Handbook on Industrial Hygiene Direct Reading Chemical Air Sampling Instruments for Use at DOE Hazardous Waste Activities

Prepared by
The Department of Energy
Industrial Hygiene Exposure Assessment
Technology Program
for Chemical and Biological Hazards

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Introduction

The problem of protecting personnel during Department of Energy (DOE) Hazardous Waste Activities (HWA) is more complex than the problems encountered in traditional workplaces. The HWA sites are unpredictable, and the information available on types of contamination, levels, and location of buried chemicals is usually limited. As work progresses, site characteristics change, and thus the potential of exposure to new unknown chemicals always exists, complicating the job of workers, and health and safety professionals. Another complicating factor at these sites is that the handling of unknown chemicals in various conditions may be required, which could potentially result in an emergency.

One way of protecting workers at these DOE HWA sites is to monitor the air for various chemical contaminants. This enables health and safety professionals to recommend proper personal protective equipment for the workers. There are two methods that can be used to detect airborne chemical contaminants for operations at these HWA sites; real-time portable monitoring to permit rapid assessment of air chemical concentrations, and the collection of air samples for detailed laboratory analyses.

Direct-reading chemical air sampling instruments can assist in determining if chemical contaminants are present in the environment. Although these instruments may not always be capable of identifying chemicals, they are very useful in locating the origin of volatile contaminants. When equipped with a data logging device, direct-reading instruments can be used for measuring time-weighted average (TWA) concentrations. Because of the potential for a large number of chemical air contaminants at DOE HWA sites, a variety of instruments may be required to adequately assess the hazards. In order to use a variety of air sampling instruments effectively, it is important that the operators have some knowledge about their operation, reliability, and limitations.

The purpose of this document is to provide personnel at DOE HWA sites with an up to date list of some of the more common, commercially available, direct reading instruments. The instruments are divided into six classes:

Combustible Gas, Toxic Gas and Oxygen deficiency;
Colorimetric Indicators;
Total Hydrocarbon Analyzers;
Portable Gas Chromatographs;
Infrared Spectrophotometers, and;
Particulate Monitors.

For each class of instruments, a brief description of the principles of operation is given. More information on the theory, use, calibration and application of these instruments is found in the documents listed in the reference section. Appendix A provides descriptions of commercially available field-deployable instruments. The information given for each instrument includes; name, model number, manufacturer, application, operating principle, performance data, recording method, sampling method, dimensions, weight, cost and, where available, a DOE contact person who has had actual experience with the instrument. Appendix B provides a quick index for instruments based on "instrument category," which is defined using the basic operating principle of the instrument.

This document is being prepared by the Department of Energy's Industrial Hygiene Exposure Assessment Technology (EAT) Program for Chemical and Biological Hazards maintained at Lawrence Livermore National Laboratory. Although more than one hundred and fifty instruments are included in this document, this is by no means a complete list of all the direct reading air monitoring devices available on the market. Robert da Roza and Nader Vadhat compiled the list by contacting manufacturers who participated in the 1994 American Industrial Hygiene Conference and Exposition. More instruments will be added to the document as they become available. The EAT Program is planning to update this document annually.

Combustible Gas, Toxic Gas, and Oxygen Deficiency Monitors

Three classes of instruments are described in this section; combustible gas monitors, toxic gas monitors and oxygen deficiency monitors.

Combustible Gas Monitors

Combustible gas monitors measure concentration in parts per million (ppm), percent volume or percentage of the Lower Explosion Level (LEL) of combustible gases in air. The basic principle of operation for most of these monitors is combustion. The heat evolved during the reaction of combustible gas with oxygen is used to measure the amount of gas in the air. The sensor consists of two electrical filaments which are incorporated in a Whetstone bridge. One of the filaments (known as the sensing filament) is coated with a catalyst in order to facilitate the combustion process. Both filaments are heated to the same temperature by a battery. Combustible gases entering the sensor burn on the catalytic filament and increase its temperature with a resulting increase in the electrical resistance. This increase in the resistance of the sensing filament reduces the current and unbalances the Whetstone bridge. The change in the current is proportional to the amount of combustible gas in the air, and is translated into a meter reading.

Another method of detecting combustible gases is using metallic oxide sensors. The principle method of operation is the decrease in the electrical resistance of a metallic oxide coated semi-conductor due to the release of electrons in a chemical reaction. The combustible gas entering the sensor reacts with the oxygen trapped in the porous surface of the metallic oxide. The released electrons from the chemical reaction increase the conductivity of the semi-conductor, which is translated into a meter reading via a Wheatstone bridge.

Combustible gas monitors are calibrated relative to a specific gas. The calibrant gases commonly used are methane, propane, pentane and hexane. If the identity of the combustible gas in the air is known, the conversion curves provided by the instrument manufacturers may be used to determine the actual concentration of the gas.

Toxic Gas Monitors

Electrochemical sensors are used to detect many specific gases. Sensors have been developed for such gases as carbon monoxide, hydrogen sulfide, sulfur dioxide, chlorine, hydrogen cyanide, nitrogen dioxide, nitric oxide and phosgene. A typical electrochemical sensor consists of a membrane, two to three metals (known as electrodes), and a solution (electrolyte). The gas diffuses through the membrane and comes into contact with one of the electrodes (known as sensing electrode). The gas interacts with the electrode causing an anodic or cathodic reaction (depending upon the cell), and produces positive or negative ions which travel through the electrolyte and reach the counter electrode. The purpose of this electrode is to generate electrons (for a cathodic sensing electrode) or absorb electrons (for an anodic sensing electrode) and complete the circuit. In some electrochemical cells, the reactions (oxidation/ reduction) occur simultaneously. This type is known as a galvanic cell, in which chemical energy is converted into electrical energy or current. In other cells known as electrolytic, electrical energy should be applied to the cell in order to induce the reactions.

The chemical nature and composition of the electrolyte is an important factor in the performance of the sensors. The selected electrolyte affects the solubility and diffusion rate of the gas to the electrode surface.

Electrochemical sensors are divided into three categories; potentiometric, conductimetric and amperometric. In potentiometric sensors, the chemical reaction of the gas with the electrode changes the potential of the sensing electrode. The difference in the voltage potential between the sensor and counter is related to the concentration of the chemical detected.

In the conductimetric cells the gas reacts chemically with the electrolyte and the change in the conductivity of the electrolyte is measured. This increase in conductivity is proportional to the amount of gas dissolved in the electrolyte, which is directly related to the gas concentration.

In the amperometric cells, the gas undergoes electro-oxidation or electro-reduction within the cell and generates a current proportional to the amount dissolved (Faraday's law). This class of electrochemical cells is subdivided to coulometric (constant current) and voltametric (constant voltage). In the first, the amount of electricity required to oxidize or reduce a gas is measured. In the second, the current flows through an electrolytic cell in which an oxidation/reduction reaction is underway and is measured. The sensor signal is amplified and reads out as a voltage.

Oxygen Deficiency Monitors

Oxygen analyzers measure the percentage of oxygen in the air. The basic principle of operation for most of these detectors is the conversion of chemical energy into chemical energy in a galvanic cell. The sensor consists of two dissimilar metals in an alkaline solution. Oxygen entering the sensor reacts with water and is reduced to the hydoxyl ion at the cathode (usually gold or platinum). These ions migrate to the anode (usually lead or zinc) where they are oxidized to oxygen. The reactions produce a current which is directly proportional to the amount of oxygen reaching the cell, which in turn is proportional to the partial pressure of oxygen in the air. The electric current produced is directly proportional to the concentration of oxygen.

