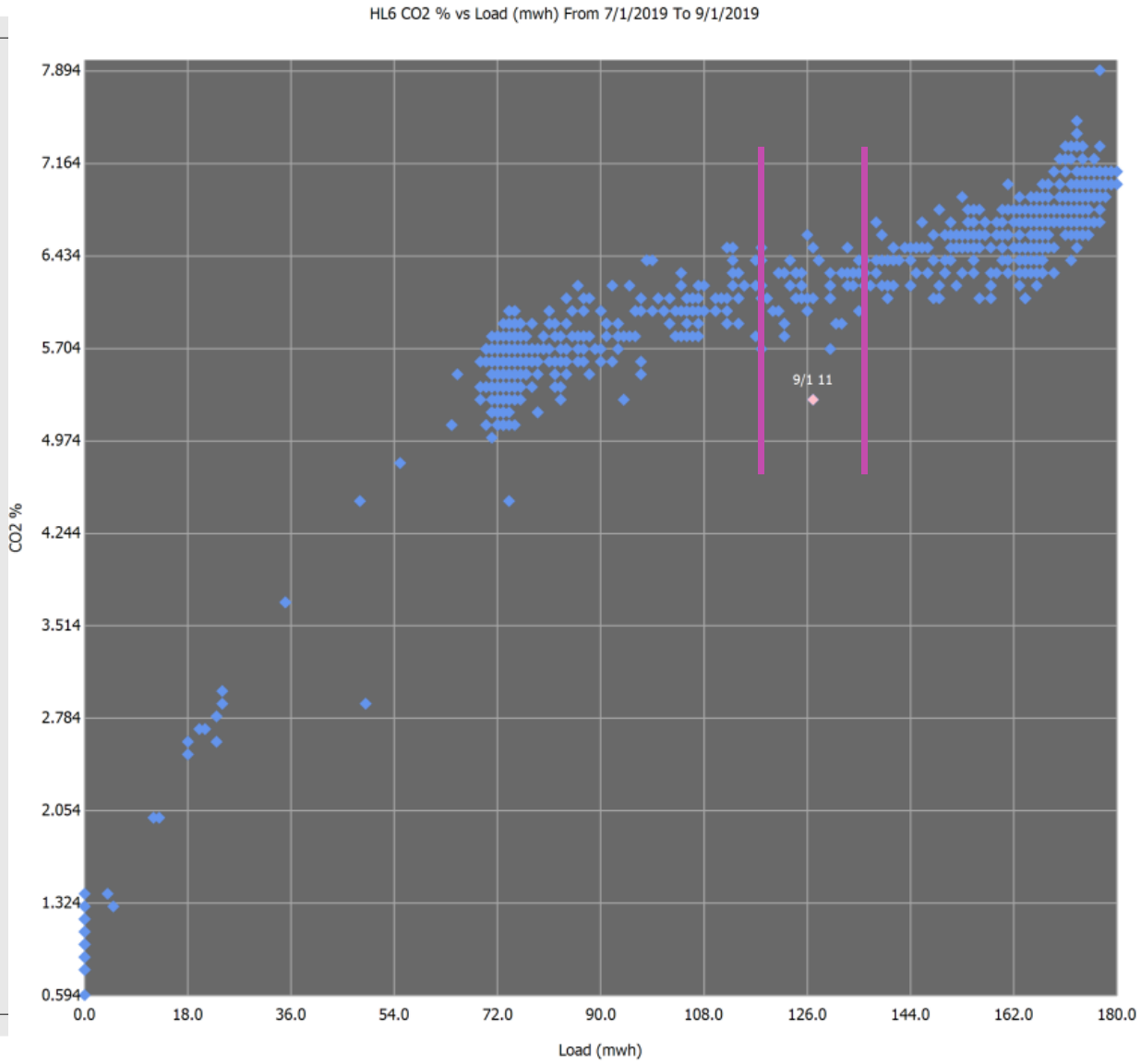
Why Automate?

