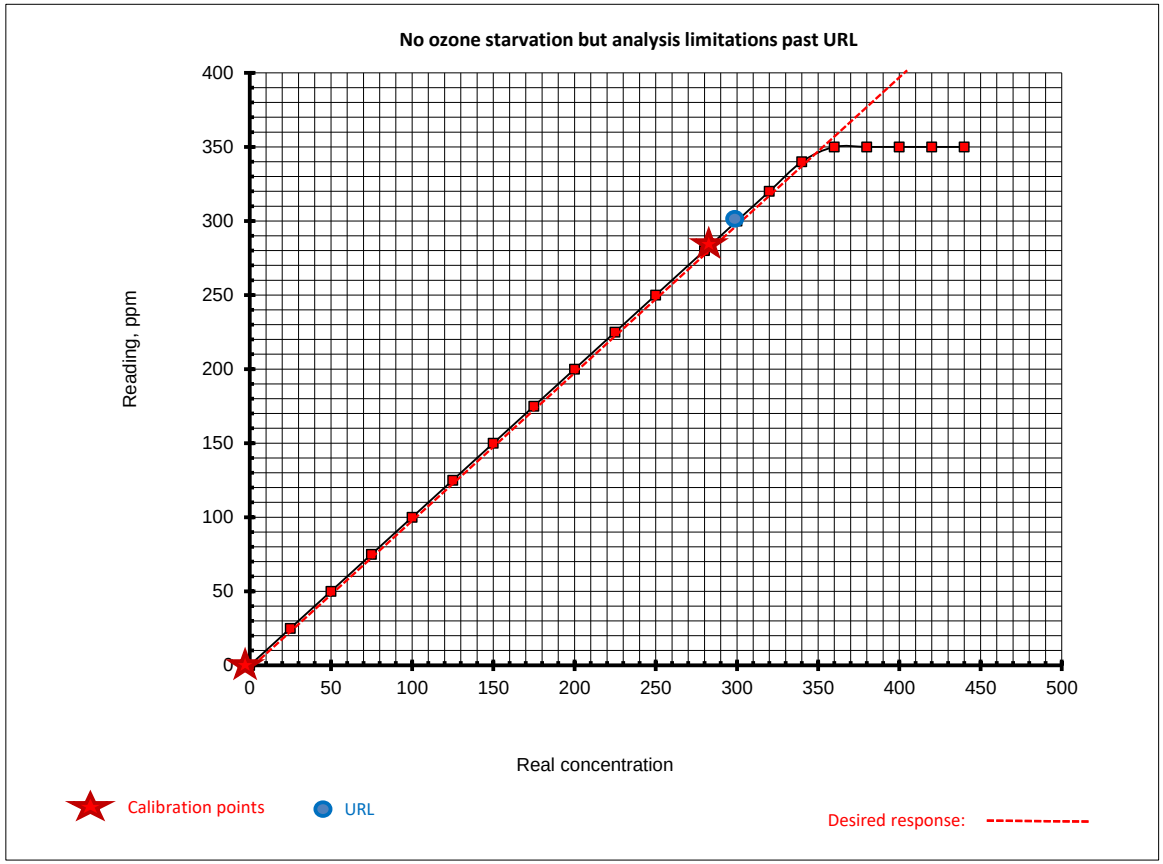
NO / NOx analyzer experiencing no OZONE STARVATION

This chart exemplifies the response of a typical NOx (CLD) analyzer that is running normally. The analyzer will calibrate properly (at the points starred) and respond linearly (the dashed red line). For this example, I'm showing an ozone limitation above the URL (upper range limit) of 300ppm; I picked an arbitrary number of 350ppm NO where the amount of ozone present is at its limit just to show "normal operation" but analysis limitations if URL is exceeded. Notice that a CGA, where two or more midpoint gases are injected, will all plot nearly perfectly. We're using an arbitrary NO (nitric oxide) concentration of 280 ppm as the cal gas value.

