

## Control Charts

What is a Control Chart? Why is it used by the EPA? How can it help me?



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## About Ameren

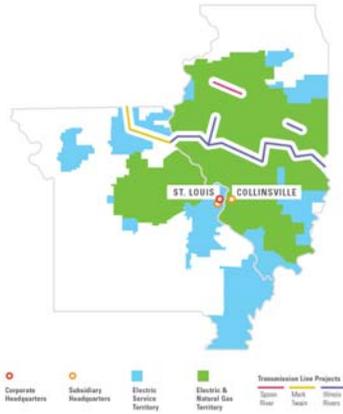
Ameren Corporation is a Fortune 500, fully rate-regulated electric and gas utility company headquartered in St. Louis.

We pride ourselves on operating safely and maintaining financial strength while providing reliable, reasonably priced energy in an environmentally responsible fashion.



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## Service Territory



This integrated utility owns a mix of energy centers with 10,200 megawatts of electric generation capacity. It is the second largest gas distributor in Missouri.



This delivery-only utility is the second largest distributor of electricity and third largest distributor of natural gas in Illinois.



This subsidiary is dedicated to electric transmission infrastructure investment and expanding Ameren's already robust system of high-voltage lines.

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**Committed to  
Building a Brighter Energy Future**

Highlights from Ameren's 2019 Corporate Social Responsibility Report\*



Every year, we look forward to sharing our Corporate Social Responsibility Report, which highlights some of the progress we are making to achieve our mission, to Power the Quality of Life. It is a never-ending journey because we know that millions of customers in Missouri and Illinois are counting on us.

As we look ahead, we are focused on executing our strategy because we are confident that it will deliver on our mission and will result in a brighter energy future for our customers and the communities we serve. Everything we do starts with empowering our customers, who will benefit from:

- A smarter, more reliable and resilient energy grid.
- Community investments through philanthropy and volunteerism.
- Significant investment plans for renewable energy.
- Stable and predictable rates.

\*The general reporting period in this book is up to Dec. 31, 2018.

**8,800**  
employees

**5,000+**  
hours of volunteer work by our co-workers

**2.4 million**  
electric customers

**\$182 million**  
annual funding of electric and natural gas energy efficiency programs in 2018

**900,000+**  
natural gas customers

**50%**  
Board of Directors members who are women or ethnically diverse

**64,000**  
square miles service territory

**\$624 million**  
spent with diverse suppliers, representing 25% of total spend in 2018

**Cleaner Energy from Diverse Sources**

Ameren is committed to providing cleaner, renewable energy solutions for our business and residential customers. We continue to diversify and expand our renewable energy portfolio, most recently through a plan to establish the largest wind generation facility in Missouri.

**Targeting Substantial Reductions in Carbon Emissions** (From 2005 levels)

**35% REDUCTION BY 2030**    **50% REDUCTION BY 2040**    **80% REDUCTION BY 2050**

Learn more by visiting [AMERENCSR.COM](http://AMERENCSR.COM)

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## What is a Control Chart?

- A statistical tool used to identify shifts in data since the last successful RATA.
- Establish a Baseline
  - 30 calendar days following a successful RATA are used
- The following values are calculated for the baseline period:
  - Daily average concentration
  - Baseline mean concentration
  - Standard deviation of the daily average values over the baseline period
- 2 Sigma and 3 Sigma control limits are set based on the standard deviation of the baseline data



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## What is a Control Chart?

- The EPA uses 3 Sigma as the audit level where 99.73 % of the daily averages fall within this range
- The EPA recommends using 2 Sigma as a warning level
  - If you have daily averages fall outside of 2 Sigma, begin investigating the cause
- The EPA looks at 7 or more consecutive daily averages that are outside of 3 Sigma as data that may have developed a sample system leak



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## What is the definition of 2 Sigma and 3 Sigma?

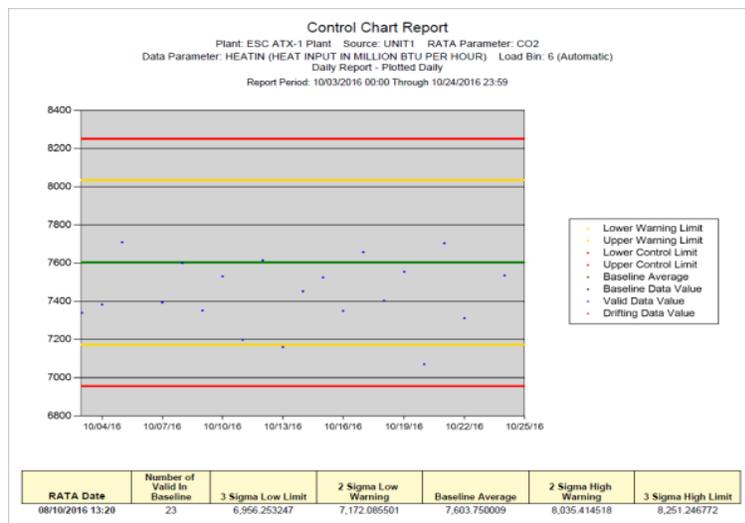
- **2 Sigma** limits indicate 95% of the emissions data lie within two standard deviations of the baseline mean
- **3 Sigma** limits indicate 99.73% of the emissions data lie within two standard deviations of the baseline mean