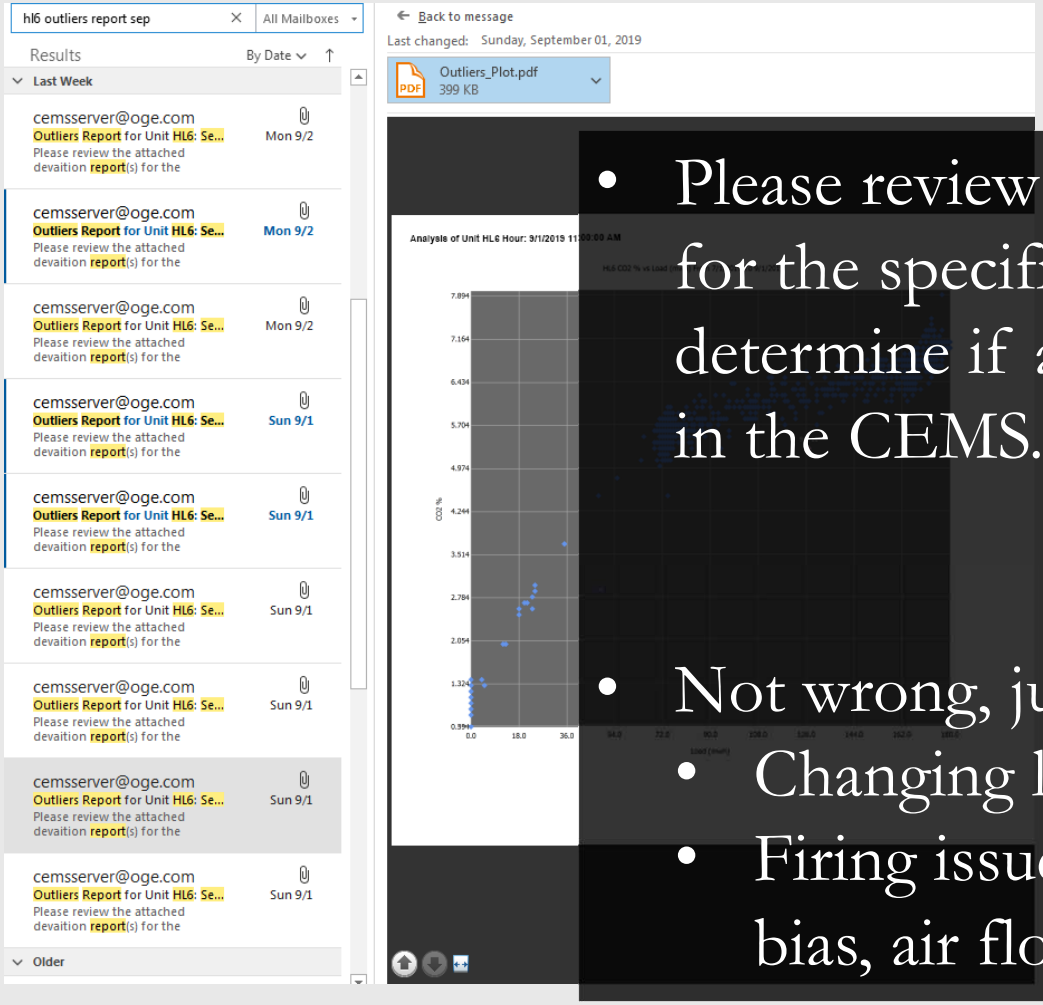
- Server is able to evaluate, every hour, each combination of pollutant parameter and independent variable
- Alert to investigate as needed



```
select @sql = '
    declare @unit_id int
    select @unit_id = id from unit where unit_name = @unit_name
    select
        u.unit_name, a.timestamp,
        case
            when a.load_range > hb.load_range then ''/''
            when a.load_range < hb.load_range then ''\''
            when a.load_range = hb.load_range then ''-''  end +
        case
            when a.load_range > ha.load_range then ''\''
            when a.load_range < ha.load_range then ''/''
            when a.load_range = ha.load_range then ''-''
            when ha.load_range is null then '''' end [load],
        '''+@y+' vs. '+@x+''' [chart], '''+@x+''' [x], '''+@y+''' [y],
        case when stdev = 0 then 0 when stdev is null then 0 else
            (a.'+@y+'-avg)/stdev
            /*(a.'+@y+' - [avg]) /  Sqrt((Square(1) / 1) + (Square([stdev]) / [count]))*/ end as [a.'+@y+'_sd]
        , [avg], [stdev]
    from
        actuals a inner join unit u on u.id = a.unit_id inner join
        (select     b.unit_id, b.timestamp,
                        avg(c.'+@y+') avg,  count(c.'+@y+') [count],
                    stdev(c.'+@y+') stdev
            from    actuals b, actuals c
            where   c.unit_id = @unit_id and b.unit_id = @unit_id
                    and c.timestamp between dateadd(d, -180, @begindate) and @enddate /*and c.'+@x+' != 0 */
                    ' + /*case when @x_min > 0 then     ' and c.'+@x+' >= ' + convert(varchar, @x_min)  else '' end + '
                    ' + case when @x_max > 0 then    ' and c.'+@x+' <= ' + convert(varchar, @x_max)  else '' end +*/ '
                    ' + case when @y_min > 0 then    ' and c.'+@y+' >= ' + convert(varchar, @y_min)  else '' end + '
                    ' + case when @y_max > 0 then    ' and c.'+@y+' <= ' + convert(varchar, @y_max)  else '' end + '
                    and b.timestamp between @begindate and @enddate and b.'+@x+' != 0
                    and b.'+@x+'    between c.'+@x+' - (c.'+@x+'/25) and c.'+@x+' + (c.'+@x+'/25)

                    ' + case    when substring(@y, 1, 3) in ('so2', 'co2', 'nox', 'stk', 'hea', 'co_', 'hg_')
                                    then 'and c.'+substring(@y, 1, case when @y in ('stk_flo', 'heat')  then len(@y) when
                    ' + case    when substring(@x, 1, 3) in ('so2', 'co2', 'nox', 'stk', 'hea', 'co_', 'hg_')
                                    then 'and c.'+substring(@x, 1, case when @x in ('stk_flo', 'heat') then len(@x) when s
```


HL6 CO2 % vs Load (mwh) From 7/1/2019 To 9/1/2019
7.894
7.164
6.434
5.704
4.974
4.244
3.514
2.784
2.054
1.324
0.594
CO2 %
9/1 11
0.0
18.0
36.0
54.0
72.0
90.0
108.0
126.0
144.0
162.0
180.0
Load (mwh)



- Please review the attached deviation report(s) for the specified unit and timeframe to determine if a system problem has occurred in the CEMS.

