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Title: Thermo Environmental (TECO) 45C/145C/450C/450CTL H2S/SO2/TS Analyzer		
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1. Purpose

To establish a standard operating procedure (SOP) for University Hygienic Laboratory (UHL) Ambient Air Quality personnel to ensure compliance with the manufacturer's manual, Environmental Protection Agency Quality Assurance Handbook and the Code of Federal Regulations (40CFR) in operating the Thermo Environmental (TECO) 45C/145C/450C/450CTL H2S/SO2/TS Analyzer. (Note: Thermo has had several generations/renumbering of the Hydrogen Sulfide instrument. All instrument numbers mentioned here have been used but refer to the same basic instrumentation. The 450CTL – TL = Trace Level -version has an improved optical bench over the other versions of this monitor.)

2. Scope

This procedure is intended for use by UHL staff during routine monitoring site operation of the TECO Model 45C/145C/450C/450CTL Hydrogen Sulfide/Sulfur Dioxide/Total Sulfur Analyzer. This procedure is not a replacement for the manufacturer's manual but provides site-specific guidance for equipment operation and site operator objectives.

3. Outline of Procedure

1. Summary of Method
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4. Routine Operation
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4. Reference

Operating Manual Thermo Environmental (TECO) 45C/145C/450C/450CTL H2S/SO2/TS Analyzer

Quality Assurance Handbook for Air Pollution Measurement Systems, Environmental Protection Agency

Code of Federal Regulations, Section 40, Part 53

5. Procedure

5.1 Summary of Method

The Thermo Environmental (TECO) model 45C/145C/450C/450CTL Hydrogen Sulfide/Sulfur Dioxide/Total Sulfur Analyzer is a catalytic conversion/pulsed fluorescence analyzer. It operates on the principle that Hydrogen Sulfide molecules can be thermally converted to SO₂ molecules which will then absorb ultraviolet (UV) light and become excited at one wavelength, decaying to a lower energy state emitting UV light at a different wavelength.

Sample air is drawn into the 45C/145C/450C/450CTL analyzer inlet. The sample flow is alternated into a fixed temperature thermal convertor (H₂S) or a bypass line (SO₂) with both lines eventually flowing into a Hydrocarbon Kicker. The Kicker unit removes hydrocarbons from the air stream by differential permeation allowing SO₂ molecules to pass through the unit on to the fluorescence chamber, where pulsating UV light excites the SO₂ molecules. The excited SO₂ molecules decay to lower energy states that emit UV light that is proportional to the SO₂ concentration. A photomultiplier tube (PMT) detects the UV light emission from the decaying SO₂ molecules and converts it to an electrical signal, which is then sent to the analyzer's front panel display and analog outputs. The Hydrogen Sulfide concentration is determined by alternately passing the bypass sample (SO₂) and the thermally converted sample (TS) as SO₂ through the fluorescence source. H₂S concentration is equal to the TS concentrations minus the SO₂ concentration. All three concentrations (H₂S/SO₂/TS) are sent on to the ESC datalogger.

5.2 Installation and Start-up

The operator should first read the manufacturer's manual to understand and become familiar with the analyzer's operations, controls, settings and various possible operating configurations. The operator should then decide which of these will best serve the UHL Air Quality department's requirements and needs. Some functions of the analyzer are mandatory to the department's requirements, while others will not be utilized.

The site operator should be thoroughly familiar with the monitor, its manual and any supporting equipment, to avoid the possibility of mechanical damage to the instrumentation or any personal injury such as electrical shock or mishap while working with high pressure gas calibration devices.

