SAN JOAQUIN VALLEY UNIFIED
AIR POLLUTION CONTROL DISTRICT
COMPLIANCE DEPARTMENT

COM #1151

APPROVED: **SIGNED** **DATE:** **June 27, 2008**
Jon Adams
Director of Compliance

TITLE: **VOLATILE ORGANIC COMPOUND ANALYZERS**

SUBJECT: **POLICY GUIDELINES FOR THE USE OF DISTRICT VOLATILE ORGANIC COMPOUND (VOC) ANALZERS**

OBJECTIVE:

It is the objective of this policy to provide guidelines for the use of District VOC analyzers to ensure accurate results to provide fair and enforceable results.

PURPOSE:

The purpose of this policy is to establish fair, efficient, and consistent usage of VOC analyzers throughout the District, and to establish a calibration policy that will ensure instrument precision and accuracy. The policy will provide instruction for proper warm up and operation to ensure usage consistent with EPA Method 21 (copy attached).

POLICY STATEMENT:

VOC ANALYZER TYPES:

The District routinely uses three analyzers to detect and measure emissions of volatile organic compounds (VOC). Facilities that require the use of these instruments include gasoline bulk plants, oil fields, refineries and gas plants, oil pipeline stations, and wineries. These instruments provide reliable and accurate service with proper calibration and usage.

The three instruments can be divided into two categories. The Bacharach TLV (Threshold Limit Value) "Sniffer" and RKI Eagle utilize an electrical resistance sensor to detect hydrocarbons. The sensor's resistance changes in the presence of burning hydrocarbons and this change is measured and converted to a meter

reading in ppm. The TVA-1000 (Toxic Vapor Analyzer) detects changes in the way a hydrogen flame burns in the presence of hydrocarbons and displays the changes as ppm. The TVA is much quicker; more precise, has a screen in the handle to make viewing easier, but is relatively heavy, and requires daily calibration and some special operation.

INSPECTOR SAFETY:

All of these instruments are safe to use in all environments and are rated as "Intrinsically Safe". However, inspectors are reminded that safety requires attention. Checking for emissions puts compliance staff into industrial environments where things are potentially hot, toxic, caustic, under high pressure, unevenly floored, slippery, noisy, and often elevated. High-voltage, electrically driven equipment may start automatically. Inspectors are advised to remember that they are looking for leaks of potentially explosive mixtures, and shall follow the source and District safety policies. If in doubt about safety do not continue the inspection. If a hydrogen sulfide (H_2S) alarm sounds, the inspector shall discontinue the inspection and leave the area immediately. If possible, the inspector shall move across the wind to get out of an H_2S plume, then move upwind or to the designated evacuation area.

EPA METHOD 21 AND ANALYZER USAGE:

Almost all of the District rules (and EPA Method 21) define a leak as a reading "as methane" above a certain value, and Method 21 adds "at the interface". The "as methane" part means that no conversion is required to use the instruments; they are to be read directly. If the equipment is subject to a rule and does not enjoy an exemption, then a reading above the threshold is a leak. "At the interface" means that the probe opening should be placed at the potential leak source. The probe should be at the hatch seal, at the valve stem, at the seal on the PV vent (not at the screen), or at the flange seal (not at the outside of the flange). There are some exceptions to this. If the inspection includes a rotating shaft on a pump or compressor, the inspector should take care not touch the shaft with the probe. The shaft might be damaged, and the probe might get tangled in the rotating machinery. If it is safe to do so, the inspector shall place the probe within 1 centimeter of the shaft seal. Inspectors are not to wear loose fitting clothes or jewelry that might get tangled in moveable parts. Long hair shall be tied back out of the way. To inspect the end of an open pipe, drain, or P/V exhaust pipe, the inspector shall not place the probe inside the enclosure. Instead, the tip shall be placed at the approximate center of the opening to the atmosphere.

Place the probe in the estimated direction of the leak flow to get the highest reading.

The value of a leak can vary widely over a short period of time. Process rates and pressures change quickly and a leak rate may not be possible to duplicate. Duplication is not required for a violation; the inspector shall take the highest reading seen for a given component. It is important to keep the probe at a potential leak source long enough to ensure the maximum reading is attained, this should be approximately twice the instrument response time. For the Bacharach TLV and RKI Eagle this is approximately 1 minute. For the TVA 1000 this is approximately 10 seconds.