- Not wrong, just different
  - Changing load
  - Firing issues, operating parameters (O2 bias, air flow, coal quality)

HL6 Log Book

9/1/2019 19:56 James Doyle	Corrective Action - 346		
	Corrective Action		pulled probe inspected and cleaned critical orifice placed back in service ran two manual followed by hands off calibrations.
	Maintenance Beginning	9/1/2019 4:20:00 PM	
	Maintenance Ending	9/1/2019 6:56:00 PM	
	Symptoms		Co2 readings looked .8% low
9/2/2019 07:49 James Doyle	Corrective Action - 346		
	Corrective Action		changed the critical orifice linearity needed
	Maintenance Beginning	9/2/2019 5:40:00 AM	
	Maintenance Ending	9/2/2019 6:45:00 AM	
	Symptoms		NOx Range Overflow co2 range over flow the orifice has systems of leaking call by operations @ 05:00
9/3/2019 17:27 Ronald Madron	LK Install		
	LK Install Date & Time	9/3/2019 5:27:00 PM	T12066-M
9/3/2019 17:30 Ronald Madron	Boyd Jones - performing linearity after the orifice had been replaced in the probe on 9-2-19. The CO2 linearity failed the second run and did not pass the average and failed linearity. We cleaned the cell and the reading did not improve. We did not have a new cell liner at HL and could not find the spare CO2 analyzer. We traveled to Shawnee Service Center and retrieved the CO2 like kind and installed followed with a hands off calibration.		
9/3/2019 18:07 Ronald Madron	Test Report		
	0.) Report Author		MadronRG
	1.) Test Type		Linearity
	2.) Test Report Number		hlpt1840
	3.) Notes		Arrived to perform diagnostic linearity after orifice change Flowed gases and adjusted regulators from 1050 hours to 1102 hours. Run 1 began at 1113 hours and finished run 3 at 1218 hours. NOx passed but CO2 did not. Went to

Reports

Actions | 1 of 2 ? | Find Next | 100%

RB1
4/1/2019 - 6/30/2019 11:00:00 PM

PMA

	Apr 2019	May 2019	Jun 2019
O2	99.7	99.7	99.7
NOxHI	99.5	99.4	99.3

Linearity Dates

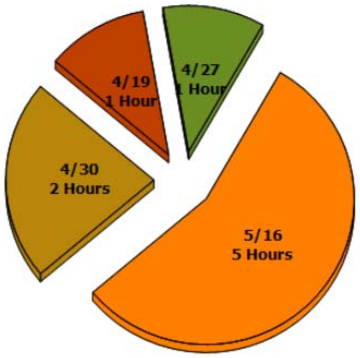
COHI	COLO	NOxHI	O2
5/16/2019	5/16/2019	5/16/2019	5/16/2019

Maintenance

	NOx	Probe - 355	Pump - 381	CO	Peristaltic
1/4ly	6/18/2019	not required	not required	4/29/2019	not required
Annual	2/6/2019	4/29/2019	2/6/2019	not required	4/16/2019

RB1 Availability
Operating Hours: 1481 hours
0.61 % Lost

RB1 Lost Hours Breakdown



Reports

Actions | 1 of 2 ? | Find Next | 100%

MT12
4/1/2019 - 6/30/2019 11:00:00 PM

PMA

	Apr 2019	May 2019	Jun 2019
O2	99.1	99.2	99.3
NOx_L	99.1	99.2	99.2
NOx_H	99.1	99.2	99.2

Linearity Dates

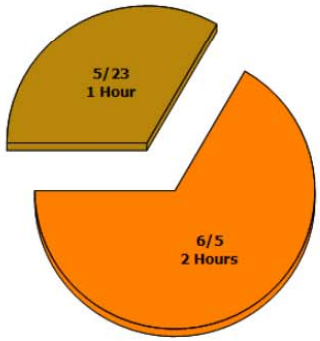
NOx_H	NOx_L	O2
4/4/2019	4/4/2019	4/4/2019

Maintenance

	Probe - 355	Alarms	NOx	Peristaltic
Annual	PAST DUE	11/20/2018	PAST DUE	PAST DUE
1/4ly	not required	not required	5/2/2019	not required

MT12 Availability
Operating Hours: 1284 hours
0.23 % Lost

MT12 Lost Hours Breakdown



Parameters

unit: MT12

begin: 4/1/2019

end: 6/30/2019 11:00:00 PM