5.2.1 Installation

- 5.2.1.1 Place the analyzer at the monitoring site, in an area where it will be accessible for operating the controls, performing maintenance and attaching calibration devices.
- 5.2.1.2 Connect a "sample line" to the "inlet" bulkhead at the rear of the analyzer and extend it out of the monitoring site shelter so that it meets EPA QA "sample train" criteria (40 CFR Appendix E) for placement, length, etc. The sample line should be constructed of ¼ inch o.d. Teflon tubing and connected to the analyzer with stainless steel or Teflon

compression nuts and ferrules. In the sample line, relatively close to the analyzer inlet, install a Teflon particulate filter cartridge containing a 5-micron pore size Teflon filter. It is recommended that the sample line, inside the site shelter, be covered with an insulating material to avoid the risk of condensation inside the sample line and moisture being drawn into the analyzer.

- 5.2.1.3 **(Optional – May be done depending on equipment adaptability)** Connect ¼ inch o.d. Teflon tubing from the “zero and span” bulkhead connections at the rear of the analyzer, to the “on-site” calibrator “zero and span” bulkhead connections, using stainless steel or Teflon compression nuts and ferrules. Keep tubing lengths as short as possible but allow for the possible repositioning of instruments during periods of maintenance. This will be used to conduct Level 2 checks on the SO₂ channel of the analyzer.
- 5.2.1.4 With appropriate signal wire, connect the analyzer’s analog outputs to the site data logging system and strip chart recorders (if used). (See step 5.2.1.8)
- 5.2.1.5 Connect the “status/relay” information cable from the back of the analyzer to the data logging system. (See step 5.2.1.8)
- 5.2.1.6 Connect a RS232 communication cable from the analyzer to the data logging system or multi communication switching device (if used). (See step 5.2.1.8)
- 5.2.1.7 Connect the analyzer’s power cord to a stable voltage source. It is recommended that a “surge protecting power strip” be placed in line between the analyzer and the electrical source.
- 5.2.1.8 All “data logging system” signal terminals and voltages will be determined by the site installation operator and coordinated with the department’s data acquisition section to ensure correct channel configuration and data monitoring take place.
- 5.2.1.9 Record installation, equipment make, model and serial numbers, data system channel and voltage settings and data collection “start time” in the “site log book”. This information should also be returned to the laboratory for inventory documentation and data acquisition section notification.

5.2.2 Start Up

- 5.2.2.1 Turn the analyzer power on by means of the front panel switch.
- 5.2.2.2 Allow analyzer a 30-60 minute warm-up period.
- 5.2.2.3 Until the operator becomes familiar with the analyzer front panel menu buttons, consult the manual in order to select and set the instrument parameters. Although the analyzer may be capable of a number of different parameter options, the normal network selection is as follows:

In “Range” menu, select	“Single”	
In “Gas Units” menu, select	“PPB”	
In “Range” menu, select	“200” *	
In “Averaging Time” menu, select	“300”	
In “Measurement Mode” menu, select	“Auto”	for H ₂ S/SO ₂ and TS
In “Temperature Correction” menu, select	“On”	
In “Pressure Correction” menu, select	“On”	
In “Flash Lamp” menu, select	“On”	

In “Baud Rate” menu, select “9600”

*Other ranges may be necessary if site measurements dictate.

- 5.2.2.4 Instrument default settings will be used for all Model 45C/145C/450C/450CTL Alarm settings unless advised differently by the manufacturer. These may be found in the Model 45C/145C/450C/450CTL operating manual.
- 5.2.2.5 A “multi-point” SO₂/TS calibration using SO₂ gas and a single point H₂S convertor efficiency test and multi-point verification using H₂S gas must be performed before data collection may begin. This procedure is discussed in the “Routine Site Operation” section of this SOP.

5.3 Monitoring Site Operation

Upon completion of “Installation and Start-up”, the analyzer is ready to begin normal, continuous sample operation for the detection of Hydrogen Sulfide, Sulfur Dioxide and Total Sulfur. The site operator will visit each monitoring site at a minimum of every 14 days for analyzer “zero, span and precision” checks. The site operator will conduct “multi-point” calibration checks when the analyzer is newly installed, repaired, when zero or span drift more than 5 ppb (zero) or 12% (span) and once per calendar quarter. All data generated at the site will be gathered and transmitted to the laboratory electronically through the use of an ESC data logging system. Optionally, as available, an “on-site” SO₂ calibrator will supply the analyzer with a sample of “zero and span” gas for daily Level 2 checks..

