The Beginning and the End: Startup & Shutdown

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Startup

- The period from when the unit first receives fuel and begins combusting until it reaches a "normal steady state operating" mode.
- The time at the beginning of operation that the unit is in a transient operational state.
- This could be almost instant, a few minutes or several hours depending on the process.
- For our purposes what we are after is the permit definition, not necessarily the operational definition.

More Startups

- Some units can have different types of Startups as well.
- Hot Startup is a startup within a few hours of a shutdown.
- Warm Startup is another type that comes within a predetermined time after a shutdown that is longer than that of a Hot Startup.
- Cold Startup is a startup that happens after the time frame for a Hot or Warm Startup has been exceeded.

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Shutdown

- The period from when the unit begins to deviate from "normal steady state operation" for the purpose of shutting the unit down until combustion and fuel cease.
- The time at the end of operation that the unit is in a transient operational state.
- Again, we are interested in the Permit definition of shutdown as well.

Why Are We Interested?

- Many Operating Permits allow emissions exemptions during these transient operational states.
- Some Permits also have other limits for these periods that are not associated with normal operations.
- There can also be facility totals or annual limits that only take into account Startup and Shutdown emissions.

This is Where CeDAR Comes in

- We need to track these events in the database for proper reporting.
- They get logged using Process Codes in the software.
- The Report Generator contains reports for Startup and Shutdown emissions for sites that need specific reports for it.
- Downtimes are not exempt during startup and shutdown; you are exempt from complying with the limits, but not exempt from monitoring.

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So, What Defines Startup?

- The beginning of Startup is usually easy to define, something along the lines of a "Flame On" signal or Fuel Flow exceeding a certain threshold.
  - We use a threshold above zero to allow for noise in analog signals.
- This information can come as hardwired signals or via a communications protocol such as AB TCP/IP or Modbus.

The End of the Beginning

- The end of Startup and the duration can be trickier depending on the unit, the air permit, and the process.
- Some permits clearly define what ends startup, but most just put a not to exceed duration on it and nothing more.
- Some permits don't define Startup (or Shutdown) at all, they just have emissions limits or operating limits tied to Startup.

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Some Options

- If the permit doesn't define what startup is, then we need to find a way to define it so we can consistently track Startup.
  - A set duration, like 30 minutes after flame on.
  - When a component reaches a predefined minimum temperature; i.e., the SCR Catalyst bed reaches temperature for catalyzation.
  - When emissions drop below their limits for a series of reads.
  - An outside signal from the unit indicating that it has reached normal operations.

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The Beginning of the End

- The end of shutdown, much like the beginning of Startup is pretty easy to pinpoint, the unit isn't combusting any longer and the fuel flow drops to zero.
- The beginning of Shutdown presents the same questions as Startup though, as to when does Shutdown begin?

Some More Options

- Without a definition from the Permit, we again need to find a way to define it.
  - A signal from the operators indicating that Shutdown has begun.
  - When the unit drops below a certain threshold such as operation less than a megawatt setpoint.
  - A set amount of time from when Shutdown ends.
    - This creates a situation where we backfill the data from the end of Shutdown forward a certain amount of time or to an out of compliance point. This means there is no live indication that Shutdown is happening in the Data Monitor.

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Defining Startup & Shutdown

- CiSCO will review the permit and work with the site to help produce the best definitions to use for Startup and Shutdown.
- This can include emails and meetings to brainstorm methods if necessary.
- We are now using a form for customer sign-off to verify that there is agreement for the Startup and Shutdown definitions.