

NO-CO Reaction in NH₃ Converters

Wes Kirk

1. Explanation of Reaction
2. Reason for Conducting the Test
3. Test Description
4. Results from the Test
5. Conclusions

Explanation

- NO begins to react with CO at high temperatures without Oxygen present
- Only affects NH₃ Slip determination systems
- Low NO calibration gas is shared between low range of stack analyzer and NH₃ analyzer
- We normally separate the low range NO and CO gases

Reason for Test

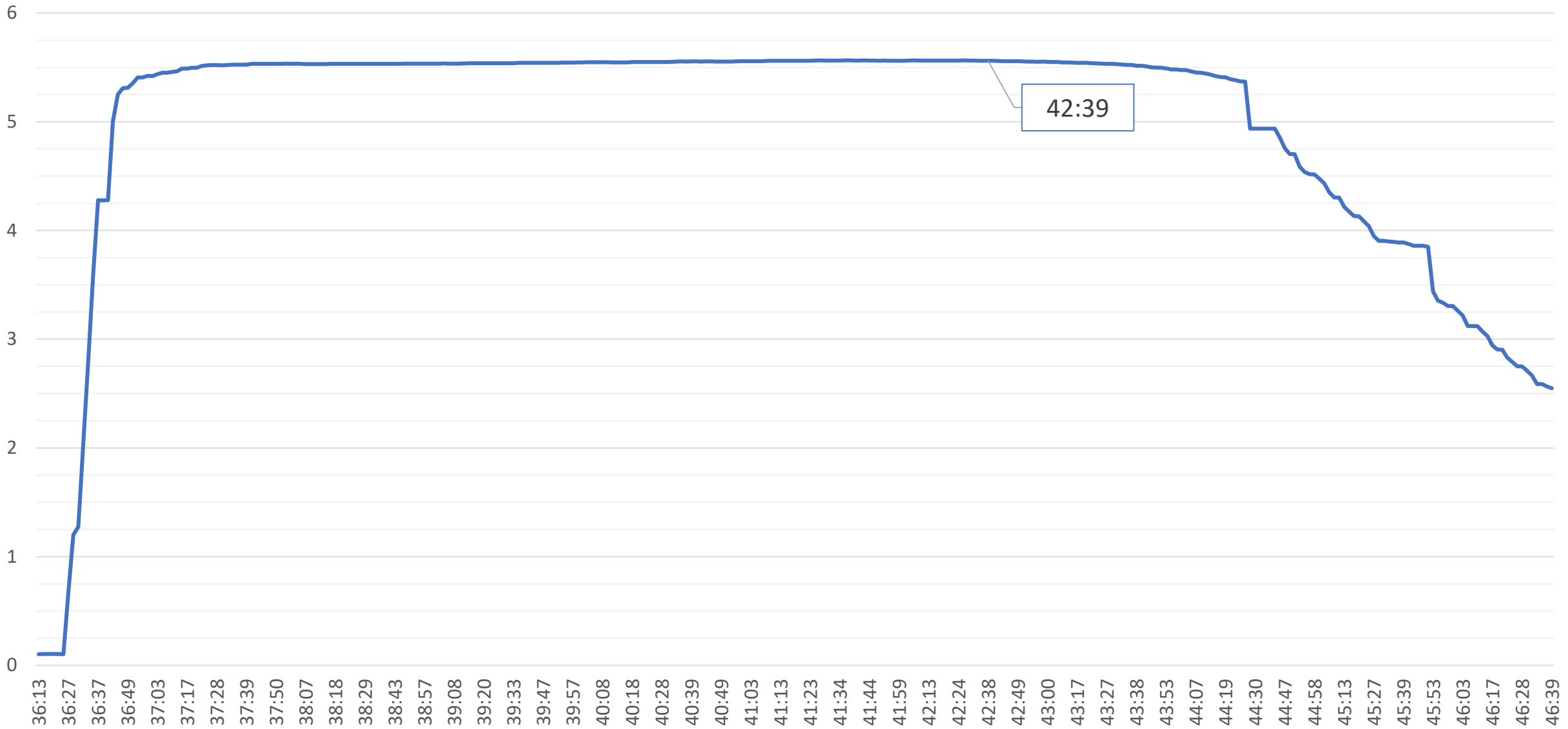
- NO-CO Reaction a known issue but never been tested
- Confronted with a problem recently while midway through a project: customer requested high range for the NH₃ analyzer.
- We needed to determine the feasibility of using a high range blended bottle with an NH₃ determination system, ie. an NH₃ converter.