5.4 Routine Operation

- 5.4.1 When visiting a monitoring site, the operator should first conduct a visual inspection of the site itself and all instrumentation. This may assist in identifying any problems before beginning any equipment operation. The analyzer’s front panel display should be checked for any “alarm” status. Unusual conditions may require action that deviates from routine procedures.
- 5.4.2 In the “site log book”, the operator should first enter the date and initials.
- 5.4.3 A number of analyzer and support equipment component statuses are selected to be monitored during each routine visit. Deterioration or degradation can be charted, assisting the operator in identifying problems during malfunctions and for preventive maintenance measures. From the analyzer “Diagnostics Menu”, monitor and record in the site log book:

Flash lamp voltage
PMT voltage
Internal temperature
Chamber temperature

Convertor temperature
Internal pressure
Pump flow rate
Oven temperature (optional on-site cal.)
Flow system pressure (optional on-site cal.)

- 5.4.4 Disconnect the analyzer sample line at the filter cartridge inlet.
- 5.4.5 Attach a 'zero air' device to the sample line cartridge inlet and allow the analyzer to sample zero air until a stable reading is obtained (approximately 15 minutes).
- 5.4.6 Record in the logbook the expected zero value and the measured zero value observed on the data logger display for the SO₂, H₂S and TS channels..
- 5.4.7 Disconnect the zero air device from the analyzer sample line inlet.
- 5.4.8 Connect the output port of a Monitor Labs 8500 SO₂ (perm tube) or a Thermo Environmental 146C (gas) calibrator to the sample line cartridge inlet by using an atmospheric bypass tube. Assure that the perm tube calibrator oven is at the proper operating temperature of 50°C by use of a NIST calibrated thermometer. See AAQGEN-016 and AAQGEN-030 for information on support of perm tube and gas calibrators.
- 5.4.9 Attach the zero air device to the calibrator's "inlet" port.
- 5.4.10 With use of the "flowrate/SO₂ concentration" chart supplied with the perm tube calibrator or the program in the gas calibrator deliver a 'precision value' (20-40 ppb) of SO₂ gas to the analyzer. If the site shelter ambient temperature and barometric pressure differ from those conditions at which the SO₂ perm tube calibrator's flowmeters were originally measured, then the flowrate must be corrected to "standard temperature/pressure" (STP) and the SO₂ concentration recalculated. See the correction calculation supplied with the SO₂ perm tube calibrator.
- 5.4.11 Allow the analyzer to sample the precision range gas until a stable reading is obtained (approximately 15 minutes or more).
- 5.4.12 Record in the logbook the expected precision values and the measured precision values for the SO₂ and TS channels taken from the data logger display.
- 5.4.13 With use of the "flowrate/SO₂ concentration chart" supplied with the SO₂ perm tube calibrator or the Span program on gas calibrator, adjust the calibrator to deliver a "span value" (~80% of analyzer full scale or 160 ppb) to the analyzer. Again correct flowrate to STP and recalculate the SO₂ concentration if needed, as in 5.4.10 for the perm tube calibrator.
- 5.4.14 Allow the analyzer to sample the span range gas until a stable reading is obtained (approximately 15 minutes).
- 5.4.15 Record in the logbook the expected span values and the measured span values for the SO₂ and TS channels observed on the data logger display.
- 5.4.16 If the measured calibration values deviate from the expected value, the operator may choose to adjust the analyzer so that the measurement is more representative of the "true or expected" concentration. This will be mandatory if zero or span has deviated by more than ± 3 ppb (from zero) or $\pm 12\%$ (from span) of the "true or expected" concentration and is up to the operator's determination of necessity if the values deviate by less than ± 3 ppb (zero) or $\pm 12\%$ (span) . Values in excess of ± 5 ppb from zero or $\pm 15\%$ from span

will result in invalidation of data back to the last acceptable check. If you have values greater than these levels, a note and/or e-mail should be forwarded to the Senior Field Chemist, Data Management staff and AQ supervisor. **Note: No adjustments may be made to the analyzer prior to zero or span measurements on a normal biweekly site visit.**

