B.F.GOODRICH CHEMICAL COMPANY

Inter-Organization Correspondence

To J. R. Render	Date April 28, 1975
Location Calvert City	From W. C. O'Brien

Subject Evaluation of the Photoionization Analyzer, Model PL 101

A portable photoionization analyzer, model PL 101, was obtained from the H·NU Systems, Inc. under a rental-purchase agreement. The instrument has been evaluated for approximately six weeks at the Calvert City plant by production, technical, safety, laboratory and process analyzer groups and all evaluations of the instrument were highly complimentary.

UL ok
FM ok

The instrument is safe to use in Class I Group D Division II areas; it is rated intrinsically safe, but not explosion proof. The instrument is also sensitive to 0.1 ppm VCl in the lowest level selection range and a very rapid response is obtained to changes in atmospheric levels of VCl. Although the present instrument does not have an illuminated dial for easier reading of results at night, and the probe cord should be lengthened, the instrument appears to be satisfactory to withstand the abuse of normal wear and tear received from our operators. It can also be used in the Calvert City vinyl areas under most operating conditions except for VCl concentrations above the LEL and in a driving rain storm. The manufacturer states that a 10% error on the low side can be expected at 95% relative humidity and the error rises to approximately 50% at 100% relative humidity; however, at eleveated temperatures (60°F) the error begins to decrease. An add-on probe heater can be used to eliminate this error, but I would question the intrinsic safety rating with the addition.

In comparing the H·NU with the OVA, the H·NU has proven to be a better portable tool for the Calvert City Plant. Background readings with the OVA average from 7-10 ppm and concentrations below 10 ppm VCl are not feasible to analyze whereas concentrations as low as 0.1 ppm VCl can be detected with the H·NU. Also, the H·NU responds more rapidly to concentration changes and, therefore, is a better instrument for leak detection of VCl. In addition most of the chlorinated hydrocarbons and other hydrocarbons found in the vinyl areas do not cause the H·NU instrument to respond and consequently the instrument is essentially considered specific to VCl in a monomer plant, particularly since EDC is not an instrument interference. The OVA is bulkier, has to be maintained in the laboratory or an equivalent area where daily calibration, fuel replenishment, etc. can be accomplished; whereas the H·NU calibration is more stable and the instrument relies only on a rechargeable battery having to be periodically replenished and this can easily be done in an operating area control room. Therefore, the H·NU instrument is much more readily available to operating personnel.

Under normal operating conditions, the H·NU instrument in guaranteed by the manufacturer for one full year. From Calvert City's experience, we would not expect any unusual maintenance problems with the instrument. The light source as reported by the manufactuer can be expected to last in excess of 3000 operating hours.

NGC 13347

The H·NU instrument has also been found to be a valuable leak detection tool in our Acrylic Acid Process building. There, minimizing benzene and allyl chloride atmospheric concentrations is very important. Attached is a manufacturers information sheet on the instrument response to other chemicals.

The Calvert City Plant ordered the 3rd H·NU analyzer on 4/28/75. If others are bought anywhere in the Company within 90 days a 5% discount is available on the next 3 units, then 7½% on the following 3 units, 10% on the next 3 units and after that the discount is negotiable. Base price of the unit is $2950.

W. C. O'Brien

bs

cc: DBSchrock
FRCarvell
JJSchonaerts
JWBloodworth
RGMolloy
WDRyan
RLToole
JAKlupar
HWaltemate
EBKatzenmeyer - Akron

Photoionization Analyzer

Model PI101

h•nu systems inc. introduces a portable analyzer employing a new technique for the measurement of gases in industrial atmospheres. The instrument is similar to a flame ionization analyzer in its response to many organics but is safe because of the absence of a flame. The instrument is sensitive and can detect less than 0.2ppm of many organics. Methane, however, gives no response. The instrument is lightweight, operates on rechargeable batteries, has a minimal warm-up time, excellent stability, and requires no hydrogen or additional gases for operation.

operating principle

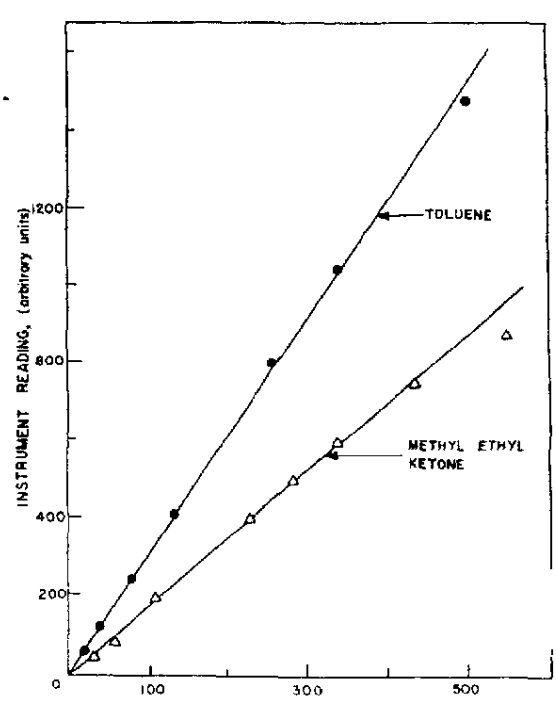
The process is termed photoionization since the absorption of ultraviolet light by a molecule leads to ionization via:

$$R + h\nu \longrightarrow R^+ + e^-$$

where R^+ is the ionized species and $h\nu$ is a photon which has an energy $\geqslant$ the ionization potential of the species.

The sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics) but do not ionize the major components of air such as O_2, N_2, CO, CO_2, or H_2O. A chamber adjacent to the ultraviolet source contains a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions formed by absorption of the UV light to the collector electrode where the current (proportional to concentration) is measured.

Typical calibration curves are shown below:



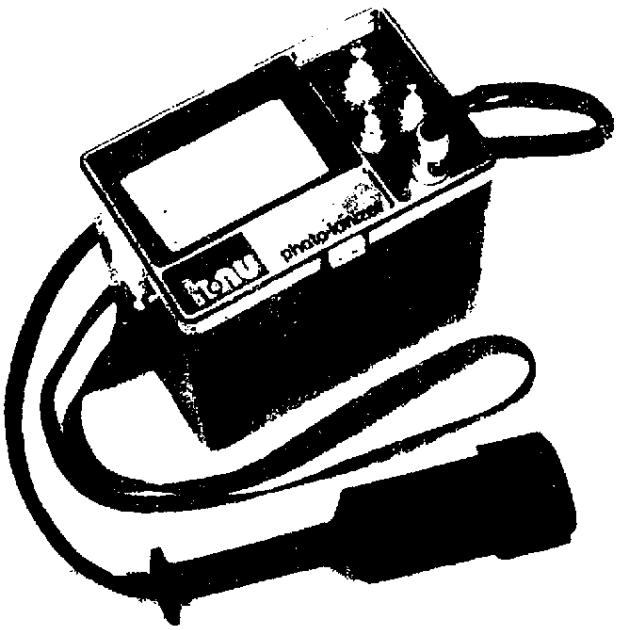
NGC 13349

Selected List of Species Detected

Class	Species	Photoionization Response: Yes	Photoionization Response: No
	Methane		X
	Ethylene		X
	Acetylene		X
	Propylene	X	
	I-Butene	X	
	Allyl alcohol	X	
	Hexane	X	
Chlorinated Hydrocarbons			
	Methyl chloride		X
	Carbon Tetrachloride		X
	Dichloroethane		X
	Vinylidene chloride	X	
	Vinyl chloride	X	
	Trichloroethylene	X	
Heterocyclics & Aromatics			
	Pyridine	X	
	Benzene	X	
	Toluene	X	
	Xylene	X	
	Styrene	X	
	Aniline	X	
Nitrogen Compounds			
	Formamide		X
	Nitric Oxide	X	
	Ammonia	X	
	Methyl amine	X	
	Ethyl amine	X	
	Butyl amine	X	
	Hydrogen cyanide		X
	Acetonitrile		X
Sulfur Compounds			
	Sulfur Dioxide		X
	Hydrogen sulfide	X	
	Carbon disulfide	X	
	Methyl mercaptan	X	
	Dimethyl sulfide	X	
	Dimethyl disulfide	X	
Aldehydes & Ketones			
	Formaldehyde		X
	Acetaldehyde	X	
	Propionaldehyde	X	
	Acrolein	X	
	Crotonaldehyde	X	
	Acetone	X	
	Methyl ethyl ketone	X	

advantages

1) simplicity of operation
2) response to a wide variety of organic and some inorganic compounds
3) no open flame
4) linear over ~ 3 decades
5) no additional gases needed for fuel
6) excellent long term lamp stability thereby reducing the need for frequent calibration
7) minimum hydrocarbon adsorption since the sensor is located at the sampling point
8) power is supplied by readily available rechargeable batteries
9) probe and accessories (battery charger, etc.) are stored in the instrument cover for better portability
10) adjustment of the wide range span potentiometer provides direct reading capability for a large number of gases



applications

industrial hygiene surveys to determine whether levels of toxic gases are in compliance with OSHA's (Occupational Safety and Health Administration) concentration limits (TLV'S).

can also be used as a stationary **area monitor** for industrial atmospheres

determination of **organic solvent emissions** from industrial processes

provides **safe leak detection** measurements in refineries or other industries where explosion hazards can be a problem

determination of the efficiency of a scrubber or an incineration process for compliance with Environmental Protection Agency (EPA), state, or local **air pollution** regulations

determination of **residual solvent vapors** in food or chemical processing

specifications

sensitivity:	better than 0.2ppm Benzene
ranges:	0-20, 0-200, 0-2000 ppm
response time:	less than 5 seconds
operating time:	minimum of 8 hours on 12V DC rechargeable batteries
packaging:	2 separate units; sensor and readout connected by a three foot shielded multi-conductor cable with electrical connector
size:	**readout:** 8¼" long x 5¼" wide x 11" high **sensor:** 10" long and 2½" maximum diameter
weight:	**readout:** less than 8 pounds **sensor:** 20 ounces
readout module front panel:	6 position switch; power(off), battery check, standby, 0-2000, 0-200, 0-20 ranges, 10 turn counting span potentiometer, and one turn zero potentiometer
meter:	4½" meter
materials of construction:	**readout:** drawn aluminum case **sensor:** (outer body) aluminum, engineering thermoplastic
output signal available:	0—10 MV recorder jacks
standard accessories:	a) AC battery charger b) probe: teflon lined telescoping probe, three feet in length for sampling inaccessible places

price **model PI 101** **$2950**

h•nu systems inc.
41 Fair Oaks Drive
Lexington, Massachusetts 02173
(617) 891-6881

Form PI101/774

NGC 13350