Oxygen monitors are dependent on relative humidity. The water vapor dilutes the air and reduces the percentage of oxygen. Some oxidants such as chlorine can interfere with the oxygen cell resulting in high oxygen readings. The service life of these monitors is usually between six months and one year, at which time the cell should be replaced.

Colorimetric Indicators

Colorimetric indicators for direct reading measurement of chemical contaminants in air have been used for many years. The principle of operation of these devices is very simple. When air is drawn through an indicator, the contaminant reacts with the reagent present in the indicator and causes a color change. This stain or color change is an indication of the presence of chemical air contaminants and may also be used to estimate concentration.

Glass indicator tubes containing solid chemicals are a convenient, inexpensive and compact example of these devices. Solid particles coated with a chemical are packed in a glass tube and the two ends of the tube are sealed. During the past several decades, there has been a great expansion in the development and use of these detector tubes and more than four hundred different types are now available on the market. Indicator tubes are calibrated against known concentrations of toxic gases, and scales are usually printed on their exteriors. It has been shown that chemical reactions between the contaminant in the air and the reagents in the indicator tubes are dependent on temperature and relative humidity. The operating temperature and relative humidity ranges are usually indicated by the manufacturers. If the tube is to be used outside the permissible ranges, the reading must be adjusted.

There are several indicator tube and pump manufacturers. The manufacturers design their indicator tubes to be used only with their pumps. Using detector tubes from one manufacturer with a pump from a another manufacturer could lead to an erroneous measurement.

Another group of Colorimetric indicators are long-term tubes, "dosimeter" tubes (a commonly used misnomer), badges and tapes. These devices are used for long-term measurements (for example during an 8-hour workday), and are usually positioned within the breathing zone of workers for personal monitoring. Long-term detector tubes are used along with a low flow personal battery-operated pump. The length of stain is usually indicated in microliters, and can be converted into ppm based on the total volume collected.

"Dosimeter" tubes do not require a sampling pump. The basic principle of mass transfer for these devices is molecular diffusion. The contaminant molecules diffuse into the tube and react with the impregnated solid particles. The length of the stain or color change is converted into an estimated concentration.

Badges and tapes are passive Colorimetric sampling devices which change color when a minimum accumulation of a given gas is reached. The color of the badge or tape is compared to a chart (supplied be the manufacturer) to estimate the average concentration of the gas. These devices are usually susceptible to drying and fading from sunlight. It is therefore important to observe them constantly, because if the badge or tape dries out sampling stops. Another problem with these Colorimetric indicators is the interpretation of the color change. Uneven color changes, the size of color change and an individual's visual acuity make it difficult to estimate the concentration of a gas. One manufacturer supplies an electronic optical reader to improve the quantification.

Total Hydrocarbon Analyzers

Total hydrocarbon analyzers are devices that can monitor for many different chemicals at once, but generally cannot distinguish between them. These instruments have wide applications, including measurements for fugitive emissions and hazardous waste site surveys. The most common detection method used for these devices is ionization. The principle of operation for this technique is based on the creation of ions and their collection under the influence of an electric field. The movement of ions generates a current proportional to the concentration of the air contaminants.

An ionization detector can be used as a specific monitoring instrument only when a single contaminant is present in the air. In such a case, although rare, the detector can be calibrated for that compound and used for quantitative monitoring. When little is known about what pollutants are present, these detectors can be used for qualitative information.

Photoionization Detectors (PID)

Photoionization detectors are used in high sensitivity instruments (0.1 to 2000 ppm) and can detect all the ionizable compounds present in air. Most organic compounds and some inorganic compounds are ionized when they are exposed to ultra violet light. The ions formed create a current that is proportional to the concentration of the gas in the air. The sensor consists of an ultra violet (UV) light source that emits photons with sufficient energy to ionize many compounds. A chamber adjacent to the light source contains two electrodes. When a positive potential is applied to one of the electrodes, the created field forces the ions to be attracted to an electrode.

The amount of energy required to ionize a molecule (known as its ionization potential) depends on its structure. Some materials are ionized easily while others are not. For a material to be ionized, the UV light energy should be more that the ionization potential of the material. The most commonly used light sources are 9.5, 10.2 and 10.6 ev.

PID has a large linear range and is a good general detector for organic and some inorganic gases. Humidity usually interferes with the performance of the instrument. Although water vapor has a large ionization potential (12.59 ev), and is not ionized by the light source, it deflects, scatters and absorbs the light resulting in a lower meter reading.

Flame Ionization Detector (FID)

Flame ionization is a method in which ions are created by burning organic compounds in a hydrogen flame. This instrument is an organic detector and does not respond to inorganics. Air is drawn into the detector and carried to a stainless steel combustion chamber where organic compounds are burned. The ions generated in the burner are collected by a negative electrode (collector). An electric field exists between the burner (which acts as the positive electrode) and the collector, which drives the positively charged ions to the collector. This movement of ions generates a current proportional to the concentration of organic compounds in the air.

Instruments using flame ionization detectors have high sensitivity with a detection range from 0.2 to 10,000 ppm. They are usually calibrated against methane. Thus, the meter responds accurately only to methane. Although all organic materials are detected, the instrument response depends on the number of carbons in the compound. FIDs do not respond to atoms other than carbon, however, other atoms (such as oxygen and nitrogen) will usually change the sensitivity of the instrument to carbon.

Portable Gas Chromatograph

Chromatography is a technique for the separation of compounds in a mixture. This method can be used for monitoring several contaminants simultaneously. During the last few years, small portable gas chromatographs (GC) have been developed by several manufacturers which can be set up and used in the field. A portable GC consists of an injection unit, a column, a detector, and an output device. An air sample may be injected manually by using a micro syringe or automatically by the instrument itself. From the injection, unit the sample is carried through a packed or capillary column where it is separated into individual compounds. Well-coated capillary columns are used to obtain better resolution. Heated columns are important to minimize thermal drift and change in compound retention time due to ambient temperature variability. Various detection methods are utilized in portable gas chromatographs, including flame ionization and photoionization detectors. The detector output is usually presented on a recorder as a chromatogram, a plot of detector response versus time. The area under each peak is proportional to the mass of the compound in the sample, and the time for the peak (known as retention time) is used to identify the component.

The GC column comes in various sizes and designs to accommodate different types of compounds. It contains a packing material or the packing is coated with a liquid phase to effect the component separation. In order to ensure adequate peak separation, the proper column must be selected. Manufacturers usually provide selection criteria for the users. Depending upon the nature of the compounds

present in the air, more than one column may be necessary for a specific field application.

In recent years the mass spectrometer has been combined with the portable GC for the identification of chromatographic fractions and peaks. In an electron impact mass spectrometer, molecules of the compound are ionized by electron bombardment at very low pressure.The ions are accelerated in an electric field and separated according to their mass-to-charge ratio in a magnetic field. Most of the portable mass spectrometers use a quadrapolar magnetic field. The ion current is amplified and a mass spectrum is generated. By comparing the spectrum with a database containing information on thousands of compounds, the unknown contaminants are identified.

Infrared Spectrophotometers

An infrared (IR) spectrophotometer is a powerful air monitoring analytical device because of its sensitivity, versatility and specificity. The basic principle of operation is the absorption of infrared light by the chemical functional groups. The device consists of an infrared light source, filter, gas chamber and detector. Infrared radiation is passed through a filter to control the wavelength and then travels through the sample gas in the chamber for a specific distance. The compound in the sample absorbs a certain percentage of the radiation, and the remaining radiation reaches the detector. The amount absorbed by a given compound depends on the concentration of the material in the air and the distance through which the infrared beam travels. Absorption coefficients of infrared light are usually much smaller than those for visible or ultraviolet light. In order to increase the amount of infrared absorption, manufacturers of IR instruments incorporate long path length cells, usually from 1 to 20 meters. Mirrors are used in the sample chamber to reflect the IR radiation and thus achieve long path lengths. As the beam's path length increases, the sensitivity and the lower detection limit of the instrument increases. The limit of detection for many compounds is from 1 to 20 ppm using the longest path length (20 meters).