- 5.4.17 Repeat steps 5.4.9 – 5.4.16 substituting H₂S gas for the SO₂ gas. Precision H₂S of 20-40 ppb and span concentration of ~160 ppb should be used. Analyzer adjustment and data invalidation levels are equivalent to the levels used with SO₂.
- 5.4.18 If adjustment of the zero or span levels are necessary, disconnect the SO₂/H₂S calibrator from the sample inlet and supply the analyzer with “zero air” until a stable reading is achieved.
- 5.4.19 Switch the analyzer from “Remote” to “Local” operation by pressing the “**Enter**” pushbutton
- 5.4.20 Press the front panel “**Menu**” pushbutton to display the “Main Menu”. Press the “down arrow” pushbutton to move the cursor to “Calibration” and press “**Enter**” to display the “Calibration menu”.
- 5.4.21 Press “**Enter**” to select “Calibrate Zero”. The “Calibrate Zero” screen appears. The first line of the display shows the current SO₂/TS reading. Press “**Enter**” to set the SO₂ reading to zero. Press the “**Menu**” pushbutton to return to the “Calibration” menu.
- 5.4.22 Reconnect the SO₂ calibrator to the analyzer and operate as described in steps 5.4.7 through 5.4.11. Adjust the calibrator to supply “span range” gas (~80% - 160 ppb) of analyzer full scale) to the analyzer.
- 5.4.23 Press the front panel “down arrow” to move the cursor to “Calibrate SO₂” and press “**Enter**” to display the “Calibrate SO₂” screen. Use the “left and right” pushbuttons to move the cursor left and right. Use the “up and down” pushbuttons to increment and decrement the digit to the “expected SO₂ concentration. Press the “**Enter**” pushbutton to calibrate the analyzer to the SO₂ calibration gas.
- 5.4.24 Press the “**Menu**” pushbutton two times to return to the “Main menu”. Press the front panel “down arrow” to move the cursor to “Calibrate TS” and press “**Enter**” to display the “Calibrate TS” screen. Verify the concentration is the same as the SO₂ concentration in 5.4.23 above then use the “left and right” pushbuttons to move the cursor left and right. Use the “up and down” pushbuttons to increment and decrement the digit to the “expected TS concentration. Press the “**Enter**” pushbutton to calibrate the analyzer to the TS channel to the SO₂ calibration gas value.
- 5.4.25 Press the “**Menu**” pushbutton two times to return to the “Main menu”. Move the cursor down and select “Calibration Factors” and press the “**Enter**” pushbutton. The SO₂/TS “Background” and “Coefficient” will now be displayed. Enter these values in the logbook.
- 5.4.26 Disconnect the SO₂ Gas source from the sample inlet line and connect the H₂S gas source. The H₂S channel will be calibrated by measuring the efficiency of the thermal converter. Sample a span concentration (160ppb) of H₂S and allow its reading to stabilize (~15 minutes).
- 5.4.27 Press the “**Menu**” pushbutton two times to return to the “Main menu”. Press the front panel “down arrow” to move the cursor to “Calibrate H₂S” and press “**Enter**” to display

