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## 40 C.F.R. § 53.23

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### Test procedures.

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(a) *Range*—(1) *Technical definition*. The nominal minimum and maximum concentrations that a method is capable of measuring.

Note to § 53.23(a)(1):

The nominal range is given as the lower and upper range limits in concentration units, for example, 0–0.5 parts per million (ppm).

(2) *Test procedure*. Determine and submit a suitable calibration curve, as specified in § 53.21(b), showing the test analyzer's measurement response over at least 95 percent of the required or indicated measurement range.

Note to § 53.23(a)(2):

A single calibration curve for each measurement range for which an FRM or FEM designation is sought will normally suffice.

(b) *Noise*—(1) *Technical definition*. Spontaneous, short duration deviations in measurements or measurement signal output, about the mean output, that are not caused by input concentration changes. Measurement noise is determined as the standard deviation of a series of measurements of a constant concentration about the mean and is expressed in concentration units.

(2) *Test procedure*. (i) Allow sufficient time for the test analyzer to warm up and stabilize. Determine measurement noise at each of two fixed concentrations, first using zero air and then a pollutant test gas concentration as indicated below. The noise limit specification in table B–1 to subpart B of part 53 shall apply to both of these tests.

(ii) For an analyzer with an analog signal output, connect an integrating-type digital meter (DM) suitable for the test analyzer's output and accurate to three significant digits, to determine the analyzer's measurement output signal.

Note to § 53.23(b)(2):

Use of a chart recorder in addition to the DM is optional.

(iii) Measure zero air with the test analyzer for 60 minutes. During this 60-minute interval, record twenty-five (25) test analyzer concentration measurements or DM readings at 2-minute intervals. (See Figure B–2 in appendix A of this subpart.)

(iv) If applicable, convert each DM test reading to concentration units (ppm) or adjust the test readings (if necessary) by reference to the test analyzer's calibration curve as determined in § 53.21(b). Label and record the test measurements or converted DM readings as  $r_1, r_2, r_3 \dots r_1 \dots r_{25}$ .

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(v) Calculate measurement noise as the standard deviation,  $S$ , as follows:

$$S = \sqrt{\frac{1}{24} \left[ \sum_{i=1}^{25} r_i^2 - \frac{1}{25} \left( \sum_{i=1}^{25} r_i \right)^2 \right]}$$

Where  $i$  indicates the  $i$ -th test measurement or DM reading in ppm.

(vi) Let  $S$  at 0 ppm be identified as  $S_0$ ; compare  $S_0$  to the noise limit specification given in table B-1 to subpart B of part 53.

(vii) Repeat steps in Paragraphs (b)(2)(iii) through (v) of this section using a pollutant test atmosphere concentration of 80 ± 5 percent of the URL instead of zero air, and let  $S$  at 80 percent of the URL be identified as  $S_{80}$ . Compare  $S_{80}$  to the noise limit specification given in table B-1 to subpart B of part 53.

(viii) Both  $S_0$  and  $S_{80}$  must be less than or equal to the table B-1 to subpart B of part 53 noise limit specification to pass the test for the noise parameter.

(c) *Lower detectable limit*—(1) *Technical definition*. The minimum pollutant concentration that produces a measurement or measurement output signal of at least twice the noise level.

(2) *Test procedure*. (i) Allow sufficient time for the test analyzer to warm up and stabilize. Measure zero air and record the stable measurement reading in ppm as  $B_Z$ . (See Figure B-3 in appendix A of this subpart.)

(ii) Generate and measure a pollutant test concentration equal to the value for the lower detectable limit specified in table B-1 to subpart B of part 53.

Note to § 53.23(c)(2):

If necessary, the test concentration may be generated or verified at a higher concentration, then quantitatively and accurately diluted with zero air to the final required test concentration.

(iii) Record the test analyzer's stable measurement reading, in ppm, as  $BL$ .

(iv) Determine the lower detectable limit ( $LDL$ ) test result as  $LDL = BL - B_Z$ . Compare this  $LDL$  value with the noise level,  $S_0$ , determined in § 53.23(b), for the 0 concentration test atmosphere.  $LDL$  must be equal to or higher than  $2 \times S_0$  to pass this test.

(d) *Interference equivalent*—(1) *Technical definition*. Positive or negative measurement response caused by a substance other than the one being measured.

(2) *Test procedure*. The test analyzer shall be tested for all substances likely to cause a detectable response. The test analyzer shall be challenged, in turn, with each potential interfering agent (interferent) specified in table B-3 to subpart B of part 53. In the event that there are substances likely to cause a significant interference which have not been specified in table B-3 to subpart B of part 53, these substances shall also be tested, in a manner similar to that for the specified interferents, at a concentration substantially higher than that likely to be found in the ambient air. The interference may be either positive or negative, depending on whether the test analyzer's measurement response is increased or decreased by the presence of the interferent. Interference equivalents shall be determined by mixing each interferent, one at a time, with the pollutant at an interferent test concentration not lower than the test concentration specified in table B-3 to subpart B of part 53 (or as otherwise required for unlisted interferents), and comparing the test analyzer's measurement response to the response caused by the pollutant alone. Known gas-phase reactions that might occur between a listed

interferent and the pollutant are designated by footnote 3 in table B-3 to subpart B of part 53. In these cases, the interference equivalent shall be determined without mixing with the pollutant.

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