Title: Standard Operating Procedure for R&R Environmental Devices Model 200 Zero Span Module		
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1. INTRODUCTION AND SCOPE

Daily data of instrument baseline and upscale response is required to verify instrument performance. The R & R Model 200 provides a stable span source. To meet the requirements for inclusion of the data in provincial and national air quality databases, this method of producing gas concentrations for demonstrating instrument performance is used. Commercially available span devices are used in the method.

This method is applicable to the measurement of SO_2 and H_2S and TRS concentrations in ambient air in the range of 0.001 parts per million (ppm) to 1.0 parts per million (ppm).

This method adheres to the requirements of the current Air Monitoring Directive (AMD). In some cases the limits and specifications exceed the requirements of the current AMD. It should be considered that the current and any future amendments of the AMD will be used as the benchmark for requirements and criteria for ambient air monitoring practices conducted in the Province of Alberta. Information used to write this procedure was also taken from sources identified in the reference section.

2. PRINCIPLE OF THE METHOD

The span gas is derived from a permeation device. The permeation source is a sealed device, whereby the Teflon membrane is permeable to the vapour of the chemical compound contained. The compound is held in liquid vapour phase equilibrium inside the device. At a given temperature the device provides a constant flow of its compound into the carrier gas stream through the Teflon membrane. The permeation rate of the source is temperature dependent, therefore strict temperature control is required. The span gas concentration to the analyzer is determined by three variables: the permeation rate of the permeation device, the permeation oven temperature, set at 35°C, and the sample flow rate of the analyzer. Permeation devices can be uncertified with a +/-20% tolerance on specified outputs. An orifice system controls the sample flow rate of the analyzer, which dilutes the permeation source gas with zero air and provides a single gas concentration.

Specifically;

$$\textit{Span Gas Concentration} = P \times (24.46/mw)/ F$$

Where:

P = The permeation rate in ng/min.

mw = the molecular weight of the pollutant gas.

F = Sample flow rate of the analyzer

24.46 is the molar volume at reference conditions.

The Zero/Span Module is generally installed within the analyzer and is connected to the existing analyzer flow system to take advantage of the internal zero and span solenoids. To provide Zero Air a charcoal scrubber is used. Zero air from the scrubber is provided to both the analyzer Zero port and to the zero air inlet on the Z/S module using a TEE. This provides zero air to the Z/S module continuously. The Span port of the analyzer is connected to the Output port of the Z/S module and the Exhaust port of the Z/S module is connected to the exhaust port of the analyzer upstream from the vacuum pump. Power (120 VAC) is provided to the Z/S module from within the analyzer and 24 VDC power which activates the internal span solenoid is connected to the Z/S module to activate its internal solenoid.

When the analyzer is in the Sample mode of operation vacuum is applied to the Exhaust port of the Z/S module and the permeating gas from the permeation device is drawn out of the oven at a flow rate of approximately 60 cc/min. and exhausted. This prevents buildup of gas in the oven. When the analyzer is put into the Zero mode of operation the analyzer is provided with zero air from the charcoal scrubber and the Z/S module continues to be in the exhaust mode. When the analyzer is put into the Span mode of operation both the analyzer span solenoid and the Z/S module internal solenoid activate. The permeation oven output flow of approximately 60 cc/min is redirected in this mode and is mixed with zero air within the Z/S module, the combined flow then travels through the analyzer span solenoid to the analyzer detector. The flow rate of the analyzer is controlled using a capillary. Changing the capillary to provide more sample flow would result in a lower span concentration delivered to the analyzer. The analyzer mode of operation can either be activated manually or remotely by the data collection system.

3. MEASUREMENT RANGE AND SENSITIVITY

The Zero/Span modules used in this method are commercially available models. The output span concentration range is user selectable to a degree by the selection of permeation devices from very low to very high outputs in order to provide spans from as low 0.010 parts per milion (ppm) by volume to as high as 5 parts per million.

4. EQUIPMENT AND APPARATUS

- This SOP is specific to R&R Environmental Devices Model 200 Span Module

5. INTERFERENCES

There are no interferences which affect the operation of the Zero/Span module provided that it has been correctly setup and that a good quality of zero air is being provide to the unit.

Particulate matter present in the measurement cell can inhibit analyzer response by absorbing SO2 molecules, thereby not allowing them to fluoresce. In order to prevent charcoal dust from being transported from the charcoal scrubber into the Z/S module and the analyzer a particulate filter must be installed at the output of the scrubber.

6. PRECISION AND ACCURACY

The measurement precision is generally considered to be the “repeatability of the measurement”. The precision of the gas generated by the span module is maintained by accurate temperature control and the flow control of the instrument.

Accuracy is generally considered the “deviation from true”. This means how close it is to what it should be. The benchmark of “what it should be” is provided by the Alberta Environment Audit Program staff and the use of high quality standards such as available from the National Institute of Standards and Technology (NIST). The permeation devices used need not be certified. A verification of the span level is conducted immediately following a multipoint calibration of the analyzer that has the zero span module installed. .

7. SITE REQUIREMENTS

Site location for specific monitoring instruments is prescribed for each type of instrument in the Instrument Methods documents.

8. INSTALLATION REQUIREMENTS

All the installation requirements are specified by the manufacturer in the installation procedures of the manual. Methods documents for each type of instrument provide specific installation requirements for each instrument type. Refer to the Instrument Methods documents.

9. OPERATIONAL REQUIREMENTS

All operational activities conducted at any ambient monitoring station, must be documented in the station logbook, and/or station checklists. This allows other operators to access a history of the station if the regular technician is not available. The following documentation must be available to the operators on site: operational and maintenance manual(s), appropriate quality system documentation and station site documentation.

The following activities must be performed when operating continuous automated analyzers in Alberta.

9.1 Zero/Span Module Maintenance

Preventative maintenance tasks should be completed on the Z/S module on a periodic basis. These tasks are outlined in the operations manual.

These tasks include:

1. Verification of oven temperature setting and operation when span level changes significantly

2. Verification of flow settings when span level changes significantly

3. Replacement of the permeation device necessary when device empties or expires.

4. Replacement zero air charcoal scrubber annually or when comparison to monthly calibration zero dictates.

A strict regiment of these tasks should be adhered to as they are intended to fix a problem before it happens. Any maintenance must be recorded in the station log book and/or the electronic logbook. This is also recorded in the instrument log that accompanies each instrument.

10. CALIBRATION

Calibration of the internal module is not required. Operational checks described in 9.2 must be verified on a periodic basis.

11. APPLICABLE DOCUMENTS

- **EM-031a** R&R Environmental Devices Model 200 Operating Manual

12. LITERATURE REFERENCES

- State of California Air Resources Board (CARB) Method Volume II Standard Operating Procedures for Air Quality Monitoring Appendix C dated April 1984

13. REVISION HISTORY

Revision 0 (new document)

Revision 1 Grammatical changes

14. APPROVAL

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Approved by: **Harry Benders** **Date: January 24, 2011**

Title: **Air Monitoring Team Leader**