- the “Calibrate H2S” screen. Line two of the screen will show the current H2S reading. . Use the “left and right” pushbuttons to move the cursor left and right. Use the “up and down” pushbuttons to increment and decrement the digit to the “expected H2S concentration. Press the **“Enter”** pushbutton to calibrate the H2S channel analyzer to the H2S calibration gas. This will update the one point converter efficiency calculation.
- 5.4.28 Press the **“Menu”** pushbutton two times to return to the “Main menu”. Move the cursor down and select “Calibration Factors” and press the **“Enter”** pushbutton. The H2S “Background” and “Coefficient” will now be displayed. Enter these values in the logbook. **Note: If H2S span coefficient value is <0.960 or >1.050, refer to Model 45C/145C/450C/450CTL manual for troubleshooting instructions.**
- 5.4.29 When multi-point calibrations are needed, three additional H2S levels of ~ 120ppb, 40ppb and 25ppb may be run for a multi-point calibration curve that can be recorded on the H2S multi-point spreadsheet.
- 5.4.30 Press the **“Run”** push button to return the analyzer display to the “operation” mode.
- 5.4.31 Press the **“Enter”** pushbutton to return the analyzer from “Local” to “Remote” operation.
- 5.4.32 Remove the H2S calibrator from the analyzer and reconnect the sample line to the analyzer, changing the particulate filter at this point, if and when needed.
- 5.4.33 Along with the logbook entries addressed above also record in the logbook:
Monitoring site ambient “temperature and barometric pressure” (taken during period of site visit)
Observe and note if “MET mph/deg” sensors appear to be operating properly and correspond with “data logger” display
SO2 calibrator and serial number used for calibrations
SO2/H2S permeation device or cylinder gas ID number(s), used for calibrations
SO2 calibrator oven temperature
Any maintenance or service to the site and its contents
The time period for which the operator has interrupted normal data collection and the reason of interruption.
- 5.4.34 Complete a “Precision/Audit, Void Hour” form, using the above information and supply it to the department’s data acquisition section.
- 5.4.35 Logbook entries are to be made in ink with date and initials of personnel. Corrections are to be struck with a single line and the entry personnel’s initials and date written along side. After each logbook page has been filled, the “carbon copy” should be removed and returned to the laboratory for archiving.

5.5 Full Scale checks

The analyzer “zero and full scale” output voltages should be checked during scheduled accuracy audits (25% of sites each quarter each site at least once per year). However, prior to beginning a “multi-point” calibration, is a desirable point to conduct this check.

- 5.5.1 From the analyzer front panel, select and press the **“Enter”** pushbutton to place the analyzer into the “Local” operation mode.

- 5.5.2 Press the **“Menu”** pushbutton and move the cursor down to select the **“Diagnostics”** menu. Press the **“Enter”** pushbutton.
- 5.5.3 Press the **“down arrow”** key to place the cursor at **“Test analog outputs”** and press the **“Enter”** pushbutton.
- 5.5.4 The cursor will be at the **“Zero Output”** selection. Press the **“Enter”** pushbutton to view **“zero output”** on the analyzer display and at the **“electronic data logger”** display.
- 5.5.5 Press the **“up/down”** arrow keys to correct the **“zero output (if needed)”** and press **“Enter”** to store the correction.
- 5.5.6 Monitor the input voltage to the datalogger with a calibrated voltmeter. Adjust the appropriate trim pot on the instrument **“analog output card”** to read 0.000VDC (if needed). See instrument instruction manual for details on analog adjustments.
- 5.5.7 Press the **“Menu”** pushbutton again to re-enter the **“output selection”** screen and move the cursor down to select **“Full Scale Output”** and press **“Enter”**.
- 5.5.8 Press the **“Enter”** pushbutton to view **“Full Scale Output”** on the analyzer display and at the **“electronic data logger”** display.
- 5.5.9 Press the **“up/down”** arrow keys to correct the **“full scale output”** (if needed) and press **“Enter”** to store the correction.
- 5.5.10 Monitor the input voltage to the data logger with a calibrated voltmeter. Adjust the appropriate trim pot on the instrument **“analog output card”** to read 10.000 VDC (if needed). See instrument instruction manual for details on analog adjustments.
- 5.5.11 Continue this process, without making any analog adjustments, setting the instrument to several output voltages to check instrument linearity, (100, 75, 50 and 25% ranges are recommended).
- 5.5.12 If instrument shows to not be linear, consult data logger instruction manual for analog input voltage, calibration procedure.
- 5.5.13 Press the **“Menu”** pushbutton to return to the **“Main Menu”**.
- 5.5.14 Press the **“Run”** pushbutton to return to the **“operate mode”**.
- 5.5.15 Press the **“Enter”** pushbutton to return the analyzer to **“Remote”**.
- 5.5.16 This process should be run for the SO₂, TS and H₂S analog outputs.

