Preparation and Field Use of the MIRAN SapphIRe 205B Analyzer for Nitrous Oxide Monitoring

USQ# N/A-4

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1.0 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this procedure is to ensure the proper use of the MIRAN SapphIRe 205B ambient air analyzer used primarily for nitrous oxide monitoring in support of field surveys performed in accordance with TF-OPS-IHT-007 and an industrial hygiene sampling plan.

1.2 Scope

The scope includes basic operation including setup, zeroing, and using the meter for real time nitrous oxide monitoring and data logging.

2.0 INFORMATION

2.1 General Information

The monitor uses an infrared detector to make direct measurements of nitrous oxide, volatile organic and inorganic compounds at the parts per million (ppm) level. The monitor takes real-time measurements, logs data, and can activate an alarm when measurements exceed preset limits.

The MIRAN SapphIRe 205B should be operated during nitrous oxide sampling within the following parameters:

- Concentration range: 0.2 to 100 ppm
- Temperature: 5 to 40 °C (41 to 104 °F)
- Operating time: 4 hours
- Charge time: 4 hours
- Accuracy: ± 10%
- Relative humidity: 5 to 95% (non-condensing)
- Response time: 20 seconds maximum
- Warm-up time: 30 minutes
- Intrinsically safe: Class 1, Division 1, Groups B, C, D, and Temperature class T4.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

3.1.1 The weight of the MIRAN is about 24 lbs. and care needs to be exercised in handling it to avoid slips, trips and falls as well as a back injury.

3.1.2 The wand is a potential eye hazard.

3.2 Equipment Safety

CAUTION - Some compounds may degrade the cell windows (e.g., 250 ppm ammonia, 100 ppm diethylamine, 100 ppm dimethylamine, 100 ppm ethanolamine, 100 ppm hydrogen cyanide, 100 ppm hydrogen fluoride and 100 ppm methylamine).

3.2.1 For the reasons noted in the “CAUTION” above, before taking source readings, monitor for the VOC and ammonia concentration using another instrument, (e.g., ppbRAE, iTX, MultiRAE PRO).

CAUTION - Selecting “2=Clear all” in the “MEMORY MENU” will erase all of the report formats that come pre-loaded in the MIRAN.

3.3 Radiation and Contamination Control

3.3.1 Planned work in radiological areas must be approved by Radiological Control personnel per the Radiological Risk Screening procedure TFC-ESHQ-RP-RWP-C-01.

When performed without a formal work package or approved procedure (i.e., Level 3 or 4 work), this procedure is limited to radiological areas and work activities permitted by a low risk Radiological Work Permit (RWP).

3.3.2 Filtration requirements for air monitoring equipment.

- A radiological particulate pre-filter (1~3 micron pore size, 25 mm diameter) when monitoring in a Contamination Area (CA), High Contamination Area (HCA), or Airborne Radioactivity Area (ARA), if instrument is capable. Not required, but encouraged in posted Radiological Buffer Areas (RBA)
3.3 Radiation and Contamination Control (Cont.)

- The “Bacterial Air Vent” filter (manufactured by Pall – Galman Laboratory) ahead of the radiological filter when monitoring from unfiltered tank systems. This is a sealed filter that cannot be opened for radiological survey purposes, in this case, dispose of as low level radioactive material waste if needed
- The use of parallel, sacrificial sorbent tubes or sample media, or multiple filters may be necessary depending on intended use and equipment parameters. A specific radiological Release Survey Plan (RSP) would need to address this allowance.

3.3.3 Before conducting sampling or monitoring, contact the responsible Radiological Control personnel for the facility or area to determine any specific survey or monitoring requirements.
- Pre, during, and post contamination survey requirements
- Any applicable RSP’s for your specific equipment or task
- Alternative survey or monitoring needs to support the radiological release survey process.

3.3.4 Comply with the requirements set forth by the RWP, HPT coverage, Release Survey Plan (RSP), and any other applicable procedures as determined above.

3.3.5 When exiting radiological areas where no HPT coverage was provided, inform the radiological control personnel of the use/history for the equipment being presented (e.g., only sampled air in the Contamination Area, No known history of contamination based on use, etc.) to aid them in properly evaluating the radiological release criteria needed.

3.3.6 Samples collected in a radiological area shall not be removed from the facility, transported by personnel, or submitted to an analytical laboratory until they have been evaluated by an HPT in accordance with approved procedures.