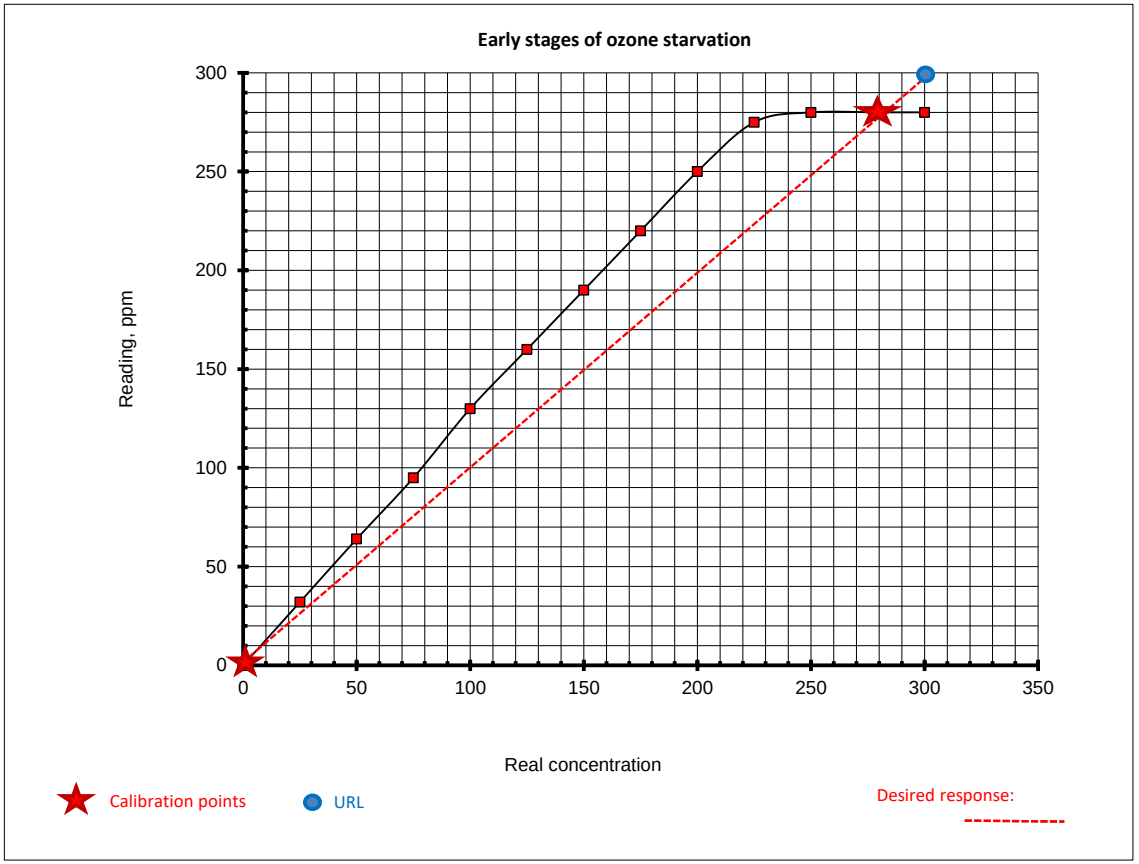
Concentration	Readings	Delta	% of scale
0	0	0	0.0%
25	25	0	0.0%
50	50	0	0.0%
75	75	0	0.0%
100	100	0	0.0%
125	125	0	0.0%
150	150	0	0.0%
175	175	0	0.0%
200	200	0	0.0%
225	225	0	0.0%
250	250	0	0.0%
280	280	0	0.0%
300	300	0	0.0%
320	320	0	0.0%
340	340	0	0.0%
360	350	10	3.3%
380	350	30	10.0%
400	350	50	16.7%
420	350	70	23.3%
440	350	90	30.0%



NO / NOx analyzer experiencing OZONE STARVATION (initial symptom)

This chart exemplifies the response of a typical NOx (CLD) analyzer that has a degraded ozone generator or a clogged ozone restrictor. The analyzer will appear to calibrate properly (at the points starred) and appear to respond linearly (the dashed red line). But, in reality, the analyzer responds as indicated with the plotted points. Note the departure from the linear response line . . . but it still hits its targets for zero and span. This kind of issue shows up initially as span drift (hardly any zero drift). It is also discovered during a CGA where two or more midpoint gases are injected but they all report back with HIGHER than expected readings. We're using an arbitrary NO (nitric oxide) concentration of 280 ppm as the cal gas value.

Concentration	Readings	Delta	% of scale
0	0	0	0.0%
25	32	7	2.3%
50	64	14	4.7%
75	95	20	6.7%
100	130	30	10.0%
125	160	35	11.7%
150	190	40	13.3%
175	220	45	15.0%
200	250	50	16.7%
225	275	50	16.7%
250	280	30	10.0%
280	280	0	0.0%
300	280	-20	-6.7%