Test Description

- 5.5 PPM NO/5.6 PPM CO at 1500°F and 1350 °F
- 46.1 PPM NO/38.4 PPM CO at 1500 °F, 1400 °F, and 1300 °F
- 92 PPM NO/9 PPM CO at 1500 °F and 1350 °F
- 180 PPM NO/1586 PPM CO at 1350°F and 1000°F

Results

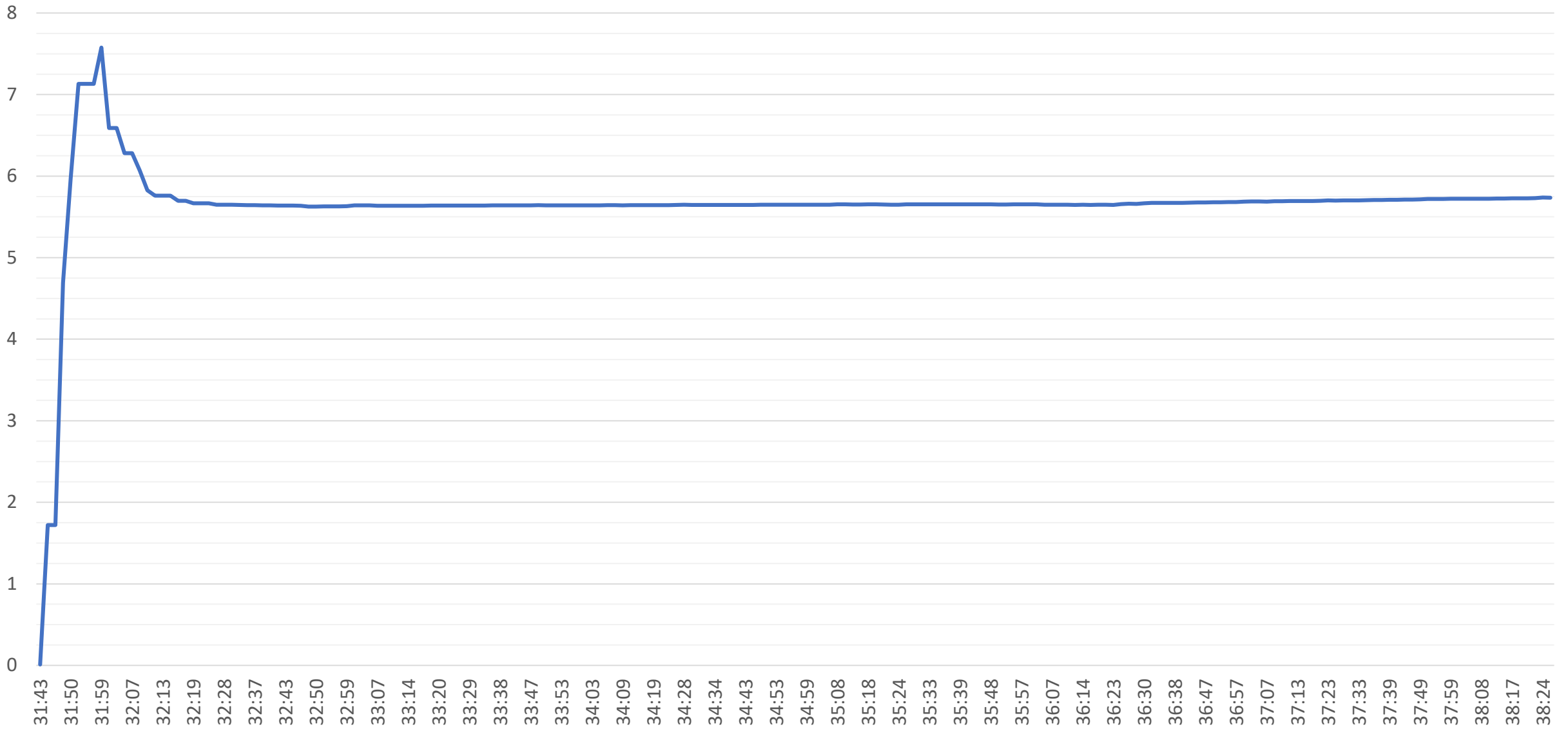
5.5 PPM NO/5.6 PPM CO at 1500°F



42:39

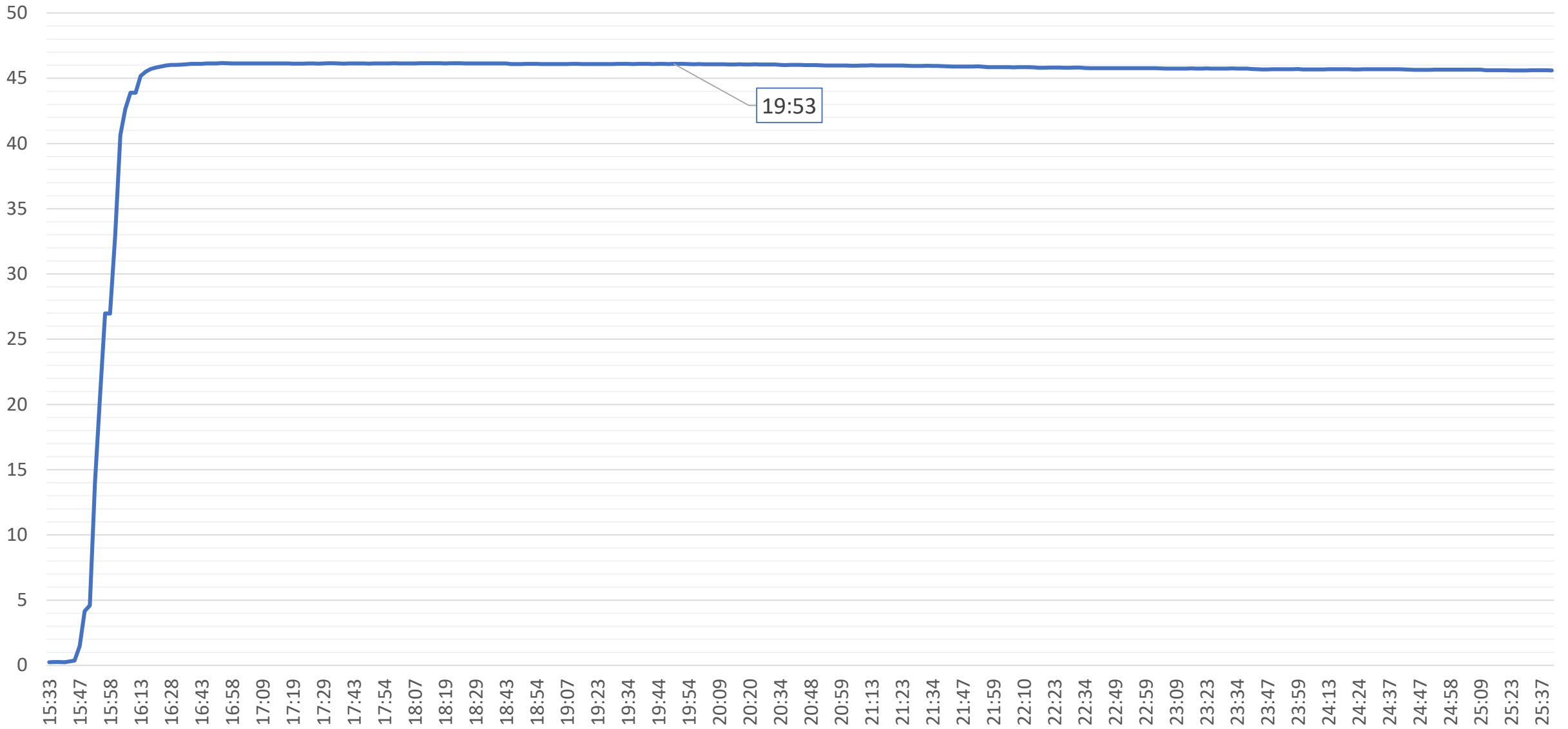
NO Destabilizes at 6.5 Minutes

5.5 PPM NO/5.6 PPM CO at 1350°F



Still Stable at Over 6.5 Min

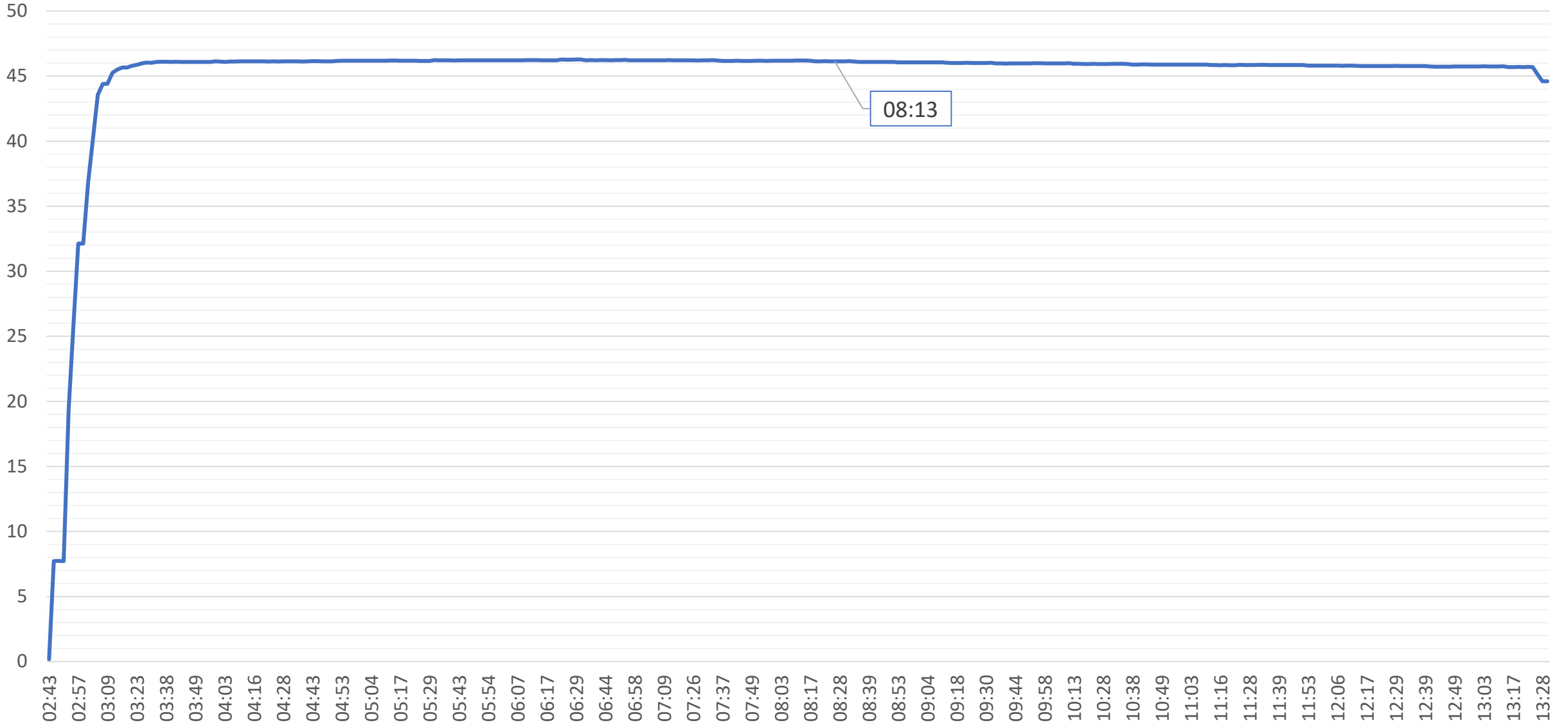