5.6 Multi-Point Calibrations

Multi-point calibrations employ the same procedure and operation as those addressed above, with the exception that more audit points/ranges are measured and the EPA designated audit levels must be included in the range selection. Quarterly multi-point calibration audits will be performed on at least 25% of the network's monitors with a SO₂/H₂S calibrator, gas dilution and/or permeation device that is different than that which was used to conduct routine **“precision, span and calibration”** checks.

- 5.6.1 After completing the **“zero and full scale”** output checks above, follow and conduct the steps outlined in 5.4.4 through 5.4.17.
- 5.6.2 After completion of steps 5.4.9 through 5.4.17, adjust the SO₂ calibrator to supply calibration gas to the analyzer at levels of at least:

Level #1	10-30 PPB
(Precision)	20-40 PPB (Optional)
Level #2	35-60 PPB
Level #3	110-140 PPB
Level #4	160-180 PPB

For both the SO2 and TS channels.

- 5.6.3 Disconnect the SO2 calibrator and connect the H2S calibrator to supply calibration gas to the analyzer at levels of at least:

Level #1	10-30 PPB
(Precision)	20-40 PPB (Optional)
Level #2	35-60 PPB
Level #3	110-140 PPB
Level #4	160-180 PPB

Note: Precision level checks may be included in a multi-point calibration but are only mandatory for the biweekly checks. The Precision check must be conducted prior to any instrument adjustment for zero and span. A Level #1 check if between 20-30ppb or a Level #2 check if between 35-40 ppb falls within an acceptable range for a Precision check point.

- 5.6.4 Calculate the percent difference by using the following formula and enter the information into the logbook:

$$. (Measured\ value - Known\ value) / Known\ value \times 100 = \% \text{ Difference.}$$

- 5.6.5 Enter results into the SO2/H2S spreadsheet. Values should pass the criteria of being within +/- 2% Full Scale (4ppb) of the linear regression best fit line with a slope of 1 ± 0.1 and a correlation coefficient of ≥ 0.995 . If the criteria are not met, a Corrective Action should be initiated to determine the cause of the failure.

MULTI-POINT CALIBRATION SPREADSHEET

SO2/TS/H2S Multi-Point Audit Spreadsheet

Analyzer:	Thermo 45C/145C/450C/450CTL										
Serial No.:	50298-285/50322-356										
Site:	Clarion										
Full Scale:	200	ppb									
2% of Full Scale:	4	ppb									
Date:	October 25, 2001										
Zero Set Pt Prior:	n.a.										
Span Set Pt Prior:	n.a.										
Zero Set Pt Post:	n.a.										
Span Set Pt Post:	n.a.										
Zero/Span Adjust Made?:	no										
SO2 Calibration											
Known Conc.	Measured Conc.	Level	rp	d	slope	intercept	rsq	forecast	distance to least squares line	acceptable distance	Pass/Fail
0	0		n/a		0.9551	0.7527	0.9998	0.7527	0.7527	4.000	pass
25	25	1	0.0%					24.6292	0.3708	4.000	pass
35	35	2	0.0%					34.1797	0.8203	4.000	pass
94	90	Optional	-4.3%					90.5282	0.5282	4.000	pass
130	125	3	-3.8%					124.9103	0.0897	4.000	pass
168	160	4	-5%					161.2024653	1.2025	4.000	pass
TS Calibration											
Known Conc.	Measured Conc.	Level	rp	d	slope	intercept	rsq	forecast	distance to least squares line	acceptable distance	Pass/Fail
0	0		n/a		0.9551	0.7527	0.9998	0.7527	0.7527	4.000	pass
25	25	1	0.0%					24.6292	0.3708	4.000	pass
35	35	2	0.0%					34.1797	0.8203	4.000	pass
94	90	Optional	-4.3%					90.5282	0.5282	4.000	pass
130	125	3	-3.8%					124.9103	0.0897	4.000	pass
168	160	4	-5%					161.2024653	1.2025	4.000	pass
H2S Calibration											
Known Conc.	Measured Conc.	Level	rp	d	slope	intercept	rsq	forecast	distance to least squares line	acceptable distance	Pass/Fail
0	0		n/a		1.0339	-0.5259	0.9992	0.7527	0.7527	4.000	pass
25	23	1	-8.0%					24.6292	1.6292	4.000	pass
35	37	2	5.7%					34.1797	2.8203	4.000	pass
94	98	Optional	4.3%					90.5282	7.4718	4.000	pass
130	133	3	2.3%					124.9103	8.0897	4.000	pass
168	169	4	1%					161.2024653	7.7975	4.000	pass