Some infrared spectrophotometers are designed to detect only one compound. An instrument which is dedicated to a single compound usually has one or two path lengths, a single filter and is precalibrated by the manufacturers. Multiple compound instruments have variable settings for wavelength and path length and can be used to monitor many contaminants. These instruments can be used to scan the entire infrared spectrum of the sample air in order to determine the number of functional group peaks in the air.

One of the problems in using IR analyzers to detect a specific chemical in air is interference by other compounds. The optimum wavelength for a compound may

be overlapped by one or more other chemicals. It is therefore possible for a user to obtain erroneously high readings if multiple compounds are present. Water vapor is a common interfering compound. Passing the air sample through a drying agent (such as silica gel) will help to reduce the effect of water vapor.

Particulate Monitors

Direct reading instruments for measuring particulates in air can determine total mass, total particle count, or particle size distribution. Each instrument usually measures one of these parameters. In general there are two methods for detecting aerosols: piezoelectric and optical.

Piezoelectric detectors measure mass concentration by the deposition of particles on a piezoelectric crystal. The change in the mass of the crystal represents the mass of the particles. Air is drawn into the instrument through an orifice, and the particles are deposited on the surface of the crystal by electrostatic precipitation. The sensing crystal and a reference crystal are part of an oscillator circuit. The resonant frequency of the crystals is a linear function of their mass. The output of the instrument is related to the difference between the reference crystal frequency and the sensing crystal frequency. As particles deposit on the sensing crystal, the frequency changes inversely with the mass of the particles.

Optical monitors detect particles by measuring the intensity of light scattered by them. The instrument consists of a light source and a sensor for transforming the light into a voltage proportional to the light intensity. Air is drawn into the scattering volume of the instrument where a narrow beam of visible light is directed through it. The light scattered by the particles reaches the sensor and is converted into a signal which can be displayed. As the number of particles in the scattering volume increases, the light reaching the sensor increases. The scattered light received from a single particle is a function of the size, shape, and refractive index of the particle, as well as the wavelength of the light and the angle of scatter. Therefore, when multiple particles are present in the sensing volume of the instrument, the amount of light scattered depends on the size distribution, concentration and refractive index of the particles (wavelength and angle of scatter are fixed for each instrument).

The sensitivity of optical monitors depends on the wavelength distribution of the light source, spectral sensitivity of the sensor, and the shape and refractive index of the particle(s).

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Appendix A

Chemical Air Sampling Instruments for Use at DOE Hazardous Waste Activities

The database is a updatable source of information for DOE facilities, and new data is currently being entered into it. We will obtain the technical information and cost from the manufacturer, but, in order to make this compilation more useful for DOE facilities, we need individuals who have actually used specific instruments to serve as contacts. If you or someone you know would like to serve as a technical contact for one or more of the instruments please contact: Virginia Lew at LLNL, phone (510) 424-5151, or Carol Watson at LLNL, phone (510) 422-5215, FAX (510) 422-5176, P.O. Box 808, L-379, Livermore, CA 94550. For your convenience, the following toll free number may also be used to contact these individuals: 1-800-322-4684.

The present version of Appendix A is arranged in alphabetical order by manufacturer. In addition to instrument contacts, we are also soliciting suggestions on useful rearrangements of the appendix that would then form an Appendix C. Comments and suggestions may be directed to the contacts listed above.

Instrument #	1	2	3
Manufacturer	AIM Safety USA Inc. P.O. Box 720540 Houston, TX 72272-0540 (713)240-5020 Fax (713)240-5022	AIM Safety USA Inc. P. O. Box 720540 Houston, TX 72272-0540 (713)240-5020 Fax (713)240-5022	AIM Safety USA Inc. P. O. Box 720540 Houston, TX 72272-0540 (713)240-5020 Fax (713)240-5022"
Name	Gas Detector	Gas Detector	Gas Detector
Model Number	Logic 000 and 100 Series	Logic 250 Series	Logic 500 Series
Instrument Category	Multiple sensor	Multiple sensor	Multiple sensor
Application	Air monitoring for combustibles, oxygen and toxic gases (CO, H2S, SO2, NO, NO2, Cl2, HCN, H2, NH3). One, two or three sensors available in one detector.	Air monitoring for combustibles, oxygen and toxic gases. Up to three sensors available in one detector. Precalibrated for 28 combustibles.	Air monitoring for combustibles, oxygen, H2S and CO.
Operating Principle	Multiple sensor Combustibles: metal oxide semi-conductor Oxygen and toxic gases: electrochemical	Multiple sensor Combustibles: metal oxide semi-conductor (calibrated for 28 gases) oxygen and toxic gases: electrochemical	Multiple sensor Combustibles: metal oxide or pellistar sensor O2, H2S and CO: electrochemical
Performance			
Compound	Combustibles, oxygen, CO, H2S, SO2, NO, NO2, Cl2, HCN, H2, NH3	Combustibles, oxygen and toxic gases	Combustibles, oxygen, H2S and CO
Ranges	Combustibles: 0 to100% LEL Oxygen: 0 to 25% vol Toxic gases: gas dependent	Combustibles: 0 to 100% LEL Oxygen: 0 to 25% vol Toxic gases: gas dependent	Combustibles: 0 to 100% LEL O2: 0 to 25% vol H2S: 0 to 250 ppm CO: 0 to 2000 ppm
Response Time			
Accuracy	Combustibles: ±3% full scale Oxygen: ±2.5% reading Toxic gases: ±5% reading	Combustibles: ±3% full scale Oxygen: ±2.5% reading Toxic gases: ±5% reading	Combustibles: ±3% full scale O2: ±2.5% reading H2S: ±5% reading CO: ±5% reading
Repeatability (precision)			
Resolution			
Sensitivity			
Operating Temperature	5 to 122°F	5 to 122°F	-20 to 50°C
Recording Method	High intensity LED display and alarm indicators data logging and downloading capabilities	High intensity LED display and alarm indicators data logging and downloading capabilities	LCD display, data logging and down loading capabilities
Power	6 V lead-acid battery	6 V lead-acid battery	6 V lead-acid battery
Sampling Method	Passive sampling	Passive sampling	Built-in sampling pump
Dimensions (W x H x L)	15.7" x 18.5" x 2.5"	15.7" x 18.5" x 2.5"	7.5" x 4" x 2.5"
Weight	2.2 lb	2.2 lb	3.5 lb
Cost	$1525-1625	$1,890	$2175-2570
DOE Contact Person		LLNL, Fire Dept.	