CALIBRATION REQUIREMENTS:

The Eagle and TLV units must be calibrated on a monthly basis to ensure precision and accuracy. This rate is more frequent then the manufacturer's recommendations and will produce repetitive results. Each region will have one or two people that are trained in this calibration. To minimize the impact on the calibrator's time, it is very important that the instruments be made available for this calibration on time and with a full charge. Because the calibration is to be done by those trained to do it, those instructions are not included here.

The TVA must be calibrated each day that it is used, or the day before to eliminate coming into the office just for the instrument. Calibration instructions follow the usage section for the TVA

The instruments are to be calibrated on EPA Protocol 1 gases with concentrations similar to the violation threshold for the equipment to be checked. For wineries this should be approximately 1000 ppm, for oil field operations and pipeline inspections this gas should be approximately 10,000 ppm. Facilities subject to Rules 4409 and 4455 should use the 10,000-ppm gas. The rationale for the latter is that even though the rules have leak definitions as low as 1000 ppm, these are enforced as a percentage of components checked. These rules call for immediate violations for emissions in excess of higher values. Permit conditions may specify lower leak thresholds and appropriate calibration gas shall be used.

The TLVs can be calibrated on 10,000 ppm and 1000 ppm gasses using the different ranges.

If the source asks us to demonstrate the accuracy of our instruments we will do so provided:

a. They have the calibration gas that meets Method 21 requirements, regulator, and equipment at hand (we will wait no more than 15 minutes), and,
b. The gas is in the original container, is properly labeled, and is not expired, and,
c. The gas is of appropriate concentration for the task.

The inspector reserves the right to deny the source's requests if any of the above requirements are not met.

If the instrument does not read the calibration gas within 10% of the gas value (as is required by Method 21) it will not be used for further inspection until checked in the District office.

GENERAL USAGE GUIDELINES:

The instruments differ in many ways but all continuously pull a gas sample though a probe. All are susceptible to probe plugging and will be damaged if liquid is pulled into the machine. Care must be taken to avoid dirt, oil, grease, or liquids that may plug the probe and get into the instrument. Even with care, the probe will require periodic cleaning. All units have an in-line filter that should be inspected before each use to determine if replacement is required. The TVA probe should be dis-assembled several times during a day's operating so that any dirt can be removed from the sintered-metal filter.

Another similarity between all of these units is that the sample takes time to go up the line and into the analyzer. There is a noticeable delay between sampling a leak and seeing the reading on the screen. Inspectors must take this delay into account in the search for leaks. If the inspection rate is too fast, the instrument will not have time to analyze the material and the effort will be biased toward never finding any but the largest leaks. Inspectors must allow a few seconds at each sample point to let the instrument catch up. However, even with slower sampling, the inspector will probably not be sampling the actual leak when the instrument readings begin to change. When an increase is detected, the probe should be moved back to the previous points and left until the maximum reading is obtained. Use the maximum number seen as the reading for that component. If the maximum is over the leak threshold, a leak has been detected.

Operation of the RKI Eagle

Once in the field and in an area clear of contamination, turn the unit on with the Power/Enter key. The instrument will go through a self-check and, if no errors are detected, will be ready for use in 3-5 minutes.

Connect the sample line and probe, and check the probe filter.

The start up screen also displays the battery life. The instrument should not be used below 4.5 volts. The Eagle can use either alkaline or rechargeable batteries, but the battery types should never be mixed. The unit will show a low battery warning 15 minutes before the rechargeable batteries are gone and about 3 hours before the alkaline cells expire. A full charge should last at least 18 hours, and a fresh set of alkaline

batteries should run for more than 30 hours. The Ni-Cd cells will be re-charged in 8-12 hours. The Eagle chargers will not over-charge the batteries.

Because the battery types discharge at different rates, the time between a low battery warning and a low battery alarm will differ. For this reason, a battery type switch will require an update of the instrument setting. Turn the instrument off before the switch is made and switch the batteries. Hold the "AIR" and "SHIFT" buttons down and turn the unit on with the "POWER/ENTER" key. The unit will come on in "Setup Mode". Using the up and down arrow keys put the curser opposite BATTERY TYPE, and push ENTER. Using the arrow keys toggle between alkaline and Ni-Cd, and press the ENTER key. The word END will appear, and in a few seconds the instrument will return to "Setup Mode". Using the arrow keys, scroll to "START MEASUREMENT" and select ENTER.

Prior to use, use the LEL/PPM key to select parts per million rather than Lower Explosive Limit. This is critical to find leaks. An operator that left the reading on LEL would never see readings at the leak definition. An instrument reading of "40" is really 40% of the LEL and is well over 10,000 ppm.

