# Startup/Shutdown/Malfunction Issues as they relate to changes in MACT Regulations

Hitting a Moving Target in an Environment of Changing Regulations

Chris Henderson

Automation Applications Inc, LLC

Exton, Pennsylvania


**Technical Focus Group, Environmental & Energy Committee Meetings**

# AAI Profile

- Independent Full Service Turnkey Solutions Provider in Process Control & Information Systems
- Solutions Delivered in Consumer Products, Petrochemical, Pharmaceutical, Pulp & Paper Markets
- Boiler Combustion Controls and Industrial Energy Management - AAI's Core Application Expertise
- Successfully Completed over 200 Powerhouse Projects
- Industrial Energy Solutions Team Comprised of Individuals with Hands-On Background in Boiler Control Design, Start-Up and Operation

# Introduction

Recent court rulings have changed the game with regards to permissible emissions during startups, shutdowns & malfunction events (SSM).

This presentation examines issues present during SSM events, and suggests new operational considerations in light of these new interpretations of Clean Air Act requirements.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

Startups, shutdowns, and malfunctions (SSM) are periods of non-continuous operation.

During such temporary periods, boilers often may might emit larger quantities of controlled pollutants, and therefore the pollution abatement equipment may be unable to effectively control it to standards in place during normal operations.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

Recognizing this problem, beginning in 1994 the EPA allowed such facilities to release larger amounts of certain controlled emissions during SSM events.

In 2002 and again in 2003 the EPA made regulatory revisions which seemed to increase the allowable periods of such non-compliance periods.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

This motivated a coalition of environmental groups to challenge the changes, by suing the EPA. These groups argued that these changes effectively neutralized the United States Clean Air Act.

On December 19, 2008, the U.S. Court of Appeals issued a decision vacating SSM exemption provisions for Source Categories.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

This decision has created substantial confusion and concern among emission sources that are subject to the MACT standards and that rely upon the SSM exemption to ensure continuous compliance.

The existing MACT standards were developed with the assumption that the SSM Exemption would address emissions during SSM events.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

Because technology is inherently fallible, facilities may not have the capability to maintain continuous compliance with strict MACT standards during non-steady state operating events.

Many MACT emissions limits do not take this variability into account and are based on short-term steady state operating data that do not consider SSM emissions.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

For some source categories, the technological capability to maintain compliance with current standards during SSM events may not even exist.

Consequently, the elimination of the SSM Exemption creates uncertainty and concern about how the MACT standards will now be interpreted.

# Brief Overview ~ History of MACT Regulations with regard to SSM events

In the absence of hard interpretations, the EPA has issued some guidelines on how to proceed.

It appears that Startups and Shutdowns will now be included in "Normal Operations", and that exceptions still will be made in some fashion for periods of malfunction, provided that such events were *"sudden, infrequent, not reasonably preventable"* and not *"caused in part by poor maintenance or careless operation."*

# Malfunctions

The unanticipated nature of malfunctions makes definition of their impact and resulting operational considerations difficult.

With uncertainty on how these event will be handled, conservative approaches should be followed.

# Malfunctions

- Develop and implement a definitive SSM plan with regards to Malfunction Events.

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- If at all feasible, shutdown the unit as soon as possible to minimize potential violations.

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**Two Types of Emissions Issues**

- Transitory/Mechanical in Nature
- Low Load Issues

# Startups and Shutdowns
## Low Load Issues

Tuning "Curves" often not developed sufficiently for Low Load situations.

Most Air Fuel ratio curves are developed using empirical data taken during testing.

# Startups and Shutdowns
## Low Load Issues

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- Historically, economic savings not worth the effort – "Play it Safe"
- Plant Steam Demand considerations often prohibit protracted operation at low loads.
- Noise inherent in data taken at low loads can cause inaccuracies.