Instrument #	4	5	6
Manufacturer	Air Scan Environmental Technologies, Inc. 197 Meister Avenue Branchburg, NJ 08876 (908)725-1342 Fax (908)725-0822	Air Techniques 11403 Cronridge Drive Owings Mills, MD 21117 (410)363-9698 Fax (410)363-9695	Arizona Instrument Corp. 4114 East Wood Street Phoenix, Arizona 85040 (602)470-1414 Fax (602)470-1888
Name	Airscan monitoring system	Portable photometer	Jerome
Model Number		TDA-2G	431-X
Instrument Category	Colorimetric	Optical	Gold film
Application	Personal exposure monitoring for formaldehyde, ethylene oxide or glutaraldehyde	Air monitoring for aerosols	Measurement of mercury vapor in air
Operating Principle	Colorimetric	Optical	Gold film Sensor.
Performance			
Compound	Formaldehyde, ethylene oxide or glutaraldehyde	Aerosols	Mercury
Ranges		5 x 10 E -6 to 200 µg/L	0 to 0.999mg/m3
Response Time		<1 sec	Sample mode - 13 sec Survey mode - 4 sec
Accuracy	±25% at PEL and STEL	1% full scale	±5% at 0.1 mg/m3
Repeatability (precision)		0.5% full scale	5% relative standard deviation at 0.1 mg/m3
Resolution		1% of full scale	
Sensitivity	Formaldehyde: 0.2 ppm Ethylene oxide: 1.5 ppm Glutaraldehyde: 0.15 ppm	0.0001 µg/L	0.003 mg/m3
Operating Temperature	45 to 95°F	40 to 100°F	0 to 40°C
Recording Method	Length of stain or color change	Digital display showing % leakage from 0.0001% to 100%, bargraph, downloading via an RS-232 port	LCD display, optional data logging, interfacing with computers and dosimeter analysis capabilities"
Power		100 to 250 VAC	115 VAC or 230 VAC
Sampling Method	Passive	Built-in pump	Built-in pump, flow rate 750 cm 3/min
Dimensions (W x H x L)	2"x 4"x 0.5"	9.5"x 5"x 13.5"	6" x 4" x 13"
Weight	22 g	18 lb	7 lb
Cost	$240-275	"$5,495 "	$4550-5900
DOE Contact Person			Bruce Bettencourt, LLNL, (510)422-5197 Model 411

Instrument #	7	8	9
Manufacturer	Arizona Instrument Corp. 4114 East Wood Street Phoenix, Arizona 85040 (602)470-1414 Fax (602)470-1888	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091
Name	Jerome	Gas-pointer	Sentinel
Model Number	631-X	II	44
Instrument Category	Gold film	Multiple sensor	Multiple sensor
Application	Measurement of low concentrations of H2S	Portable gas detector for natural gas and carbon monoxide	Personal multi-gas monitor for confined space entry
Operating Principle	Gold film Sensor	Multiple sensor Combustible gas: catalytic bead, electrochemical O2 cell CO: electrochemical CO cell	
Performance			
Compound	H2S	Natural gas and carbon monoxide	O2, CO and H2S
Ranges	0.001 to 50 ppm	Combustible gas: 0-99% LEL, 5-99% gas, CO: 0-500 ppm with overrange indicator for over 500 ppm	O: 0 to 25% CO: 0 to 999 ppm H2S: 0 to 200 ppm Humidity: 5 to 95%, non-condensing
Response Time	10 to 50 ppm - 13 sec 1 to 10 ppm - 16 sec 0.1 to 1 ppm - 25 sec 0.001 to 0.1 ppm - 30 sec		
Accuracy	0.003 ppm at 0.05 ppm, 0.03 ppm at 0.5 ppm, 0.3 ppm at 5 ppm, 2 ppm at 25 ppm	Combust. gas: 0-99% LEL, range ±0.25% gas 5-99% gas, range ±3% gas CO: ±10 ppm.	
Repeatability (precision)	5% rel. standard deviation		
Resolution	0.001 ppm		
Sensitivity	0.003 ppm	20 ppm	Intrinsically safe for use in class 1, division 1, groups A,B,C and D areas
Operating Temperature	0 to 40°C	-15 to 50°C	-4 to 122°F
Recording Method	LCD display, RS232 IBM-compatible PC using Jerome communication interface software	Two line by 16 character, alphanumeric liquid crystal display with backlight	LCD display, backlit. Built-in data-logging mechanism, data can be downloaded directly to a computer
Power	115 VAC or 230 VAC	NiCad rechargeable battery	Lead-acid gel cell battery
Sampling Method	Built-in pump, flow rate 150 cm3/min	Integral sample draw pump with quick disconnect coiled hose and sample probe	Diffusion or sample draw operation
Dimensions (W x H x L)	6" x 4"x 13"	8.09"x 3.75"x 2.20"	7.75"x 4.5"x 2.0"
Weight	7 lb	2 lb	2.5 lb
Cost		$850-1225	$1580-2560
DOE Contact Person			

Instrument #	10	11	12
Manufacturer	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091
Name	Sniffer	Sniffer	Sniffer
Model Number	505	506	301, 302, 303
Instrument Category	Multiple sensor	Multiple sensor	Multiple sensor
Application	Portable area monitor for the measurements of combustible gases, oxygen deficiency and H2S	Portable area monitors for the measurements of combustible gases, oxygen deficiency and CO	Intermittent measurements of combustible gas and oxygen deficiency
Operating Principle	Multiple sensor Combustibles: catalytic combustion type sensor (all) Oxygen deficiency: electro-chemical cell (all), H2S: electrochemical cell (505)	Multiple sensor Combustibles: catalytic combustion type sensor (all mods) Oxygen deficiency: electro-chemical cell (all mods), CO: electrochemical cell (Mod 506)	Multiple sensor Combustibles: catalytic combustion type sensor (all models) Oxygen: electrochemical cell (302)
Performance			
Compound	Combustible gases, oxygen deficiency and H2S	Combustible gases, oxygen deficiency and CO	Combustibles and oxygen
Ranges	Combustibles: 0 to 100% LEL , O2: 0 to 25%, H2S: 0 to 100 ppm	Combustibles: 0 to 100% LEL, O2: 0 to 25%, CO: 0 to 500 ppm	Model 301: 0 to 100%LEL, 302: 0 to 25% O2, 0 to 100 LEL, 303: 0 to 2000 ppm combustible gas
Response Time	90% of final reading, <60 sec	90% of final reading, <35 sec	Warmup time: Mod 301: 20 sec, 302: 45 sec, 303: 5 min for op,, 20 min for calib.
Accuracy			
Repeatability (precision)			
Resolution			
Sensitivity			All combustibles: ±1% LEL (±10 ppm for Mod 303), O2: ±0.1% for Mod. 302
Operating Temperature	-4 to 104°F	5 to 104°F	-20 to 50°C
Recording Method	Two analog meters	Two analog meters	Models 301, 302, 303: 3-digit LCD, 0.4" high, backlit
Power	Lead-acid rechargeable battery	Lead-acid rechargeable battery	301: 4 "D" alkaline batteries , 302, 303: NiCad batteries
Sampling Method	Integral pump with low flow sensor and alarm - 100 ft. max. distance	Integral pump with low flow sensor and alarm - 100 ft. max. distance	301, 302, 303: electric motor operated integral pump, 300: manually actuated, front connected bulb-type aspirator
Dimensions (W x H x L)	7.625"x 10"x 6.25"	7.625"x 10" x 6.25"	3.2" x 7.1"x 10.3"
Weight	Less than 9.5 lb	Less than 9.5 lb	Model 300: 2.4 lb less batteries; 301, 303: 2.6 lb less batteries, 302: 3.4 lb including battery pack
Cost	$2,365	$2,365	$895-1195
DOE Contact Person	Bruce Bettencourt, LLNL, (510)422-5197		