3.4 Environmental

3.4.1 If any of the filter papers associated with the MIRAN Sapphire 205B are to be discarded after use, follow operating procedure TO-100-052, “Perform Waste Generation, Segregation, Accumulation and Clean-up” for disposal instructions.
4.0 PREREQUISITES

4.1 Performance Documents

The following documents may be needed to perform this procedure:
- MIRAN 205B Series SapphIRe Portable Ambient Air Analyzers, Instruction Manual (02/27/2004 edition or later)
- Site Form A-6003-860, “IH DRI MONITORING FIELD LOG” form or approved equivalent
- Site Form A-6003-861, IH DRI “FUNCTIONAL TEST DATA”
- TFC-BSM-IRM_DC-C-02, “Records Management”
- TFC-ESHQ-S_IH-C-46, “Industrial Hygiene Reporting and Records Management”
- TFC-ESHQ-RP_RWP-C-03, “ALARA Work Planning”
- TF-OPS-IHT-007, “Using Direct Reading Instruments.”

4.2 Field Preparation

4.2.1 **PERFORM** a review of applicable industrial hygiene sampling plan prior to execution of this procedure.
5.0 PROCEDURE

5.1 Setup and Operation of the MIRAN SapphIRe 205B

5.1.1 CHECK that the maintenance calibration date on the sticker from the calibration facility is current.

5.1.2 IF calibration is past due, RETURN the monitor to the equipment custodian with a completed green tag, i.e., “IH Instrument Service Tag” (BT-6004-019) checking the box next to “Scheduled Maintenance Calibration.

NOTE – A fully charged battery will indicate 4 hours or greater.

5.1.3 CHECK for a fully charged battery by pressing the “CONTROL” key and observing “Battery” use.

5.1.4 WARM UP the MIRAN for a minimum of 30 minutes by pressing the “ON/OFF” key to start it.

5.1.5 IF a “WARNING” message appears regarding its “Last factory service performed: (date)”, PRESS the “ENTER” (or “SELECT”) key to continue.

5.1.6 AT the “MAIN MENU” screen, PRESS the “2 = Change gas” option on the keypad.

5.1.7 AT the “Select applic” menu, PRESS the “Enter = Other” option on the keypad.

5.1.8 AT the “APPLIC MENU,” PRESS the “1 = Standard lib” option on the keypad.

5.1.9 AT the “STANDARD LIB” screen, PRESS the “Enter = Search” option.

5.1.10 ENTER “N2O” using the keypad by pressing “5” first, then “2” (“N2O” will be displayed) AND

PRESS “ENTER” on the keypad to accept this chemical.

5.1.10.1 CONFIRM “N2O” is displayed in the left-hand side of the screen under “CURRENT APPLICATION.”

5.1.11 AT the “MAIN MENU,” PRESS the “3 = Site info” option.
5.1 Setup and Operation of the MIRAN SappHIRE 205B (Cont.)

NOTE - If another site has already been entered, this will initiate a warning that putting in a “new site” will cause the loss of the previous data.

5.1.12 AT the “SITE MENU” screen, PRESS the “1 = New site” option.

5.1.13 IF the previous site data is no longer needed, PRESS “ENTER” to continue to start a new sampling site.

NOTE - The space key is located on the “9” keypad as “SP” and the up arrow acts as a backspace erase key.

5.1.14 ENTER the site name (e.g., “C FARM”) using the keypad AND PRESS either the “SELECT” (or “ENTER”) key to accept this entry.

5.1.14.1 CONFIRM the site name is displayed in the left-hand side of the screen under “SUMMARY.”

5.1.15 PRESS the “ESC” key to return to the “MAIN MENU”.

5.1.16 ZERO the MIRAN as follows:

5.1.16.1 ORIENT the equipment horizontally for the most stable readings when possible.

5.1.17 ENSURE that the protective cap is removed from the outlet port, (i.e., “OUT”).

5.1.18 AT the “MAIN MENU,” PRESS the “1 = Analyze/Start” key AND CONFIRM the display reads “745.0 mmHg at the “Pressure compensation” screen.”

5.1.19 PRESS the “ENTER” key.

5.1.19.1 IF the display does not read “745.0 mmHg,” PRESS the “1 = Change” key to change it AND PRESS “ENTER” after keying in the correct pressure.

5.1.20 AT the “ZERO MENU” screen, PRESS the “1 = New zero” option.
5.1 Setup and Operation of the MIRAN SapphIRe 205B (Cont.)