The inspector shall monitor the VOC and readings during operation and backtrack as required to determine the source of any leaks detected. The H_2S readings should be watched as well for safety.

The instrument will have an audible alarm and lights will flash when the VOC reaches approximately 5000 ppm. Pushing the RESET/SILENCE button once will silence the. Another push will turn off the lights. However, if the probe is still full of gas the alarm will go off again. It should be noted that these are the standard settings. The alarm points are adjustable from Setup Mode identified above.

If a leak is detected, record the highest reading, the component leaking, the precise leak location. The operator should provide a tag to mark the leak.

At the end of the day or at lunch, turn the unit off by holding down the POWER/ENTER button for several seconds. The unit will beep several times and then the screen will read "Goodbye".

Some of the long probes supplied with the Eagles include dilution holes about 4" from the tip. The instrument will not read correctly if these

holes are left open. Cover the holes with tape before use, and periodically check the condition of the tape.

Operation of the TLV Sniffer

Once in the field and in an area clear of contamination, turn the unit on with the knob on the right side of the display. Turn the knob to "Battery Check" and ensure that the battery charge is adequate. Move the knob to the desired scale. On the "100" scale the instrument reads 50,000 ppm at full scale. On the "10" scale, the instrument reads 5000 ppm at full scale, with a 500 ppm full-scale reading on the "1" scale. The TLVs are calibrated with both 10,000-ppm gas and 1000-ppm gas on the 100 and 10 scales, respectively.

Connect the sample line and probe and check the probe filter.

The TLV will respond more quickly on the lower scales, and the 10 scale is ideal for surveying for leaks. If a leak is detected, switch to the 100 scale to record the highest reading.

After a 10-minute warm up the instrument is ready to use. As it continues to warm up and as the battery charge changes, the left-hand knob can be used periodically to set the needle to zero ppm when in clear air.

Some of TLV probes have a rubber O-ring that can be slid out of a groove to let dilution air into the machine. When the O-ring is moved the scale reading is 10 times the normal. The inspector should be sure that the O-ring is where you want it before you use the machine.

The TLV uses rechargeable Ni-Cd cells. The cells should be charged for 16 hours when fully discharged, should never be charged longer than 16 hours. The instrument will sound an alarm when the battery is low and should not be used until re-charged. If the battery charge is getting close to the low limit, the unit should be run to the alarm, shut off, and re-charged. The batteries will last longer and perform better if they are always run to the alarm before re-charging. A good set of batteries will give more than 8 hours of use.

The inspector shall watch the VOC readings during operation and backtrack as required to determine the source of any leaks detected.

When in very close proximity, some radio communications (walkie-talkies) can trigger a false high reading and may set off the alarm. This is characterized by needle swing that is much faster than that caused by

the worst leak. The needle will drop just as fast when the radio is not in use. If radio interference is suspected, the inspector should re-check the immediate area for leaks and look around for someone using a radio.

If a leak is detected record the highest reading.

When the inspection is complete, at the end of the day, or at lunch, turn the unit off by rotating the right-hand knob to off.

Operation and Calibration of the TVA-1000

This instrument will operate for a full day on a battery charge, and the user must ensure that it has been charged prior to use. The battery must be removed from the back of the instrument in order to charge. The inspector will use the special wrench in the tool kit to open the battery case. The battery fits snugly into the compartment and a tape "handle" has been made to allow the battery to be removed. When re-installing, ensure that the handle is up and the plug has been tucked into the side of the battery compartment. The compartment cover should close easily.

The TVA also consumes hydrogen, and the on-board tank must be re-filled prior to use. Do not store the unit with the hydrogen tank installed. The pressurized gas cylinder (bomb) must be re-filled before use, but will also last the entire day. There is a hydrogen fill adapter inside the case and this must be connected to the hydrogen storage bottle that is kept with the calibration gasses. Attach the adapter to the bottle and the bomb to the adapter. Note that the both the bomb and adapter have left-handed threads. Once everything is tight, open the bottle valve, and then open the adapter valve. Wait at least 3 minutes as the bomb fills very slowly. After filling, close the adapter and bottle valves, unscrew the bomb, and open the valve on the adapter to relieve the pressure. Then remove the adapter and replace the bottle cover on the hydrogen. Once the bomb is filled, install it in the TVA (remember the left-hand threads). Turn the red hydrogen supply valve to on.

Connect the sample and electrical lines to the unit, and check the probe filter. Under normal operation the TVA readings will vary constantly. If no VOC is detected the readings will be very close to 0 ppm. If the same reading is noted for more than a few seconds the probe is probably plugged or the filter is dirty and should be cleaned.