Instrument #	13	14	15
Manufacturer	Bacharach, Inc. 625 Alpha Drive Pittsburg, PA 15238 (412)963-2000 Fax (412)963-2091	Biosystems Inc. 5 Brookside Drive Middlefield, CT 06455 (203)344-1079 Fax (203)344-1068	Biosystems Inc. 5 Brookside Drive Middlefield, CT 06455 (203)344-1079 Fax (203)344-1068
Name	Sniffer	Cannonball 2	Personal Gas Monitor
Model Number	503A	1700 Series	3000 Series
Instrument Category	Multiple sensor	Multiple sensor	Multiple sensor
Application	Portable area monitors for the measurements of combustible gases, oxygen deficiency	Air monitoring for O2, combustible and toxic gases (H2S, CO, SO2, NO, NO2, HCN)	Personal air monitoring for oxygen, H2S or CO
Operating Principle	Multiple sensor Combustibles: catalytic combustion type sensor (all) Oxygen deficiency: electrochemical cell (all)	LEL: catalytic combustion O2: galvanic Toxic: electrochemical	Multiple sensor O2: Galvanic Sensor Toxics: electrochemical polarographic sensors
Performance			
Compound	Combustible gases, oxygen deficiency	O2, H2S, CO, SO2, NO, NO2, HCN	O2, H2S, CO
Ranges	Combustibles: 0 to 100% LEL, 0 to 2000 ppm, 0 to 10,000 ppm O2: 0 to 25%	O2: 0 to 25% O2 LEL: 0 to 100% LEL CO: 0 to 999 ppm H2S: 0 to 125 ppm	O2: 0 to 25% CO: 0 to 999 ppm
Response Time	90% of final reading, <30 sec	O2: T90=30 sec, T10=20 sec LEL: T90=30 sec, T10=45 sec CO: T90=20 sec, T10=35 sec H2S: T90=30 sec, T10=50 sec	O2: T90=30 sec, T10=20 sec CO: T90=20 sec, T10=35 sec H2S: T90=30 sec, T10=50 sec
Accuracy		±5% of reading	±5% of reading
Repeatability (precision)		±2%	±3%
Resolution		O2: 0.1% LEL: 1% Toxic: 1 ppm	O2: 0.1% CO: 1 ppm H2S: 0.1 ppm
Sensitivity		O2: 0.1%; LEL: 1%; Toxic: 1 ppm	O2: 0.1%; CO: 1 ppm; H2S: 0.1 ppm
Operating Temperature	-4 to 122°C	5 to 120°F	5 to 120°F
Recording Method	Two analog meters	LCD display, data logging and down loading capabilities	LCD display
Power	Lead-acid rechargeable battery	Lead acid and alkaline	9 V alkaline battery
Sampling Method	Integral pump with low flow sensor and alarm - 100 ft max. distance	Built-in sampling pump, 1 liter/min flow rate	Passive sampling, optional manual sample draw assembly
Dimensions (W x H x L)	7.625" x 10"x 6.25"	9.25"x 6.5" x 6"	4.75" x 3.75" x 2"
Weight	Less than 9.5 lb	6 lb	1 lb
Cost	$1,825	$1795-2845	$545-820
DOE Contact Person	Bruce Bettencourt, LLNL, (510)422-5197 Model L		

Instrument #	16	17	18
Manufacturer	Biosystems Inc. 5 Brookside Drive Middlefield, CT 06455 (203)344-1079 Fax (203)344-1068	Biosystems Inc. 5 Brookside Drive Middlefield, CT 06455 (203)344-1079 Fax (203)344-1068	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450
Name	PhD2	ToxiLog	Gas Detector
Model Number	1600 Series	1800 Series	TG-KA Series
Instrument Category	Multiple sensor	Multiple sensor	Electrochemical
Application	Air monitoring for combustibles, oxygen and up to two toxic gases (H2S, CO, NH3, Cl2, SO2, NO, NO2, NO3, HCl, HCN)	Personal air monitoring for oxygen and toxic gases (H2S, CO, SO2, Cl2, NO2, NO, HCN, HCl, NH3)	Portable toxic gas monitoring in the low ppm with accuracy for O3, COCl2, Cl2, H2S, HCN, HCl, SO2, NO2, HF, Br2, F2, H2, O2, NH3 or Hydrides. For personal monitoring or mounted for AC operation.
Operating Principle	Multiple sensor, LEL: catalytic combustion, Oxygen: galvanic Toxic: electrochemical	Multiple sensor Oxygen: galvanic Toxic Gas: electrochemical	Electrochemical
Performance			
Compound	H2S, CO, NH3, Cl2, SO2, NO, NO2, NO3, HCl, HCN, O2 and combustibles	H2S, CO, SO2, Cl2, NO2, NO, HCN, HCl, NH3, O2	O3, COCl2, Cl2, H2S, HCN, HCl, SO2, NO2, HF, Br2, F2, H2, O2, NH3 or Hydrides
Ranges	O2: 0 to 25% O2; LEL: 0 to 100% CO: 0 to 999 ppm; H2S: 0 to 125 ppm	O2: 0 to 25% O2; CO: 0 to 999 ppm H2S: 0 to 125 ppm	Gas dependent
Response Time	O2: T90=30 sec, T10=20 sec LEL: T90=30 sec, T10=45 sec CO: T90=20 sec, T10=35 sec H2S: T90=30 sec, T10=50 sec	O2: T90=30 sec, T10=20 sec CO: T90=20 sec, T10=35 sec H2S: T90=30 sec, T10=50 sec	<30 sec to 1/3 full scale
Accuracy	±5% of reading	±5% of reading	±5% of full scale
Repeatability (precision)	±2%	±2%	±5% of full scale
Resolution	O2: 0.1%; LEL: 1% Toxic: 1 ppm	O2: 0.1% O2 Toxic: 1 ppm / 0.1 ppm	Gas dependent
Sensitivity	O2: 0.1% LEL: 1% Toxic: 1 ppm	O2: 0.1% O2 Toxic: 1 ppm / 0.1 ppm	Gas dependent
Operating Temperature	5 to 120°F	5 to 120°F	0 to 40°C
Recording Method	LCD display, data logging and down loading capabilities	LCD display, data logging and down loading to PC capabilities	LED display
Power	NiCad or lead acid rechargeable battery	3 "AAA" disposable alkaline batteries	Rechargeable NiCad
Sampling Method	Manual sample draw assembly (squeeze bulb), optional motorized draw pump	Passive sampling, optional manual sample draw assembly	Passive
Dimensions (W x H x L)	4.3" x 2.2" x 7.2"	2.4" x 1.0" x 4.1"	5" x 1.5" x 5.25"
Weight	With sealed lead acid battery: 32 oz With NiCad battery: 27 oz	5.6 oz	10 oz
Cost	$1095-2395	$645-995	$2,195
DOE Contact Person			

Instrument #	19	20	21
Manufacturer	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450
Name	Gasman	Portable CO2 Indicator	Riken Infrared Gas Analyzer
Model Number		R1-411A	R1-550A
Instrument Category	Electrochemical	IR	IR
Application	Single gas, personal gas monitoring for toxic gases. Models are available for O2, H2S, CO, SO2, Cl2, NO, NO2, HCl, HCN, NH3, flammables and 03	Portable infrared CO2 monitoring	Transportable, gas monitoring of CO, CO2, CH4, C2H4, C3H8 or C4H10
Operating Principle	Electrochemical	Infrared absorption, non-dispersive	Infrared absorption, non-dispersive
Performance			
Compound	O2, H2S, CO, SO2, Cl2, NO, NO2, HCl, HCN, NH3, flammables and O3	CO2	CO, CO2, CH4, C2H4, C3H8 or C4H10
Ranges	Gas dependent	0 to 4975 ppm in 25 ppm increments 0 to 9950 ppm 0 to 5% 0 to 10% and 0 to 20% available on request	0 to 0.5% up to 0 to 100% Can be calibrated by means of a disposable calibration (span) gas canister located inside the unit
Response Time	O2:10 sec Flammables: 20 sec Toxics: 20 sec	10 sec to 90% of full scale	<10 sec to 90% of full scale
Accuracy	±5% of full scale	±2% full scale	±2% full scale
Repeatability (precision)	±5% of full scale		
Resolution	Gas dependent	for 0 to 9950: 50 ppm 0 to 4975: 25 ppm 0 to 19.19: 0.01 ppm 0 to 4.9: 0.02 ppm"	1% of full scale
Sensitivity	Gas dependent	Same as resolution	1% of full scale
Operating Temperature	-10 to 50°C	-10 to 40°C	0 to 40°C
Recording Method	Pulsating red LED display	Illuminated dot-matrix digital display recorder output	Analog meter
Power	4 "AA" batteries	6 "D" NiCad batteries	115 or 230 vac
Sampling Method	Passive	Built-in pump	Built-in pump
Dimensions (W x H x L)	2.5" x 6.5" x 1.5"	10" x 7.5" x 4.5"	8.667"x 7.875" x 12.667"
Weight	<10 oz	6 lb	21 lb
Cost	$495-895	$2,775	$2,750
DOE Contact Person			