46.1 PPM NO/38.4 PPM CO at 1500°F



19:53

NO Begins to Slowly Drop after 4.5 Min

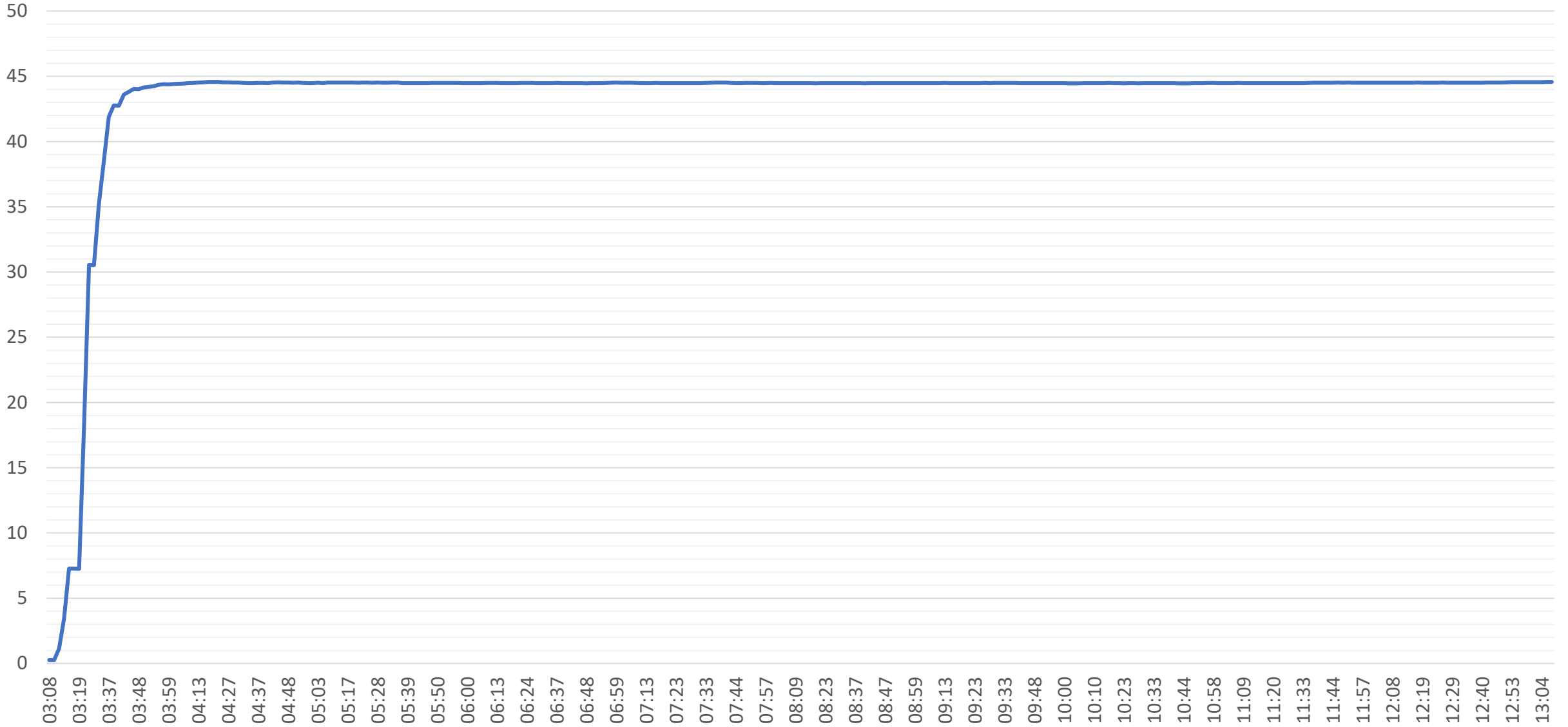
46.1 PPM NO/38.4 PPM CO at 1400°F



08:13

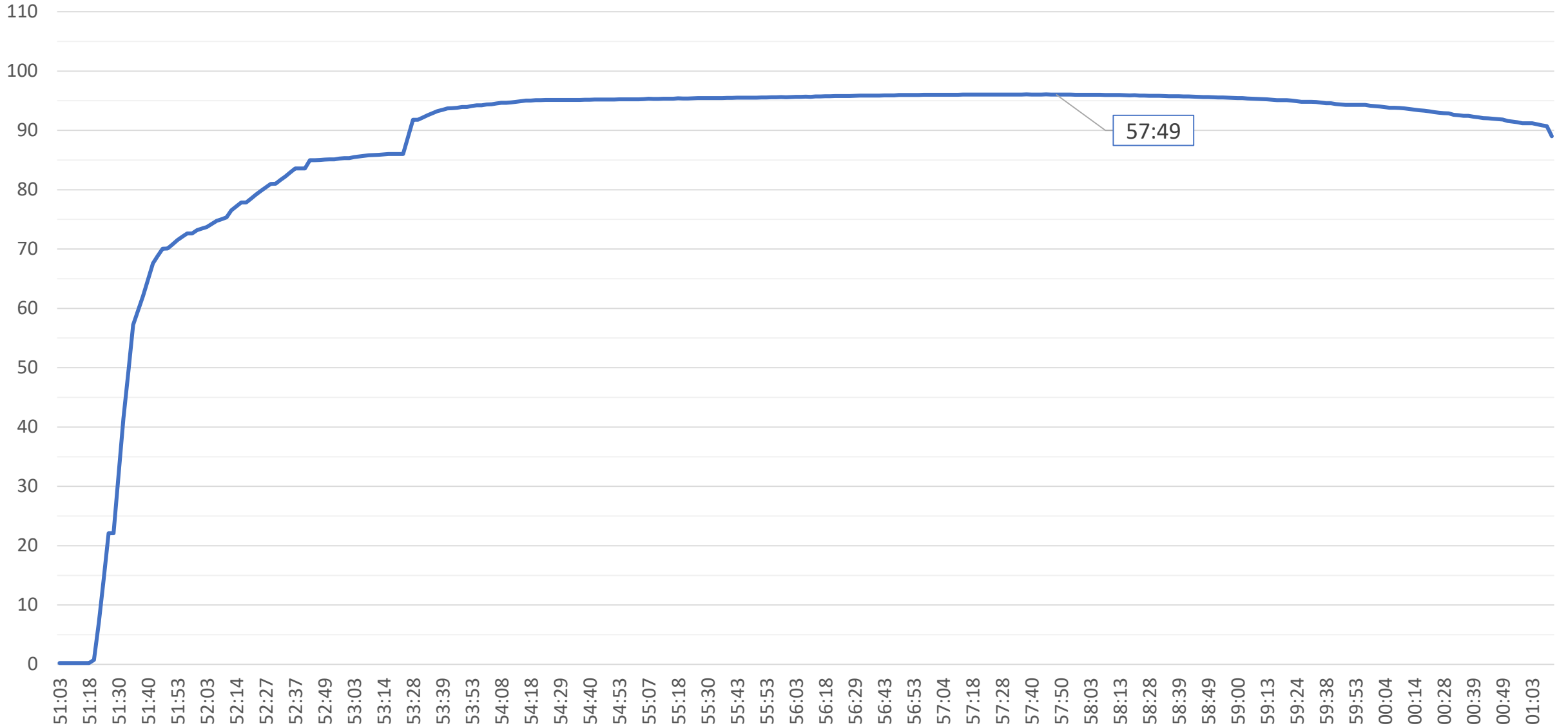
NO Slowly Drops After 5.5 Min

