

BUSINESS CONFIDENTIAL

MEMORANDUM

VC exposure monitor
VINYL CHLORIDE

EVALUATION OF A JOHNSON-WILLIAMS "TLV SNIFFER"
FOR AIR ANALYSES

RECEIVED

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SUMMARY The manufacturer's calibration of a Johnson-Williams (J-W) "TLV Sniffer" combustible gas detector, which had been modified by the factory to read parts per million by volume of vinyl chloride in the air, was verified in the R/D Environmental Health Laboratory. Sampling of known concentrations of vinyl chloride in air in the range of 25 to 500 ppm confirmed that the instrument read to within ± 10 percent of the contained amount of vinyl chloride in air. (Present ACGIH TLV-200 ppm; while the MCA has recently proposed a TLV of 50 ppm.)

Contrary to the manufacturer's information the instrument was found to be subject to major errors due to changes in humidity in air. The Sniffer was zeroed with dry cylinder air and water was added to cylinder air to give approximately 60 percent relative humidity. The humidified air gave an indicated reading of 150 ppm as vinyl chloride on the meter. Conversely, low readings would result if the instrument were zeroed in high humidity air and then used to measure vinyl chloride in drier air.

The following points should be kept in mind when using the TLV Sniffer as a survey-type instrument:

1. All combustible organic gases and vapors will indicate on the Sniffer, not just vinyl chloride.
2. Changes in humidity can seriously affect the readings on the instruments.
3. The Sniffer requires atmospheric air for combustion - false readings will be obtained in air with reduced oxygen content or in inert atmospheres.
4. The purity and relative humidity of the air used to set the zero on the meter is a critical factor in obtaining reliable results with this instrument.

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INTRODUCTION Mr. D. A. Ellwood of the South Charleston Plant requested that we verify the calibration for vinyl chloride of a J-W TLV Sniffer manufactured by the Bacharach Instrument Co. The TLV Sniffer is a sensitive combustible gas and vapor detector with the usual instrument being calibrated in ppm by volume in air using hexane. The instrument tested was modified by the factory to give a scale reading from 0 to 300 ppm by volume of vinyl chloride in air. The regular Sniffer as supplied with a hexane calibration has a scale reading from 0 to 100 ppm.

The TLV Sniffer has a two-element sensing system which consists of an "active" and reference element in a Wheatstone bridge circuit. The "active" element has a catalytic-coating which oxidizes gas and vapor, changing the resistance of the element as compared to the reference element. Other features include a built-in sampling pump, an audible alarm, and provision for attaching a recorder, a three-position mode selector switch (X1, X10, X100), giving the instrument a range of 0 - 30,000 ppm vinyl chloride.

DISCUSSION The calibration of the J-W TLV Sniffer was checked by preparing static concentrations of vinyl chloride in the range of 25 to 500 ppm by volume in air using Saran plastic bags. Cylinder air was used to prepare the standards and to zero the instrument. The results of the tests are shown in Table I. The factory calibrations for vinyl chloride were found to be in good agreement with the known air standards. The data show that the Sniffer was indicating the concentration of vinyl chloride to within ± 10 percent of the contained amount over the range tested.

The zero setting on the Sniffer was made using cylinder air as the reference. When the sampling probe was removed from the cylinder air and allowed to aspirate air from the laboratory through this instrument a positive deflection of the meter needle was always observed indicating 30 to 80 ppm vinyl chloride. At first this was assumed to be caused by traces of organic vapors in the laboratory air. When the instrument was taken from the laboratory and placed in an office, essentially the same meter reading indicating 35 ppm vinyl chloride was observed in office air as was found in the laboratory.

This indicated that some other effect was being observed other than traces of organic vapors in the air. According to the manufacturer's instruction manual changes in temperature and humidity do not effect the Sniffer's performance. The instrument has two sensing elements, one a reference and the other the active element, incorporated into a Wheatstone bridge circuit. Air is drawn across both elements and temperature and humidity are supposed to affect both elements equally. The effect of humidity was evaluated by bubbling cylinder air through an impinger containing distilled water. Dry air was mixed with the water saturated air until a sample which would be equivalent to air containing 60 percent relative humidity at 24°C. The Sniffer was adjusted to zero with the dry cylinder air, then the moist air placed on the probe. The instrument responded to the moisture, indicating a vinyl chloride concentration of 150 ppm (Table I).

In addition to the moisture indication, the Sniffer is a combustible gas detector and will respond to any combustible gas or vapor in the air, not to just vinyl chloride. To demonstrate the effect of other vapors, 100 ppm by volume standards of acetone and hexane in air were analyzed on the Sniffer and the results are given in Table I.

The purity of the air used to set the meter needle to zero is a very important factor in the use of this instrument. If the air used to zero the instrument is relatively pure and at or below the relative humidity in the sampling area, then the reading taken will be on the safe side; i.e., increases in humidity or other combustible gases in the air to be sampled will indicate more vinyl chloride than is actually present. However, if air which contains a greater moisture content or some combustible gas or vapor in higher concentration than would be found in the sampling area is used to zero the Sniffer, then actual vinyl chloride concentrations could be underestimated. The use of this meter around steam emissions or sumps could result in erroneously high readings for vinyl chloride.

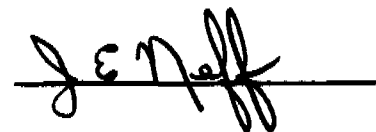
Attempts to use activated carbon to purify air at the sampling site to be used to zero the Sniffer were not totally successful. The 100 ppm standards of acetone and hexane in air were measured with the Sniffer and gave values of 132 and 235 ppm, respectively. A carbon tube was inserted between the standards and the Sniffer and results of 85 and 75 ppm, respectively, were obtained on the same samples. This may have been caused by the carbon restricting the air flow to the instrument causing a change in the sensing element rather than failure to adsorb the acetone and hexane.

CONCLUSIONS The TLV Sniffer accuracy for measuring vinyl chloride in air was within $\pm 10\%$ on concentrations over the range of 25 to 500 ppm using the same air to zero the instrument as was used to prepare the vinyl chloride standards. The following points should be emphasized to make sure the instrument is used in the proper manner as a survey-type instrument:

1. All combustible organic gases and vapors will indicate on the instrument, not just vinyl chloride.
2. Changes in humidity conditions will affect the readings on the instrument, with higher humidities giving a positive response on the meter.
3. The instrument requires atmospheric air for combustion — false readings are obtained in air with reduced oxygen content or in inert atmospheres.
4. The purity and humidity of the air used to set the zero reading on the meter is a critical factor in obtaining reliable results with this instrument.

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TABLE I

CALIBRATION OF J-W TLV SNIFFER

	<u>Prepared Conc., ppm</u>	<u>J and W Meter Conc., ppm</u>	<u>Scale Factor</u>
Vinyl Chloride	25	28	X1
"	50	57	X1
"	100	105	X1
"	100	107	X1
"	100	11	X10
"	300	295	X1
"	300	29	X10
"	500	50	X10
Acetone	100	132	X1
Hexane	100	245	X1
"	100	235	X1
Wet Air ($\approx$ 60 R.H.)*	-	150	X1
"	-	145	X1
"	-	140	X1
Lab. Air (31% R.H.)	-	38	X1
Off. Air (")	-	35	X1

* The J and W TLV Sniffer was zeroed with dry cylinder air, then cylinder air was passed through an impinger containing distilled H_2O to give a concentration $\approx$ 60% R.H. at 25°C. This air was then read on the J and W.

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