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## StackVision Control Chart



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## StackVision Control Chart Legend

- Lower Warning Limit
- Upper Warning Limit
- Lower Control Limit
- Upper Control Limit
- Baseline Average
- Baseline Data Value
- Valid Data Value
- Drifting Data Value

- **Green** = Baseline Average
- **Top Red** = 3 Sigma High Limit/Upper Warning Limit
- **Top Yellow** = 2 Sigma High Warning/Upper **Control** Limit
- **Bottom Red** = 3 Sigma Low Limit/Lower **Control** Limit
- **Bottom Yellow** = 2 Sigma Low Warning/Lower Warning Limit



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## Load Bin Analysis

### Load Bin Analysis

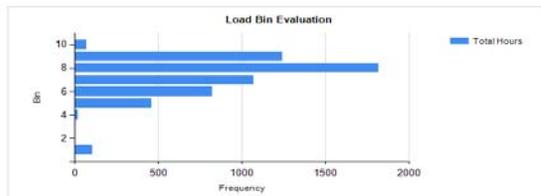
Plant: [redacted] Source: [redacted]

Parameter: CO2

Report Period: 01/01/2019 00:00 Through 09/30/2019 23:59

Most Frequent

Load Bin	Total Hours
9	1810
8	1242
7	1067
6	824
5	460
1	107
10	68
4	19
2	4
3	4



Report Generated: 10/31/19 11:53 Report Version 4.8 SIOUXP2reportuser 1 of 1



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## Control Chart – Load Bin Selection

**Pro Tip: Select Automatic**

Control Chart				
Start Date	07/01/2019 00:00	End Date	09/30/2019 23:59	Show Report
Plant		Source		
RATA Parameter	CO2	Data Parameter	CO2 (CO2 PERCENT)	
Load Bin	Automatic	Baseline Average Type	Daily	
Plotted Average Type	Daily	Days in Baseline	30	
Hours Per Baseline Day	6	Show Data Table	<input type="checkbox"/>	
Method Code	01 - Primary emission/flow monitoring	Show Legend	<input type="checkbox"/>	
Footer Options	Show Report Date, Show Report Vert			



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## Why are Control Charts Used by the EPA?

- The EPA uses Control Charts to determine if there are any issues with emissions data
  - Leaks in the sample system
  - Leaks or issues with a gas analyzer or flow monitor
  - Drift in a flow monitor measurement
- The EPA has stated it looks at data in an “ad hoc” manner after the data has been submitted
- EPA recognizes there can be false positives



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## CO2 Control Charts

- Why does the EPA select CO2 for Control Chart analysis?
  - CO2 concentrations show low variability across all load bins
    - This low variability can be used to help determine if there are any potential leaks
  - Two Sources of Air in Leakage
  - First, a leak somewhere in the Continuous Emission Monitoring System
    - Sample Probe
    - Sample Line
    - Loose Fittings
    - Leak inside analyzer
      - TFE line holes
    - Sample Pump Issue



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## CO2 Control Charts

- Second, there could be air in leakage somewhere in the unit
  - Leak in the ESP
  - Leak in the scrubber
  - Leak in the air heater
  - Leak in the duct work
- When troubleshooting changes in a CO2 concentration, communication with plant maintenance personnel play a critical role in determining the cause and source of unit air in leakage



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## How can Control Charts Help Me?

- Data Accuracy and Early Detection of Issues
  - The most important thing Control Charts can do is help CEMS personnel detect issues early and reduce the amount of time data would need to be invalidated due to a CEMS leak
- Control Charts can be used to demonstrate CEMS compliance
  - If you are part of the “ad hoc” selection, frequent use of control charts, communication with plant maintenance, and understanding trends will help with providing information to the EPA
  - Recommendations:
    - Document CEMS air in leakage and correction in the StackVision logbook
    - Document unit air in leakage and maintenance activity to repair leak



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## EPA Contact Information

- EPA Administrator, Andrew Wheeler, spoke at the National Press Club Luncheon on June 3, 2019.
  - He mentioned the following:
    - 40% of EPA workforce will be eligible to retire within the next 5 years and plans they will retire over the next 10 years.
    - Proper transition and training are a concern.
- It is important to know your EPA Region contact.
  - The person in that role may be new.
  - Understanding Control Charts will be valuable when working with new EPA personnel.
  - CAMD Contacts Link
    - <https://www.epa.gov/airmarkets/business-center#tab-6>



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Questions?

