7.9 What is meant by the "span value", and why is it important?

The "span value" is an important concept in Part 75, for several reasons:

• It provides a basis for selecting the full-scale measurement range of a continuous monitor;

• It is used to define the upscale calibration gases (or calibration signals) that are used for daily calibrations and linearity checks; and

• The principal performance specifications for daily calibration error checks of SO_2, NO_x, and flow monitors are expressed as a percentage of the span value;

The span value is a reasonable estimate, or "educated guess" of how large an analyzer scale (i.e., range) is needed to accurately record the emissions or flow rate data at a particular monitored location. For each parameter monitored (e.g., SO_2 , NO_x, Hg, flow), Part 75 requires a high span value and a corresponding full-scale measurement range to be defined in the monitoring plan. For gases, the high span value is based on the maximum potential concentration, or MPC. For flow, the span value is based on the maximum potential flow rate, or MPF.

These maximum potential values can be determined in a number of different ways. For instance, depending on which gas is being monitored, the MPC may either be a "generic" default value prescribed in Part 75, or it may be based on historical fuel sampling data, emission test results, or historical CEM data. The MPF may either be estimated using Equation A-1a or A-1b in Appendix A of Part 75, or may be derived from measurements of stack gas velocity at maximum load.

Once the MPC or MPF has been determined, the high span value is set by multiplying the MPC or MPF by a factor of 1.00 to 1.25, and rounding off the result appropriately.52 Thus, the span value may either be set equal to or slightly higher than the maximum potential value. After determining the span value, the full-scale range of the monitor must be set. Part 75 requires the range to be greater than or equal to the span value.

However, note that when setting the range, the guidelines in section 2.1 of Appendix A should be taken into account, to avoid setting it too high. According to section 2.1, the range should (with certain exceptions, described below) be selected to ensure that the majority of the data fall between 20% and 80% of full-scale.

For many Part 75 units, the use of high span values and full-scale ranges derived from the maximum potential values is sufficient to ensure that data are accurately recorded. However, for units with add-on SO_2 or NO_x emission controls, or for units that burn multiple fuels with distinctly different SO_2 or NO_x emission rates, it may be necessary to define a second, low span value and a low range. A low span and range will be required if the emission levels are expected to be consistently below 20% of the high range when the add-on emission controls are operating properly, or when the lowest-emitting fuel is burned.

If a second span and range are required, the low span value is set in a similar manner to the high span value. The only difference is that the low span is based on the maximum expected concentration (MEC), rather than the MPC. The MEC is the highest that the concentration of the pollutant is expected to be when the add-on controls are in normal operation or when the lowest-emitting fuel is combusted. There are a number of ways to determine the MEC. For units with add-on emission controls, it may be based on the expected efficiency of the controls. Emission test data, historical CEM data, or an emission limit in the operating permit may also be used to determine the MEC. Once the MEC has been established, the low span value is calculated by multiplying the MEC by a factor of 1.00 to 1.25 and rounding off the result appropriately. Then, the low range is set greater than or equal to the low span value.

Note that for units with dual SO_2 or NO_x spans, Part 75 allows a "default high range value" to be reported when the emissions go off the low scale, as an alternative to maintaining and calibrating a high monitor range. But the default high range value is a very high number (200% of the MPC) and may grossly overstate the emissions. Therefore, this option is probably not a good one except for sources whose emissions rarely, if ever,

exceed the full-scale of the low range. Note also that for dual-span units there are exceptions to the "20-to-80% of range" guideline in section 2.1 of Appendix A. For instance, if the add-on emission controls are operated year-round, the high range is exempted from this guideline. Also, provided that the MEC, low span value, and low range have been set according to the rule, the low range is similarly exempted (e.g., since 10 ppm is the lowest NO_x span and range allowed by the rule, if NO_x readings are consistently below 2 ppm due to excellent performance of the emission controls, the "20-to-80%" guideline does not apply).

An unusual feature of Part 75 is that for flow monitors, there is only one measurement range, but there are two span values— the "calibration span value" and the "flow rate span value". These two span values are both derived from the MPF and are actually equivalent, but are usually in different units of measure. The calibration span value is the one used for daily calibrations of the flow monitor. Often it is expressed in units such as inches of water (in. H_2O) or thousands of standard cubic feet per minute (kscfm), depending on the type of flow monitor. The flow rate span value is always in units of standard cubic feet per hour (scfh), which are the units of measure prescribed by Part 75 for reporting hourly stack gas flow rates.

Once the span values for all of the required continuous monitors have been established, these values are used for daily calibration assessments and linearity checks, as follows:

- For the daily calibrations of gas monitors, zero and upscale gases are used. The zero gas must be 0 to 20% of the span value, and the upscale gas may be either a mid level gas (defined as 50 to 60% of the span value) or a high level gas (80 to 100% of the span value).

- For the daily calibrations of flow monitors, a zero calibration signal (0 to 20% of the calibration span value) and an upscale calibration signal (50 to 70% of the calibration span value) are used.

- For linearity checks of gas monitors, calibration is required at three different gas levels (low, mid, and high), using calibration standards with concentrations of 20 to 30%, 50 to 60%, and 80 to 100% of the span value, respectively.

- The principal performance specification for certain daily calibration error tests are expressed as a percentage of the span value. For an SO_2 or NO_x monitor, the performance specification is $\pm$ 5.0% of the span value, and for a flow monitor, it is $\pm$ 6.0% of the calibration span value.

Finally, Part 75 requires periodic evaluations (at least once a year) of the MPC, MEC, span and range values. These evaluations are done by reviewing the emissions and flow rate data from the previous four quarters. If any of the MPC, MEC, span and/or range values are found to be improperly set, the necessary adjustments must be made within 45 days (or within 90 days if new calibration gases must be ordered) after the end of the quarter in which this is discovered.