Instrument #	22	23	24
Manufacturer	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450
Name	Triple Plus		
Model Number		CEA 105	LMS
Instrument Category	Electrochemical	IR	Multiple sensor
Application	Confined space entry monitoring of any combination of oxygen, combustible gases, and toxic gases such as H2S, CO, Cl2, SO2, NO2, H2, HCl, HCN, NH3, O3, NO and CH4, simultaneously and as TWA	Affordable infrared CO2 monitoring	Portable land fill gas monitoring for methane, CO2 and oxygen. The unit also measures temperature and pressure
Operating Principle	Electrochemical	Infrared sensor, non-dispersive	Infrared spectroscopy: CH4 and CO2 Electrochemical cell: O2 External thermistor: Temp Vacuum referenced pressure transducer: Pressure
Performance			
Compound	Any combination of oxygen, combustible gases, and toxic gases simultaneously	CO2	Oxygen, CO2 and CH4
Ranges	Gas dependent	0 to 2000 ppm	CH4 and CO2: 0 to 10% and 0 to 100% O2: 0 to 25%
Response Time	O2:10 sec Flammables: 20 sec Toxics: 20 sec	<20 sec	CH4 and CO2: 10 sec to 90% of full scale O2: 20 sec to 90% full scale
Accuracy	±5% of full scale	±5% of reading or 50 ppm which ever is greater	CH4: ±2% at 5%, ±1% at 30%, ±3% at 100% O2: ±0.5% CO2: ±0.1% at 10%
Repeatability (precision)	±5% of full scale	±20 ppm	
Resolution	Gas dependent	1 ppm	0.1%
Sensitivity	Gas dependent	1 ppm	
Operating Temperature	-10 to 50°C	0 to 50°C	
Recording Method	Computer interface and data logger	Digital display, 0 to 2 VDC output and optional data logger	Internal data/logger with software and computer cable
Power	Sealed lead-acid battery	12 VDC	Rechargeable lead-acid battery
Sampling Method	Passive or built-in pump	Passive	Built-in sample pump
Dimensions (W x H x L)	6.75" x 3" x 4.75"	3.5" x 7" x 3"	15 x 20 x 19 cm
Weight	<2 lb	12 oz	6.4 lb
Cost	$1100-2200	$595	$5,250
DOE Contact Person			

Instrument #	25	26	27
Manufacturer	CEA Instruments, Inc. 16 Chestnut Street Emerson, NJ 07630 (201)967-5660 Fax (201)967-8450	Dynamation 3784 Plaza Drive, Ann Arbor, MI 48108 (313)769-0573 Fax (313)769-1888	ENMET P.O. Box 979 Ann Arbor, MI 48106 (313)761-1270 Fax (313)761-3220
Name		AGM	Smart Logger
Model Number	TG-BA Series	500,502,503,504,507, 508,534,547	
Instrument Category	Electrochemical	Multiple sensor	Electrochemical
Application	Portable toxic gas monitoring for all the gases detected by Mod TG-KA Series as well as NF3, CH3Br, BCl3, SF6, chlorinated hydrocarbons or WF6	Monitoring combustible and oxygen gas levels and, in addition up to two toxic chemicals (CO, H2S, SO2 or Cl2)	Personal air monitoring for toxic gases (H2, CO, H2S, SO2, Cl2, HCN, HCl, NO, NO2, NH3, O3, ClO2, ETO and O2)
Operating Principle	Electrochemical	Multiple sensor, Hot wire, platinum bended pair for combustible. Electrochemical: others.	Electrochemical
Performance			
Compound	See Mod TG-KA plus: NF3, CH3Br, BCl3, SF6, chlorinated hydrocarbons or WF6	Combustible, oxygen, CO, H2S, SO2, Cl2	H2, CO, H2S, SO2, Cl2, HCN, HCl, NO, NO2, NH3, O3, ClO2, ETO and O2
Ranges	Gas dependent	Combustible: 0 to 100%LEL; H2S: 0 to 200ppm; CO: 0 to 999ppm; O2: 0 to 25%; SO2: 0 to 100ppm; Cl2: 0 to 20ppm	Varies with toxic gas Temp range: -10 to 40C
Response Time	<30 sec to 1/3 full scale	Combustible, 90% in 5 sec; H2S: 90% in 30 sec; CO: 90% in 30 sec; O2: 90% in 10 sec; SO2: 90% in 30 sec; Cl2: 90%in 180 sec	
Accuracy	±5% of full scale	Combustible: ±1%LEL; H2S: ±1 ppm; CO: ±1 ppm; O2: ±0.1%, SO2: ±0.2 ppm; Cl2: ±0.1 ppm	
Repeatability (precision)	±5% of full scale		
Resolution	Gas dependent	1 ppm for toxic gases, 1% LEL for combustibles, 0.1% vol for O2	Gas dependent
Sensitivity	Gas dependent	1 ppm for toxic gases, 1% LEL for combustibles, 0.1% vol for O2	
Operating Temperature	0 to 40°,	Warmup time: Cl2 in 5 min Others 1 min	-10 to 40°C
Recording Method	Analog meter	LCD display, optional data logging output port (AGM-D)	LCD display, data logging capability. Serial printer connector and PC compatible link.
Power	110 VAC or internal battery	Rechargeable battery	Rechargeable NiCad battery
Sampling Method	Uses a built-in sample pump	Passive	Passive, Optional sampling pump
Dimensions (W x H x L)	8" x 8" x 13"	3.1" x 1.5" x 6.2"	130 x 63 x 43 mm
Weight	13 lb	18 oz	225 g
Cost	$4,995	$1400-1800	$895-1395
DOE Contact Person			