46.1 PPM NO/38.4 PPM CO at 1300°F



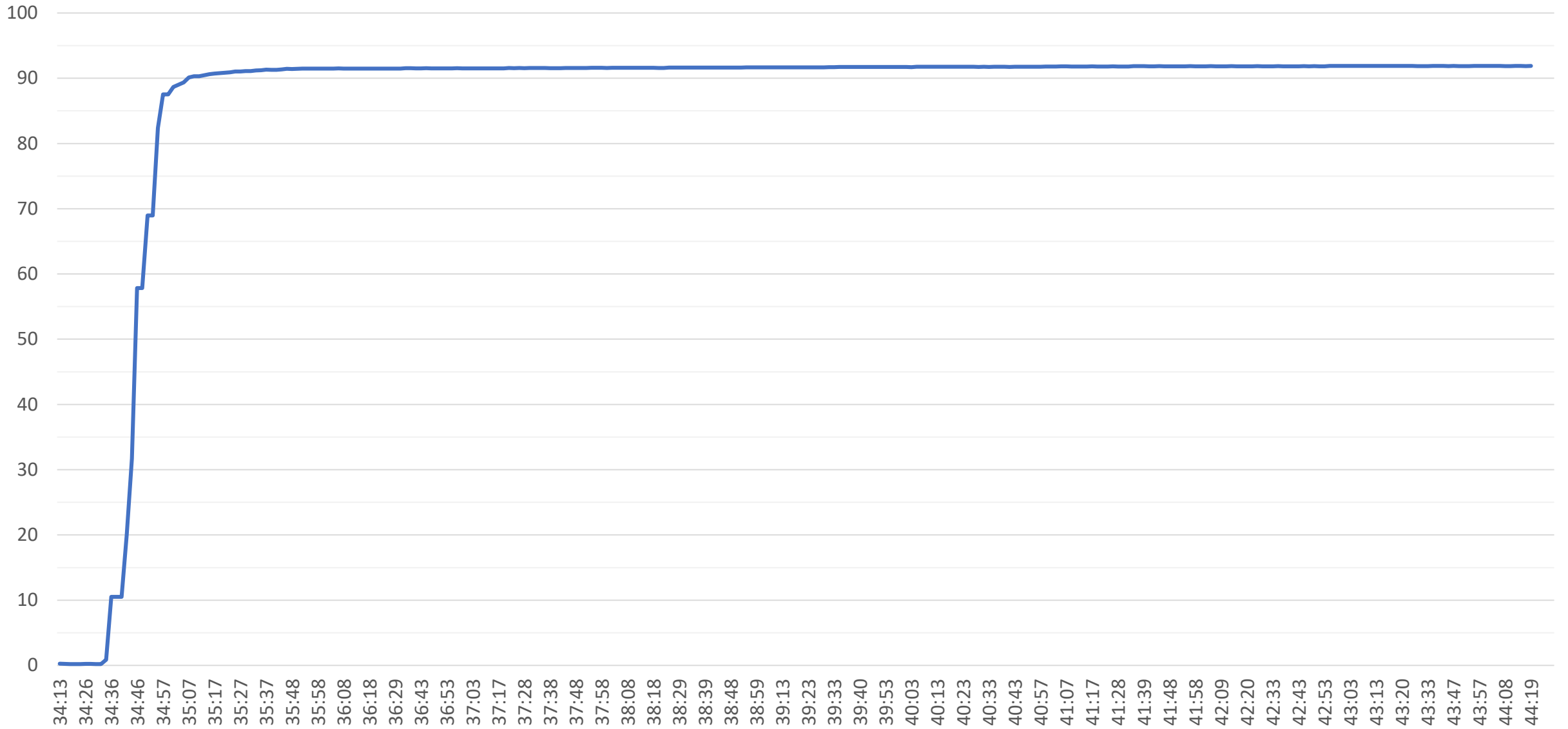
After 10 Minutes NOx Still Stable

92 PPM NO/9 PPM CO at 1500°F



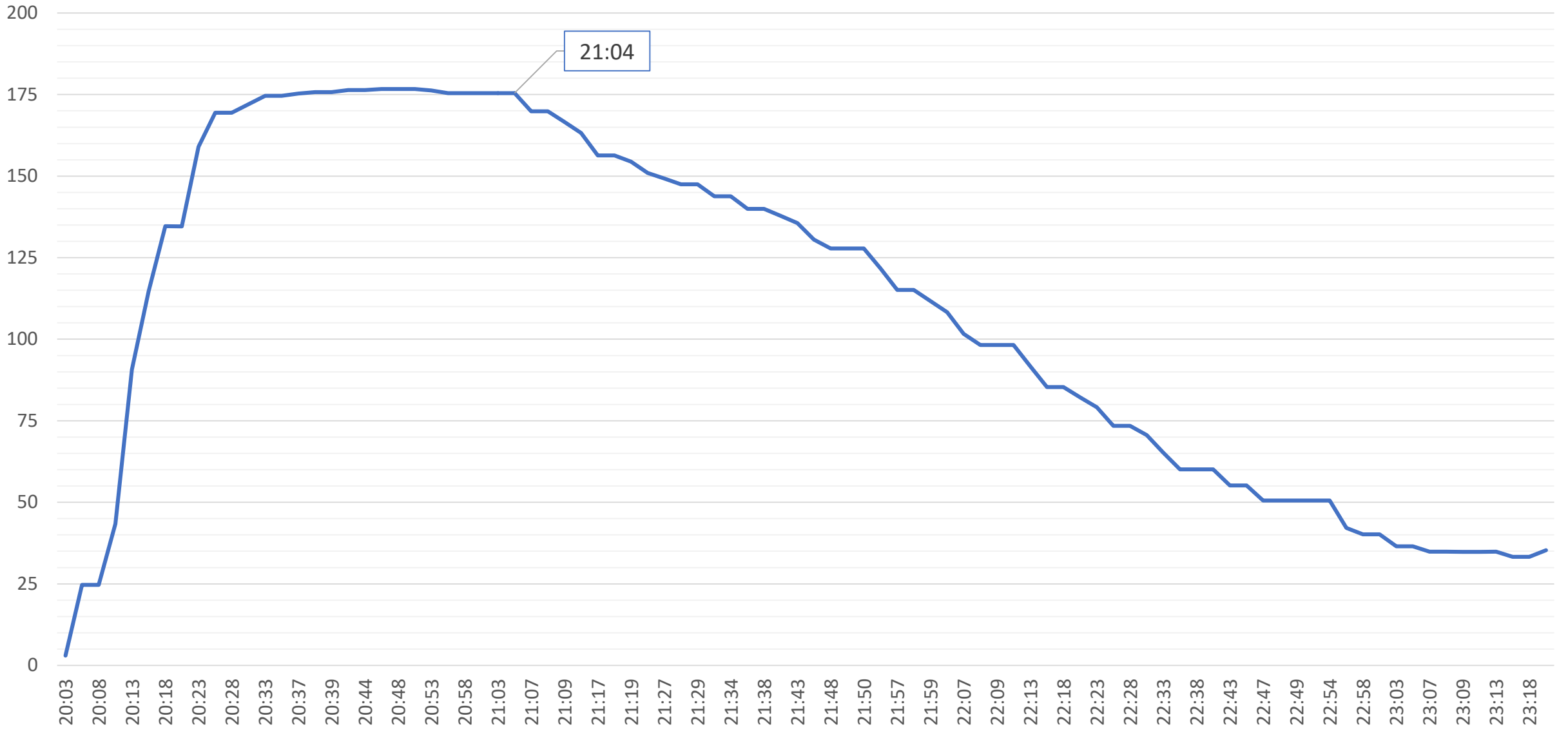
NOx Destabilizes After 6.5 Min