5.1.21 **CHECK** that zero filter (i.e., “chemical filter”) has no more than 30 cycles of use (count the hash marks; one hash mark per cycle).

5.1.21.1 **AT** the command “Install chemical filter,” **ATTACH** the zero filter to the wand **AND**

**PRESS** the “Enter = Continue” option.

5.1.21.2 **WAIT** at least 60 seconds for the sample cell to purge and zero.

5.1.21.3 **LOG** on the zero filter that has been used for this step by making a hash mark and placing it in a sealed plastic bag.

5.1.21.4 **IF** the “Save this zero?” message appears, and “Status: Valid” is displayed, **PRESS** “ENTER” to save.

a. **IF** “Status: Valid” is not displayed, **PRESS** “1” to repeat zero.

5.1.21.5 **AT** the command “Install particulate filter”, **REPLACE** the zero filter with the HEPA filter on the wand **AND**

**PRESS** “ENTER” to continue.

5.1.21.6 **WAIT** 60 seconds for the sample cell to purge and fill.

5.1.22 **PERFORM** a pre-function check as follows:

**NOTE** - Readings are taken 20 times a second and the concentration on the screen is updated every half second.

5.1.22.1 **CONFIRM** the MIRAN SapphIRe is now sampling as indicated by the black bands both above and below the left portion of the screen.
5.1 Setup and Operation of the MIRAN SapphIRe 205B (Cont.)

5.1.22.2 AT the “ANALYSIS MENU,” PRESS the “3 = Location menu.”

NOTE - The current location sampled will be displayed in the lower bottom bar.

5.1.22.3 IF NOT in the system, ADD the two locations, “PRE LAB” and “POST LAB” individually to the location menu by performing the following:

a. PRESS the “2 = Add or search” key.

b. ENTER the location letters.

c. PRESS “SELECT.”

d. ADD other locations as needed.

5.1.22.4 ENSURE the calibration connector is secured in place at the end of the wand and the sample location (i.e., “PRE LAB”) is in place in the lower black bar of the screen by pressing “6=Previous” or “9=Next.”

5.1.23 PERFORM a function check as follows:

5.1.23.1 CHECK that the N2O calibration gas has not expired.

5.1.23.2 ATTACH the calibration connection AND APPLY the 25 ppm N2O gas via a minimum 25 L Tedlar bag, pressure valve set at 6 lpm or demand valve.

5.1.23.3 WAIT for the reading to stabilize AND ENSURE it is within +/- 10% of the bump gas concentration.

5.1.23.4 IF reading is not within +/- 10% of the bump gas concentration:

a. DISCONNECT the N2O gas.

b. ALLOW the concentration to return to “0 ppm”.

c. ATTEMPT to function check again by performing Steps 5.1.23.2 and 5.1.23.3.
5.1 Setup and Operation of the MIRAN SapphIRe 205B (Cont.)

5.1.23.5 IF reading fails again, troubleshoot AND
PERFORM Step 5.1.23.2 and 5.1.23.3 again.

5.1.23.6 IF the gas readings is not within +/- 10% of the bump gas concentration, RETURN the meter to the equipment custodian with a completed green tag, (i.e., “IH Instrument Service Tag” (BT-6004-019) indicating “Function Check Failure.”)

5.1.23.7 REMOVE the calibration connection piece from the Tedlar bag, pressure or demand valve.

5.1.24 USE in survey mode as follows:

5.1.24.1 AT the “ANALYSIS MENU” screen, PRESS “3 = Location”, then “2 = Add or search” and ENTER the location names to be sampled using the keypad AND
PRESS the “ENTER” key.

5.1.24.2 CONFIRM the current sampling location is displayed in the bottom bar of the left-hand screen.

NOTE - When changing sites, (e.g., Farms) the monitor should be zeroed at the new site.

5.1.24.3 ZERO the monitor by pressing “2 = Zero” near the location to be sampled but outside the Farm.

5.1.24.4 AT the “ZERO MENU”, PRESS the “1 = New zero” key.

5.1.24.5 AT the command “Install chemical filter,” REMOVE the HEPA filter AND
ATTACH the zeroing filter to the wand.

5.1.24.6 PRESS the “SELECT” key on the keypad to accept the “Enter = Continue” command.

5.1.24.7 WAIT at least 60 seconds for the sample cell to purge and zero.
5.1 Setup and Operation of the MIRAN SapphIRe 205B (Cont.)