5.7 Daily Auto Zero Span (Optional)

Each SO₂/TS/H₂S analyzer may be equipped with a supporting “on-site” SO₂ calibrator, if possible. This calibrator will perform automatic, daily “zero and span” checks. The “on-site” calibrator will not be used to calibrate the analyzer or correct any analyzer data but will be used instead to monitor the daily performance of the analyzer and possibly alert the department to malfunctions between site visits.

- 5.7.1 After the multi-point calibration has been completed, (see section 5.6) press the “**Run**” pushbutton on the analyzer front panel. This manually sets the analyzer into the “zero” mode and opens an internal solenoid valve which allows the analyzer to measure “zero air” supplied by the “on-site” calibrator. Allow the analyzer to sample zero air until a stable reading is achieved. Note the zero air value.
- 5.7.2 Press the “**Run**” pushbutton once again. This manually sets the analyzer into the “span” mode and opens a second solenoid valve, allowing the analyzer to sample “span gas” supplied by the “on-site” calibrator. Allow the analyzer to sample this span gas until a stable reading is achieved. Note the span gas value and press the “**Run**” pushbutton a third time to return the analyzer to the “operate” mode.
- 5.7.3 This measured zero and span concentration will now become the daily, expected “auto zero/span” values. Record this “auto zero/span” values in the logbook and on the “on-site” calibrator front panel. Supply the department’s data acquisition section with these values so that they can be entered into the data collection software.
- 5.7.4 The preprogrammed data logger will automatically switch the analyzer into a daily ‘zero and span’ sample period. The expected “zero and span” will be compared to the daily measured “zero and span” to assess the analyzer’s performance.

5.8 Preventive Maintenance

Along with standard good laboratory practice, refer to the TECO Model 45C/145C/450C/450CTL Instruction Manual. Schedules for preventive maintenance are contained in Chapters 5 and 7.

Summary of QA Procedures and Criteria for H ₂ S Monitors			
Requirement	Frequency	Acceptance	Notes
Multi-Point Calibration with at least 5 points with each gas standard, SO ₂ , TS and H ₂ S	At least once every 6 months, after failure of a QC check, after monitor maintenance	All points within 2% of full scale of the best fit straight line.	Zero gas and at least four upscale calibration points. 0-10%, 15-25%, 35-50%, 50-70%, & 70-90 of Full Scale
Zero and Span Check with SO ₂ , TS and H ₂ S	Every 2 weeks	Zero Drift ± 5 ppb Span Drift $\pm 15\%$	Invalidate data to last acceptable zero/span check, adjust analyzer, and perform multipoint calibration.
Multipoint audit H ₂ S only	25% of network per quarter	± 5 ppb on zero and $\pm 15\%$ difference on any of upscale points	Corrective action request initiated
Precision Checks SO ₂ , TS and H ₂ S	Every 2 weeks	$\pm 15\%$	$> \pm 12\%$ Recalibrate analyzer