# Startups and Shutdowns
## Low Load Issues

### Control Challenges in Low Load Situations

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- Process Variable Noise at Low Flows.
- Dynamics of Control Elements nearly Closed
- Air Fuel Mixing Issues

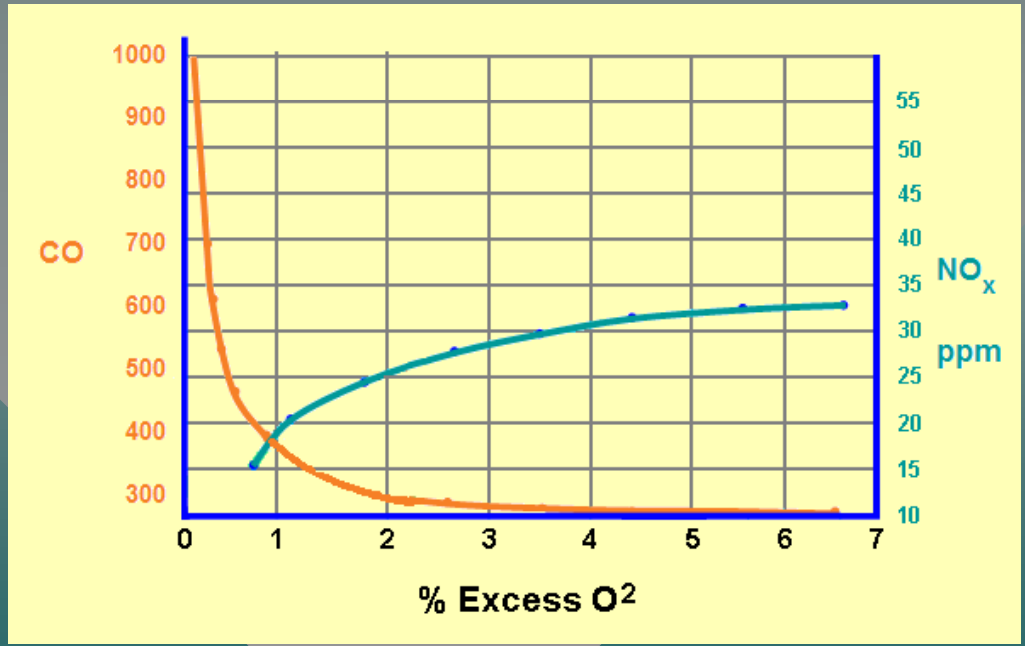
# Startups and Shutdowns
## Low Load Issues

Tight stable Air/Fuel ratio control is tough to maintain under Low Load conditions.

As such, the choice historically has been to err on the side of caution with higher excess air than necessary.

# Startups and Shutdowns
## Low Load Issues

Controlling emissions however requires "walking a tightrope." Too much excess air leads to higher oxides of nitrogen and sulfur. *(NOx & SOx)* Too little excess air leads to high levels of CO and Opacity.



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## Low Load Solutions

- Air Demand based on stoichiometric calculations rather than empirically derived "load curves"
- Characterization of control elements to linearize controller output versus flow
- Greater attention to tuning the boilers for low load conditions

# Shutdowns
## Potential Operational Changes

- Shutdown Quickly.

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## Potential Operational Changes

- Shutdown Quickly.
- Don’t allow units to sit idle at low load on “standby

# Startup Issues

## Boiler Warm-up

Boilers are warmed up slowly using a "Startup Curve" supplied by the manufacturer. This is done to reduce mechanical stress on the boiler tubes and other components.

Typically this is done manually, with operators gradually increasing heat input every so often, ensuring that the allowable temperature is not exceeded.

# Startup Issue Solutions

## Boiler Warm-up

Cost Benefit analysis to determine if pushing the startup is worth a slight decrease in tube and equipment life.

Install Steam Coil Drum heaters to preheat and partially pressurize the boiler without firing.

# Startup Issue Solutions

## Boiler Warm-up

Utilize automated startup supervisory control systems to ramp the boiler up to operational levels as soon as possible within programmed constraints.

# Summary

In today's uncertain regulatory environment, reevaluation of operational procedures is more essential then ever.

There is no one solution. Examining every opportunity for small incremental improvements may make the difference between compliance and non-compliance.

*Innovative  Industrial Energy Solutions*

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