The TVA is heavier than the other units and is only comfortable to use with a backpack. There are some pipe cleaners in the supplied backpack to clean the probe. The unit has an extension wand that can be added to the probe to allow measurement up to 3' from the handle.

Push the “On” button and wait for the instrument to perform a self-check. If any errors are detected, contact Dave Baldwin or Mike Oldershaw. Once the check is successfully completed, push the “Control” button and then select “Turn Pump On”. The pump will be audible, and should be allowed to run for a few minutes before attempting to ignite the hydrogen flame. While the TVA is warming up, assemble the calibration equipment and gas. Once the unit has operated for a few minutes, push the Control button and select “Ignite”. The pump will momentarily stop and then start again. If the unit successfully ignites, select “Run” (#1) from the Main Menu screen that will appear. VOC readings will be seen on the screens of the base unit and in the handle. If it does not ignite, an alarm will sound and no reading will be seen except the message “FID Flameout! Ignite again”. Push the “Exit” key to clear the alarm and return to the Control key to re-ignite. Repeat as required. Generally, once the unit has been lit, it will re-light readily during a days use. It is much easier to light if the hydrogen has had a chance to permeate through the machine.

The instrument has three programmable alarms that will sound when a certain VOC readings are reached. The display will also blink. The low alarm ppm value can be set in the instrument menu and should be set below the leak threshold. The higher alarm may be set at a higher threshold. These alarms are adjustable from the “Alarm Settings” section of the “Setup Menu” (from the Main Menu).

If the instrument samples a very rich stream, the high VOC will extinguish the hydrogen flame, an alarm will sound, and the screen will display “FID Flameout” or “999.9”. Silence the alarm with the Exit key and re-light the flame from the base unit using the “Control” key, and then select “Ignite”.

To calibrate the unit, make sure that it has been running for several minutes and select the Exit Key, and the Main Menu will appear. Select “Setup” (#2), then “Calibrations” (#1). Select “Gas Concentration” (#4) to make sure that the unit is set up for the gas intended for use. The value of the calibration gas must be accurately specified or none of the subsequent readings will be meaningful. If the concentration is not correct select enter, and follow direction to specify the correct concentration. Once the calibration gas is selected, select “Background” from the menu, and push enter to begin checking the background gas value. This will allow the unit to set the ambient air as a reading of 0 VOC. It is critical that the calibration gas be kept away from the unit during this process. The TVA menu will ask that the background gas be

applied. Select Enter and allow the unit to operate for 30 seconds or so. The readings on the screen do not indicate ppm; they are internal instrument numbers and will vary somewhat during normal operation. After 30 seconds or so, if these numbers are relatively stable, push the Enter button.

This process will be repeated for the span gas. Attach the regulator to the appropriate gas bottle, make sure it is tight and obtain the appropriate calibration gas bag. If the bag is not empty, empty it out by opening the valve two turns and rolling up the bag from the bottom (go to an unused section of the office or outside to do this). Re-fill the bag with the cal gas and empty again. Repeat once more. Be careful to close the valve to avoid pulling in air when the bag is empty. When the bag is full of the pure gas, select "Span" from the menu, press Enter, and when the instrument calls for the gas open the bag and attach it to the probe. If the bag is attached before the valve is opened, the TVA will flame out. Just as before, allow the instrument to run for 30 seconds or so to stabilize and then push Enter. Remove the bag, close the bag valve, and Exit from the Calibration and Setup menus. Select Run from the Main Menu and the instrument should be reading very close to 0 ppm. The readings will fluctuate under normal operation but should not climb above 10 ppm or so unless a leak is nearby. As a last confirmation of correct operation, open the valve on the gas bag and apply it to the probe. The instrument should read very close to the correct value. If not, repeat the span gas process.

Once the calibration is complete, turn the unit off by pushing the "Off" button and close the hydrogen valve. Disconnect the sample lines. Put the calibration equipment away (including the gas regulator). If the unit can be transported to the field in the backpack, inside the vehicle and strapped in a seatbelt, the case need not be taken. If it will ride in the back of a truck, put it back in the case.

Once in the field, re-assemble the unit, connect the lines, turn on the hydrogen, turn the unit on, wait for the self-check, and if successful, turn on the pump and light the unit. It will be ready for use in a few minutes. At the end of the day, dis-assemble the unit, clean the probe and stow everything in the case.

APPENDIX 1:

EPA Method 21 can be found at the following link:

http://www.epa.gov/ttn/emc/promgate/m-21.pdf