5.1.24.8 IF the “Save this zero?” message appears and “Status: Valid” is displayed, PRESS “ENTER” to save.

a. IF “Status: Valid” is not displayed, PRESS “1 = New zero” to repeat zero.

5.1.24.9 AT the command, “Install particulate filter”, REPLACE the zero filter with the HEPA filter on the wand AND PRESS “ENTER” to continue.

5.1.24.10 WAIT 60 seconds for the sample cell to purge and fill.

5.1.24.11 LOG ON the zero filter that it has been used for this step by making a hash mark and placing it in a sealed plastic bag.

5.1.24.12 CONFIRM the MIRAN SapphIRe 205B is now sampling as indicated by the black bands both above and below the left portion of the screen.

NOTE - See Section 5.2 for further instructions on how to log nitrous oxide readings for specific point sweeps.

CAUTION

Some compounds may degrade the cell windows (e.g., 250 ppm ammonia, 100 ppm diethylamine, 100 ppm dimethylamine, 100 ppm ethanolamine, 100 ppm hydrogen cyanide, 100 ppm hydrogen fluoride and 100 ppm methylamine).

5.1.25 USE another instrument (e.g., ppbRAE, iTX, and MultiRAE PRO) AND MONITOR for the VOC and ammonia concentration prior to using the MIRAN SapphIRe 205B for source monitoring.

5.1.26 CONDUCT the survey as indicated by the sampling plan.
5.1 Setup and Operation of the MIRAN SappHIRE 205B (Cont.)

5.1.27 AT the end of the survey, PERFORM the following:

5.1.27.1 PRESS “ESC” AND

ZERO the monitor by orienting the equipment horizontally for the most stable readings when possible, following Steps 5.1.16 through 5.1.21.4.

5.1.27.2 CONDUCT a post-function check as outlined in Steps 5.1.21.5 through 5.1.23.3 with the calibration connector attached and “POST LAB” in the lower left hand bar.

5.1.28 RECORD the results in the Site-Wide Industrial Hygiene Database or if the Site-Wide database is not available, use the IH DRI MONITORING FIELD LOG form (A-6003-860) and IH DRI FUNCTIONAL TEST DATA form (A-6003-861) or an approved equivalent.

5.1.29 PRESS “ESC” to get back to the “MAIN MENU.”

5.1.30 PROVIDE completed monitoring forms and associated field records to the Project Industrial Hygienist within 2 working days.
5.2 Setting up and Conducting Data Logging

5.2.1 AT the “MAIN MENU” screen, PRESS “4= Config/Setup”.

5.2.2 AT the “SETUP MENU” display, PRESS “4=Clock”.

5.2.3 CHECK that the date and time are correct by looking at this information on the left-hand side of the screen AND

IF the date and time are not correct, PERFORM the following:

5.2.3.1 ENTER the right date using a combination of numbers, letters and the up or down arrows on the keypad AND

PRESS the “ENTER” key.

5.2.3.2 WHEN the time is displayed, ENTER the correct time using the combination of numbers and the up or down arrows on the keypad AND

PRESS the “ENTER” key.

a. CONFIRM the correct date and is displayed in the “SUMMARY” screen when returning to the “SETUP MENU” screen.

5.2.4 AT the “SETUP MENU” display, PRESS “5=Analysis”.

5.2.5 AT the “ANALYSIS SETUP” screen, PRESS “1=Logging”.

5.2.6 AT the “LOG MENU” display, SET the logging parameters as indicated by the sampling plan.
5.2 Setting up and Conducting Data Logging (Cont.)

5.2.7 FOR logging short duration specific point sweeps, CONFIGURE the MIRAN to the following parameters.

5.2.7.1 PRESS “1=Log mode” and then “2=Single sample”.

5.2.7.2 PRESS “2=Log interval” and using the keypad, ENTER “240” seconds AND PRESS “ENTER”.

5.2.7.3 PRESS “3=Log start”, then “1=Manual”.

5.2.7.4 PRESS “4=Log store”, then “1=_Max”, “2=_Min” and “3=_Avg” until a check (✓) appears.

5.2.7.5 PRESS “ENTER” to accept the changes.

5.2.7.6 PRESS “5=Other parms” AND ENSURE that “1=_Auto repeat” and “2=_Auto save” are not checked.

a. IF checked, PRESS “1”, “2” AND PRESS “ENTER” to accept the changes.