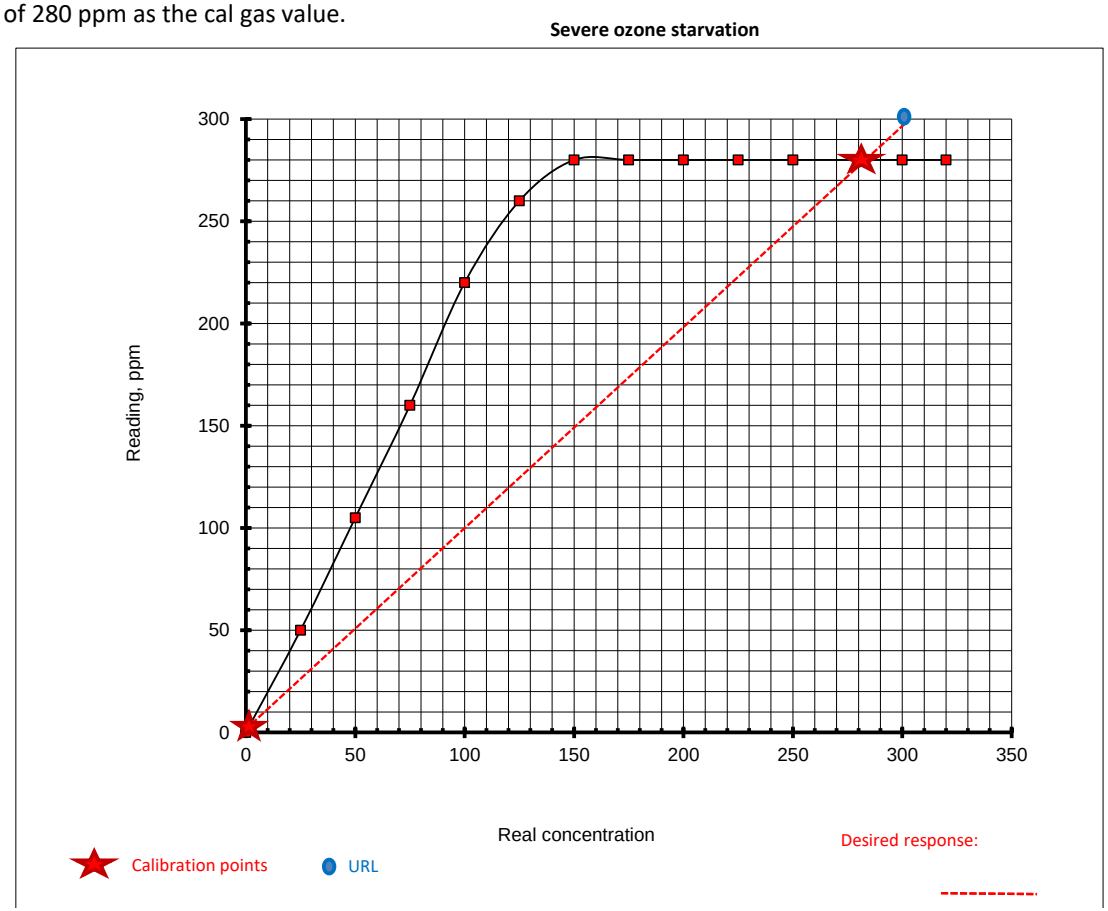


What this means is: you'll calibrate the analyzer (zero and span) and believe that all of the points in between are accurate. In reality, all of your data is going to be skewed HIGH. If this analyzer is associated with a CEMS, all of your emissions data will be higher than actual (erring in the conservative direction which make pleading your case in front of an EPA judge easier). But, ultimately, you will fail your monthly CGAs and your RATA.

NO / NOx analyzer experiencing OZONE STARVATION (near lamp end-of-life symptom)

This chart exemplifies the response of a typical NOx (CLD) analyzer that has a severely degraded ozone generator or a severely clogged ozone restrictor. The analyzer will appear to calibrate properly (at the points starred) and appear to respond linearly (the dashed red line). But, in reality, the analyzer responds as indicated with the plotted points. Note the serious departure from the linear response line . . . but it still hits its targets for zero and span. This kind of issue shows up as span drift (with hardly any zero drift). It is also discovered during a CGA where two or more midpoint gases are injected but they all report back with SIGNIFICANTLY HIGHER than expected readings. This kind of problem will also be discovered during a CEMS RATA.
We're using an arbitrary NO (nitric oxide) concentration of 280 ppm as the cal gas value.

Concentration	Readings	Delta	% of scale
0	0	0	0.0%
25	50	25	8.3%
50	105	55	18.3%
75	160	85	28.3%
100	220	120	40.0%
125	260	135	45.0%
150	280	130	43.3%
175	280	105	35.0%
200	280	80	26.7%
225	280	55	18.3%
250	280	30	10.0%
280	280	0	0.0%
300	280	-20	-6.7%
320	280	-40	-13.3%



What this means is: you'll calibrate the analyzer (zero and span) and believe that all of the points in between are accurate. In reality, all of your data is going to be skewed HIGH. If this analyzer is associated with a CEMS, all of your emissions data will be higher than actual (erring in the conservative direction which make pleading your case in front of an EPA judge easier). But, ultimately, you will fail your monthly CGAs and your RATA.

Author: Larry Runyan, RIGAS, Wooster, OH, USA

Revised: 1/2/2024