Instrument #	28	29	30
Manufacturer	ENMET Corp. P.O. Box 979 Ann Arbor, MI 48106-0979 (313)761-1270 Fax (313)761-3220	ENMET Corp. P.O. Box 979 Ann Arbor, MI 48106-0979 (313)761-1270 Fax (313)761-3220	ENMET Corp. P.O. Box 979 Ann Arbor, MI 48106-0979 (313)761-1270 Fax (313)761-3220
Name	Multi-Function Microproc. Based Detector	TOXIMET	Tritector
Model Number	OMNI-4000		CGS-90, CGS-90R
Instrument Category	Multiple sensor	Electrochemical	Multiple sensor
Application	Simultaneous monitoring of combustible gases and any three of the following: H2, O2, toxic gases (CO, H2S, NH3, SO2, Cl2, HCN, HCl, NO, NO2)	Personal single function gas detector for O2, CO, H2S, NO, H2, NO2, HCl, SO2, Cl2, NH3, O3, ClO2, and ETO	Simultaneous monitoring of combustible gases, oxygen and toxic gases. Model CGS-90R includes detachable sensor head and 20 ft. cable.
Operating Principle	Multiple sensor Hot wire combustion gas sensor, one to three electrochemical interchangeable sensors.	Electrochemical	Multiple sensor Combustible: metal oxide semiconductor. Oxygen: galvanic electrochemical. Toxic: metal oxide semiconductor.
Performance			
Compound	Combustible gases, H2, O2, CO, H2S, NH3, SO2, Cl2, HCN, HCl, NO, NO2	O2, CO, H2S, NO, H2, NO2, HCl, SO2, Cl2, NH3, O3, ClO2, and ETO	Combustible gases, oxygen and toxic gases
Ranges	Gas dependent	Gas dependent	
Response Time			Combustible: <30 sec Toxic: <60 sec O2: 5 sec (for 19.5%. Alarm in 18% O2)
Accuracy			
Repeatability (precision)			
Resolution	Gas dependent	Gas dependent	
Sensitivity			
Operating Temperature	-10 to 40°C toxics	-10 to 40°C	
Recording Method	LC display, data logging capability. Serial printer connector and PC compatible link.	3-digit back lighted LCD	Two separate bar graphs for toxic and combustible, and LCD display for oxygen
Power	NiCad battery pack	9 V alkaline battery	9.6 V rechargeable NiCad battery pack
Sampling Method	Passive optional sampling pump	Passive	
Dimensions (W x H x L)	19.4 x 11.9 x 5.8 cm	130 x 63 x 28 mm	7.6″ x 4.4″ x 2.4″
Weight	1 Kg	215 g	3.5 lb (Model CGS-90); 3.9 lb (Model CGS-90R)
Cost	$1995-3000	$595-995	$1475-1745
DOE Contact Person			

Instrument #	31	32	33
Manufacturer	Envirometrics Products Co., Inc. 1019 Bankton Drive Charleston, SC 29406 (800)255-8740	Foxboro Company P.O. Box 500 East Bridgewater, MA 02333 (508)378-5556 Fax (508)378-5505	Foxboro Company P.O. Box 500 East Bridgewater, MA 02333 (508)378-5556 Fax (508)378-5505
Name	ACT Monitoring Card System	Century Organic Vapor Analyzer	Miran
Model Number		OVA-128	203
Instrument Category	Colorimetric	Portable GC	IR
Application	Personal toxic gas monitoring. Available for many gases.	Air monitoring of toxic gases	Detection and measurement of a single contaminant in air
Operating Principle	Colorimetric passive	Gas chomatography	Infrared spectrometry
Performance			
Compound	Toxic gases	many toxic gases	Many toxic gases
Ranges	Gas dependent	up to 5% of gas	Concentration range: gas dependent
Response Time	On site	2 sec	15 sec
Accuracy	±25% at 95% confidence interval	±20% on x1 scale ±10% on x10, x 100 scales	±5% of full scale
Repeatability (precision)	±0.5% at 95% confidence interval		Application dependent
Resolution		Application dependent	Depends on wavelength and application
Sensitivity	Gas dependent	Application dependent (down to 0.2 ppm CH4)	Can detect a 0.8% loss of infrared energy resulting from sample absorption
Operating Temperature	15 to 35°C	10 to 40°C	5 to 40°C
Recording Method	Qualitative Card: read visually by comparing the color developed during exposure to a preprinted standard. Quantitative Card: used with electronic reader to give concentrations in ppm.	Analog output	Analog meter, 0 to 1 V output for recorder
Power	16 V Pb-acid rechargeable battery	120/220 V and lead-acid battery	Rechargeable NiCad battery or 120/220 VAC
Sampling Method	Molecular diffusion	Built-in pump	Built-in pump, 30 L/min
Dimensions (W x H x L)	12.8 x 7.7 x 25.6 cm	9″ x 12″ x 5″	5.9″ x 7.5″ x 18.5″
Weight	1.63 Kg	12 lb	20 lb
Cost	$1,800	$8,500	$7820-8802
DOE Contact Person		Carroll A. Thomas, LANL, 505/667-3136. Bruce Bettencourt, LLNL, (510)422-5197 David Gettelfinger, MMES(K-25), (615)574-4621 for Mod. 128GC, also [Y12 & PNL]	

Instrument #	34	35	36
Manufacturer	Foxboro Company P.O. Box 500 East Bridgewater, MA 02333 (508)378-5556 Fax (508)378-5505	Foxboro Company P.O. Box 500 East Bridgewater, MA 02333 (508)378-5556 Fax (508)378-5505	GASTECH 8407 Central Avenue Newark, CA 94560-3431 (510)745-8700 Fax (510)794-6201
Name	Miran	Miran	Three Gas Personal Portable
Model Number	1A	1B2, 1BX	GX-82
Instrument Category	IR	IR	Multiple sensor
Application	Air monitoring for toxic gases	Air monitoring and identification of toxic gases	Air monitoring for combustible gases, oxygen and CO, H2S, or SO2
Operating Principle	Infrared spectrometry	Infrared spectrometry	Multiple sensor Combustibles: Catalytic Oxygen and Toxic Gases: Electrochemical
Performance			
Compound	Many toxic gases	Many toxic gases	Combustible, O2, CO, H2S, SO2
Ranges	Range: 0 to 0.025, 0 to 0.1, 0 to 0.25, 0 to 1 adsorption. 0 to 100% transmission. Wavelength ranges: 2.5 to 4.5, 4.5 to 8.0, 8.0 to 14.5 µm. Path length: 0.75 to 20.25 m.	Concentration Range: gas dependent	Combustibles: 0 to 99% LEL Oxygen: 0 to 39.9% VOL CO: 0 to 499 ppm H2S: 0 to 99.9 ppm SO2: 0 to 49 ppm
Response Time	1, 4, 10 and 40 sec	Cycle time: 1 minute	90% full scale in 30 sec
Accuracy	Application dependent generally ±10% of full scale	Application dependent generally ±10% of full scale	±5% of reading
Repeatability (precision)	Wavelength repeatability is ±0.1%	Wave length repeatabililty: ±0.1% Path length repeatability: ±0.1%	±2% of reading
Resolution	0.05 m at 3 µm, 0.12 µm at 6 µm, 0.25 µm at 11 µm.	0.05 µm at 3 µm 0.12 µm at 8 µm 0.25 µm at µ11 m	
Sensitivity	Can detect a 0.8% loss of infrared energy resulting from sample absorption	Can detect a 0.8% loss of infrared energy resulting from sample absorption	
Operating Temperature	0 to 40°C	5 to 40°C. RH 5 to 95%	5 to 104°F
Recording Method	Analog meter	LCD display, analog output 0 to 10 V, downloading capability (with RS-232)	LCD display
Power	120/220 V	Rechargeable NiCad battery	2 "C" alkaline batteries or NiCd batteries
Sampling Method	Sampling pump with flow rate of 30 L/min	Built-in pump, flow rate 25 to 30 L/min	Continuous diffusion, (optional sample-drawing)
Dimensions (W x H x L)	11.1" x 7.5" x 28.4"	9" x 11" x 27.8"	3.2" x 2" x 7.3"
Weight	32 lb	30 lb (1B2); 31 lb (1BX)	2 lb, 6 oz
Cost	$15,340-20,865	$19,700-21,687	$1550-2300
DOE Contact Person	Bruce Bettencourt, LLNL, (510)422-5197	David Gettelfinger, MMES(K-25), (615)574-4621 Bruce Bettencourt, LLNL, (510)422-5197	Carroll A. Thomas, LANL, 505/667-3136 David Gettelfinger, MMES(K-25), (615)574-4621 Bruce Bettencourt, LLNL, (510)422-5197