5.2.7.7 AT the “LOG MENU” screen, PRESS “ESC”, then “3=Compensations”.

5.2.7.8 SELECT “2=_Pressure” and “4=_Humidity” until a check (✓) appears.

5.2.7.9 PRESS the “ENTER” key to accept the changes.

5.2.7.10 AT the “ANALYSIS SETUP” screen, PRESS the down arrow on the keypad.
5.2 Setting up and Conducting Data Logging (Cont.)

5.2.7.11 SELECT “1=Batch sample”, then “2=Enabled” AND CONFIRM a check (✓) mark appears next to “Batch sampling” at the left-side of the screen under “SUMMARY”.

5.2.7.12 PRESS “ESC” repeatedly until the “MAIN MENU” screen appears.

5.2.7.13 REPEAT steps 5.1.18 through 5.1.21.6.

5.2.7.14 CONFIRM the MIRAN SapphIRe is now monitoring as indicated by the black bands both above and below the left portion of the screen.

5.2.7.15 CHOOSE the first location to be logged by pressing either “6=Previous” or “9=Next” until the location appears in the lower black bar of the screen.

5.2.7.16 WITH the sampling wand at the location of interest, START logging by pressing “1=Log” AND CONFIRM the following:

- “Log in progress” flashes in the display
- After the logging interval, the location advances to the next one.

5.2.7.17 AFTER logging is finished at that location, CHOOSE either “Enter=Save” to store the data point in memory or “1=Repeat” to re-sample.
5.3 Downloading Data

**Download logged data to a PC.**

NOTE - These steps will download logged data to a PC that has the software installed, (i.e., “ThermoConnect”).

5.3.1 **STOP** operation of the MIRAN by pressing the “ESC” key until the “MAIN MENU” appears.

5.3.2 **AT** the “MAIN MENU” screen, **PRESS** the “5= Report/Data” key.

5.3.3 **AT** the “REPORT/DATA” screen, **PRESS** the “1 = Select site” key.

5.3.4 **AT** the “SITE LIST” screen, **SELECT** the appropriate site.

5.3.5 **CONNECT** the data transfer cable to the MIRAN.

5.3.6 **AT** the “REPORT/DATA” screen, **PRESS** the “3 = Data transfer” key.

5.3.7 **AT** the “DATA TRANSFER” screen, **PRESS** the “3 = Send/receive” key.

5.3.8 **OPEN** the “ThermoConnect” software program.

5.3.9 **IF** the “Edit” menu appears, **CHOOSE** “Options” under “Analyzer Options” AND

**CONFIRM** “MIRAN SappIRe” is checked.

5.3.9.1 **PRESS** “OK”.

5.3.10 **SELECT** from the “Transfer” menu, “Receive to file,” **THEN**

**SELECT** “Logged Site Data”.

5.3.11 **NAME** the file to be saved in the “File name” box AND

**CLICK** on “Save”.

5.3.12 **OPEN** the file by double clicking on it.
5.3 Downloading Data (Cont.)

Clear the memory on the analyzer.

NOTE - The following step will clear the memory when the data transfer has been completed.

5.3.13 PRESS the “ESC” key until the “REPORT/DATA” screen appears AND PRESS the “4 = Memory clear” key.

CAUTION

Selecting “2=Clear all” in the “MEMORY MENU” will erase all of the report formats that come pre-loaded in the MIRAN.

5.3.14 AT the “MEMORY MENU” screen, SELECT “1 = Clear logged sites and data”.

5.3.15 AT the “!!! WARNING!!!” screen, PRESS the “ENTER” key AND CONFIRM the left-hand screen entitled “SUMMARY,” “Memory” indicates “100 % free.”

5.3.16 TURN OFF the MIRAN by pressing the “ON/OFF” key.

5.3.17 CHARGE the unit by plugging the battery charger lead into the “INPUT POWER” connection on the top right-hand side of the unit & charger with an A/C outlet.
5.4 Records

5.4.1 PERFORM the following for records identified within this procedure.

5.4.1.1 RECORD the number of times the record was generated in applicable column

OR

PLACE a check mark (✓) in the N/A column.

5.4.1.2 SUBMIT the package to IH.

<table>
<thead>
<tr>
<th>Records Submittal Checklist</th>
<th>Number of times completed</th>
<th>N/A (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Hygiene surveys (including applicable forms and data.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEND the completed records with Records Submittal Checklist attached to the Safety and Health Program for records retention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signature / Print (First and Last) / Date</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE - The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.