92 PPM NO/9 PPM CO at 1350°F



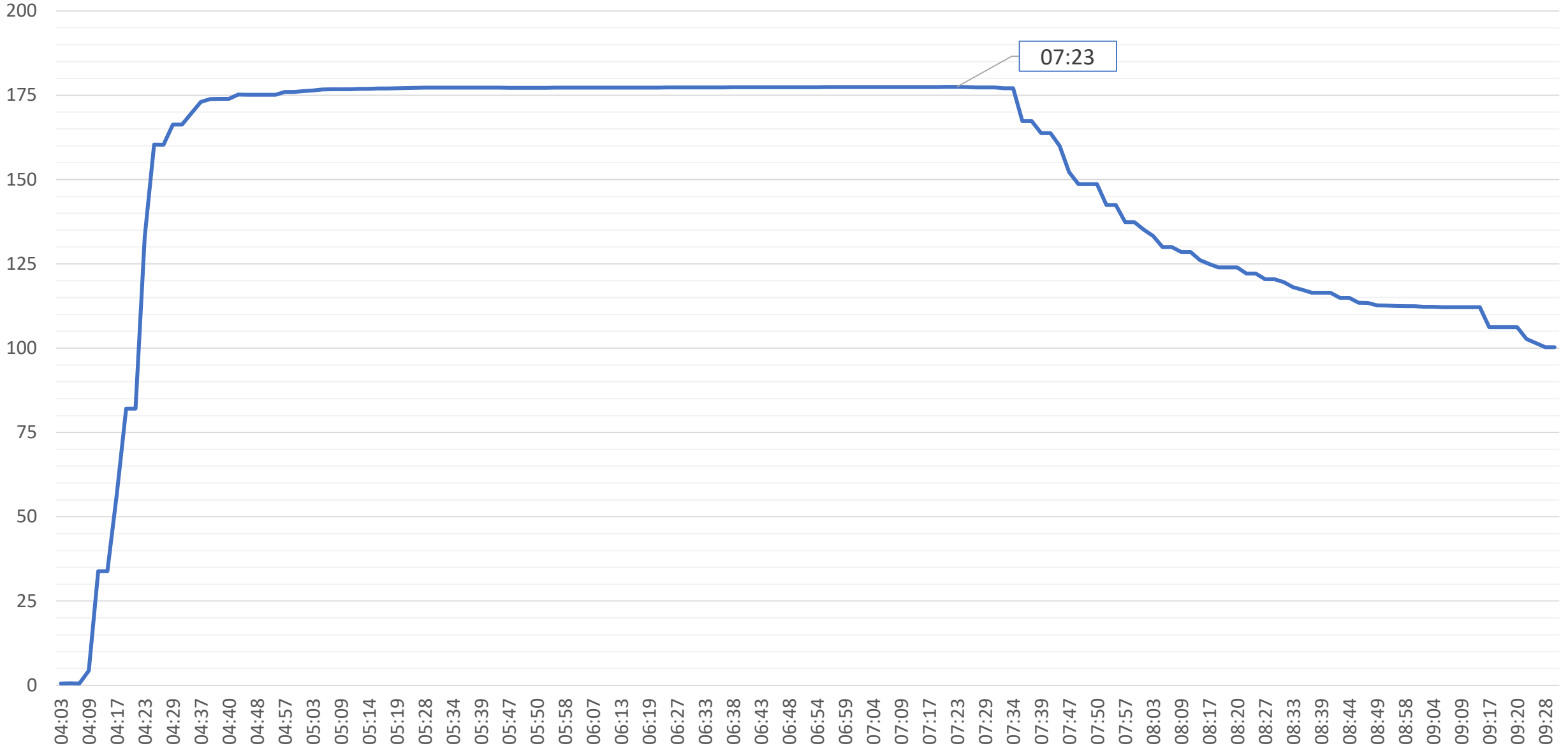
After 10 Minutes NOx Still Stable

180 PPM NO/1586 PPM CO at 1350°F



Rapid Destabilization at 1 Minute

180 PPM NO_x/1586 PPM CO at 1000°F



NO_x Begins to Destabilize at 3.5 Minutes

Conclusions

- Reaction is much less pronounced with low concentrations
- Reaction rate increases with temperature; more care is required with calibration check timing.
- Safe to use blended NO-CO daily calibration cylinders less than 20 PPM with low range NH₃ determination systems
- NO and CO cal gases must be separate if using a high range NH₃ analyzer
- CiSCO does not recommend using dual range NH₃ analyzers
- Advise using dedicated NO cylinders for NH₃ CGA