# WBEA – Standard Operating Procedure

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| **SOP Title** | **Procedures for operating TRS converters** |
| **SOP Number** | **WBEA SOP-ANA-009 TRS converter** |
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## Revision History

| Revision # | Date | Description | Author |
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## Introduction and Background

WBEA currently collects data for Total Reduced Sulphur (TRS) compounds continuously at a number of stations in the network. The process to measure TRS compounds continuously requires a high temperature converter to convert TRS compounds to SO2 to be measured by an SO2 analyzer. This procedure describes the maintenance steps to be taken on the high temperature converter only.

This SOP adheres to the requirements of the current Air Monitoring Directive (AMD) finalized by Alberta Environment in 1989. 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 or drafts of the AMD will be used as the benchmark for requirements and criteria for ambient air monitoring practices conducted in the WBEA network. Information used to write this procedure was also taken from sources identified in the reference section.

## Principle of the Method

Currently TRS is measured using heated conversion to reduce the TRS molecules to $SO_2$. The converted $SO_2$ molecules are then analyzed using continuous fluorescent $SO_2$ analyzers.

**TRS**

Total reduced Sulphur compounds include a variety of airborne compounds that contain Sulphur. Some of the common ones found in Alberta are; Carbonyl Sulphide (COS), Carbon Disulphide ($CS_2$) and Methyl Mercaptan ($CH_3SH$). TRS molecules will be oxidized to $SO_2$ in the presence of Oxygen and heat. This is accomplished by diverting the sample flow, after the SOx scrubber, through a TRS converter. The TRS converter is a Quartz tube heated to at least 800 degrees centigrade. The TRS molecules are then converted to $SO_2$ as illustrated in the following equation.

Specifically;

$$TRS + O_2 + heat \rightarrow SO_2 + H_2O$$

The converted $SO_2$ molecules then return to the standard $SO_2$ analyzer for detection and are reported as TRS.

## Measurement Range and Sensitivity

TRS converters are capable of converting concentrations in the range of most analyzers they are coupled with, typically 0 to 100 ppb.

The TRS converter does not have an effect on sensitivity, this comes from the analyzer measuring the converted $SO_2$ molecules. Because the range of TRS analyzers is lower, signal noise from the analyzer is more difficult to keep low; diligence is required on routine maintenance.

## Equipment and Apparatus

The following are available commercial converters configured specifically for the measurement of TRS, and are suitable for used in this method and are currently in use in the WBEA network:

- CD Nova model CDN 101 TRS converter
- JC Andelle model JC-102 Thermal Oxidizer

This list does not exclude the use of other equipment that has received the USEPA Reference and Equivalent Method designation.

## Interferences

The listed converters have no interferences to their operation.

## Precision and Accuracy

The analyzer measuring the $SO_2$ concentrations governs precision and accuracy for these systems. See SOP – WBEA-ANA-002 for details.

## Site Requirements

Site location for TRS converters is considered as to where they should be installed in the instrument rack. As the TRS converter is heated to a high temperature, it is typically located at the top of a rack above any other instrumentation in the rack. This is so the heat from the converter does not affect the performance of other analyzers in the rack.

## Installation Requirements

All the installation requirements are specified by the manufacturer in the installation procedures of the manual. General requirements listed below must also be followed.

Generally when installing the converter, follow the instructions found in the operation manual. One consideration is to keep the tubing from the analyzer and back to the analyzer as short as possible.

## Operating Parameters and Instrument Configuration

Converter Optimization – after the analyzer has been installed, The converter temperature must be optimized. This process should be completed annually. This task involves the following steps:

- Have the analyzer running and all connections made

- Connect the calibration gas source using a calibrator capable of generating selected concentrations
- Generate a concentration of $H_2S$ at 80% of full scale and wait for the analyzer response to stabilize
- Increase the converter temperature at increments of 5 degrees, and wait for stable response between each change. The response will start to drop once the optimum temperature has been passed.
- Decrease the converter temperature at increments of 5 degrees, and wait for stable response between each change. The response will start to drop once the optimum temperature has been passed.
- The median temperature between these two points is where the converter should be operated

## Operational and Maintenance Requirements

There are no routine maintenance procedures to be carried out on the TRS converter. Symptoms from the response of the analyzer can indicate some of the problems listed below:

- No response – heater no functioning
- Unlinear response – leak in the system
- Elevated reading during $SO_x$ scrubber check – spent $SO_x$ scrubber, replace with a recharged scrubber

## Calibration Requirement

The calibration procedure for $H_2S$/TRS converters is to check the temperature of the heated block or tube with an external temperature measuring device. This temperature is compared to the displayed temperature on the digital panel display of the converter. If the temperatures agree within the specified range given in the operations manual, then no action needs to be taken. If they differ, follow the troubleshooting steps in the operations manual.

## Reference Documents

- CD Nova model CDN101 TRS Converter Operations Manual
- JC Andelle model JC101 Thermal Oxidizer Operations Manual