Model-Free Adaptive (MFA) Control of Flares to Comply with RSR-63.670 Rules
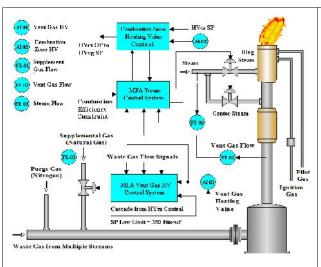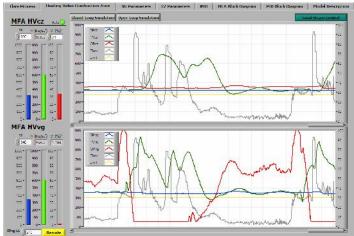
RSR-63.670 Rules and What is Needed	Solution and Benefits
Requirements for Flare Control Devices. For all Sources. Compliance Requirement Date: January 30, 2019.	MFA can control combustion zone heating value, NHV dilution par., and combustion efficiency.
Flare is very difficult to control due to various challenges.	MFA has solved various tough control problems.
The compliance deadline is approaching quickly. Be ready for Clean Air Act (CAA) section 114 investigations.	Robust performance, substantial natural gas savings, and quick return-on-investments.

MFA Control for Flare Combustion Zone Heating Value

Refining Sector Rules (RSR 63.670): (1) Vent Gas NHVvg >= 300 Btu/scf., and NHVcz >= 270 Btu/scf; (2) Combustion Efficiency (CE) > 96.5%; (3) For air assisted flares, Net Heating Value Dilution Par (NHVdil) > 22 Btu/sq. ft).

Flare Control Challenges: (1) The vent gas flow can change widely; (2) The heating value in vent gas can vary widely and quickly; (3) The assist air and/or steam needs to have a proper ratio to the total amount of vent gas and its contained heating value, where NHVcz and NHVdil are good indicators; (4) Nitrogen is often used as purge gas to keep the vent pipe with positive pressure, making the process more complex; (5) There are large and varying time delays in heating value loops,

especially for the NHVcz loop; and (6) The flare processes are extremely nonlinear in different operating conditions. Therefore, PID or model-based control systems are difficult to design, commission, and maintain.

MFA Flare Control with Assist Steam: (1) The MFA Vent Gas Heating Value Control System controls the NHVvg and can deal with large vent gas flow disturbances and Btu changes caused by nitrogen purge; (2) The MFA Steam Control System controls the steam flow based on the total amount of vent gas and its contained heating value; and (3) The MFA Combustion Zone Heating Value Control System uses an Anti-delay MFA controller to deal with large and varying time delays.

Control Trends: An MFA NHVcz controller (top) is cascaded

with an MFA NHVvg controller (bottom), showing good control under large vent gas flow and Btu changes, complying with the combustion zone heating value limit above 270 Btu/scf.

Solution: CyboSoft is working with industry leaders to offer flare solutions to comply with RSR-63.670 rules. We can provide: (1) Flare Process Modeling and Control Simulation Software; (2) MFA flare control solutions and products; (3) flare control system design, consulting services, and on-site commissioning.

Implementation: CyboSoft's flare control solution is delivered in off-the-shelf CyboCon MFA Control Software or MFA Flare Control Software, interfacing to DCS through OPC or CyboLink Interface software. Plant engineers can maintain the flare control system after attending CyboSoft's flare control training class.