Instrument #	37	38	39
Manufacturer	GASTECH 8407 Central Avenue Newark, CA 94560-3431 (510)745-8700 Fax (510)794-6201	GASTECH 8407 Central Avenue Newark, CA 94560-3431 (510)745-8700 Fax (510)794-6201	GASTECH 8407 Central Avenue Newark, CA 94560-3431 (510)745-8700 Fax (510)794-6201
Name	Portable gas monitors	SAFETMATE	Single gas monitors
Model Number	GT Series		95 Series: OX-95, CO-95, HS-95
Instrument Category	Multiple sensor	Multiple sensor	Electrochemical
Application	Air monitoring for combustible gases, oxygen, CO and H2S	Personal air monitoring for two, three or four gases: combustibles, O2, H2S and CO	Personal air monitoring for CO, H2S and O2
Operating Principle	Multiple sensor Combustibles: Catalytic O2, H2S, CO: Electrochemical	Multiple sensor Combustibles: Catalytic O2, H2S, CO: Electrochemical	Electrochemical
Performance			
Compound	Combustible, O2, CO, H2S	Combustible, O2, CO, H2S	O2, CO, H2S
Ranges	Combustibles: 0 to 100% LEL & 0 to 10,000 ppm Oxygen: 0 to 30% vol CO: 0 to 300 ppm H2S: 0 to 200 ppm	Combustibles: 0 to 100% LEL Oxygen: 0 to 30% vol CO: 0 to 1000 ppm H2S: 0 to 500 ppm	Oxygen: 0 to 30% vol in 0.1% incr CO: 0 to 500 ppm in 1 ppm incr H2S: 0 to 100 ppm in 1 ppm incr
Response Time	90% in 20 sec	90% in 30 sec	90% in 30 sec
Accuracy	±5%, 0.5%, 10% of reading, 10% of reading	±5% of full scale	±5% of full scale for CO-95 and HS-95 ±0.2% of full scale for OX-95
Repeatability (precision)		±3% of full scale	±3% of full scale
Resolution	1% of 20ppm		
Sensitivity			
Operating Temperature		5 to 104°F	-20 to 45°C
Recording Method	LCD display	LCD display	LCD display
Power	4 D alkaline or NiCad batteries	2 C alkaline or NiCad batteries	9 V alkaline battery
Sampling Method	Built-in pump	Passive. Sample-drawing optional.	Passive/diffusion
Dimensions (W x H x L)	5″ x 6″ x 10″	2.8″ x 5″ x 1.6″	2.5″ x 4.5″ x 1″
Weight	5 lb	21 oz	6.5 oz
Cost	$1450-2300	$995-2150	$500
DOE Contact Person	GT402 @ PNL Bruce Bettencourt, LLNL, (510)422-5197 Models: GP-205, 1214, 1238, 1313 & 1314		Bruce Bettencourt, LLNL, (510)422-5197 Models: OX-95 & HS-91

Instrument #	40	41	42
Manufacturer	GASTECH 8407 Central Avenue Newark, CA 94560-3431 (510)745-8700 Fax (510)794-6201	Gilian Instrument Corp. 35 Fairfield Place W. Caldwell, NJ 07006 (201)808-3355 Fax (201)808-6680	Gilian Instrument Corp. 35 Fairfield Place W. Caldwell, NJ 07006 (201)808-3355 Fax (201)808-6680
Name	Three gas personal portable	Chrom Air	Trace Air
Model Number	GX-82		OVM-1, OVM-2
Instrument Category	Multiple sensor	Colorimetric	Badge
Application	Personal air monitoring for combustibles, O2 and H2S, CO or SO2	Personal screening, task and stationary sampling of ambient gases and vapors	Personal organic vapor monitoring
Operating Principle	Multiple sensor Combustibles: Catalytic O2, H2S, CO, SO2: Electrochemical	Colorimetric passive monitoring	Adsorption on charcoal strip
Performance			
Compound	Combustible, O2, CO, H2S, SO2		VOC
Ranges	Combustibles: 0 to 99% LEL Oxygen: 0 to 39.9% vol CO: 0 to 499 ppm H2S: 0 to 99.9 ppm SO2: 0 to 49 ppm		Should be returned to Lab for analysis
Response Time	90% in 30 sec		
Accuracy	±5% of reading		
Repeatability (precision)	±2% of reading		
Resolution			
Sensitivity			
Operating Temperature	5 to 104°F		
Recording Method	LCD display	Built-in scale for direct-reading of exposure dose	
Power	2 C alkaline batteries		
Sampling Method	Passive. Sample-drawing optional.	Passive air sampling	Passive air sampling
Dimensions (W x H x L)	3.2″ x 2″ x 3.2″		
Weight	22 oz		12 g
Cost	$1550-2300	$145 for 20	$70-80 for 5
DOE Contact Person	Carroll A. Thomas, LANL, 505/667-3136 Bruce Bettencourt, LLNL, (510)422-5197 Models: (CO, GX, OX)-82, OX-80, GX-3 & 1177		

Instrument #	43	44	45
Manufacturer	GMD Systems, Inc. (A Bacharach Affiliate) 625 Alpha Drive Pittsburg, PA 15238 (412)963-2200 Fax (412)963-2650	Heath Consultants, Inc. 9030 Monroe Road Houston, TX 77061 (713)947-9292 Fax (713)947-0422	Heath Consultants, Inc. 9030 Monroe Road Houston, TX 77061 (713)947-9292 Fax (713)947-0422
Name	Autostep plus	Detector-pak OVD	Gasurveyor
Model Number	400-011, -045, -015, -150, -020, 030, -110, -095		
Instrument Category	Colorimetric	FID	Multiple sensor
Application	Portable toxic gas monitor with multiple gas capability	Air monitoring for volatile organic compounds	Air monitoring for flammable gases, O2, CO and H2S
Operating Principle	Colorimetric paper tape and reflected light level. Measurement microprocessor controlled.	Flame ionization	Catalytic oxidation sensor for low concentrations and thermal conductivity sensor for high concentrations
Performance			
Compound	Toxic gases	VOC	Flammable gases, O2, CO and H2S
Ranges	Gas and model dependent	0 to 10,000 ppm in 5 range settings	0 to 1000 ppm accuracy 50 ppm 0 to 10% LEL accuracy 0.5% LEL 0 to 100% LEL accuracy 1% LEL 0 to 100% gas accuracy 1% gas
Response Time		3 sec to 90% full scale	5 sec to 95%
Accuracy	Gas and model dependent: ±15% of reading or 1 ppb/0.01 ppm, whichever is greater		50 ppm for 0 to 1000 ppm 0.5% LEL for 0 to 10% LEL 1% LEL for 0 to 100% LEL
Repeatability (precision)		±1% full scale detection	
Resolution		0.5 ppm	
Sensitivity		0.5 ppm	10 ppm
Operating Temperature			Temp range: -20 to 50°C Humidity: 20 to 95%
Recording Method	LED 4 digit display. Data logging capability with up to 2000 data points of instrument storage. Data can be downloaded directly to a computer.	Analog meter, 0 to 500 mV datalogger output	Analog and digital display, downloading capability via an RS232 port
Power		Rechargeable Ni metal hydride batteries, 12 V	4 D alkaline batteries
Sampling Method		Built-in pump with flow rate of 2 L/min	
Dimensions (W x H x L)	3.85″ x 8.55″ x 9.62″	10.5″ x 11″ x 28″	7″ x 3.75″ x 4″
Weight	4.75 lb, dependent on battery pack type	7 lb	3.5 lb
Cost	$4,900	$5,495	$1495-2395
DOE Contact Person			

Instrument #	46	47	48
Manufacturer	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812
Name	Photoionizer	Photoionizer	Photoionizer
Model Number	DL-101	HW-101	IS-101
Instrument Category	PID	PID	PID
Application	Survey, hazardous waste, industrial hygiene, and leak detection - volatile organic compounds.	For use in hazardous waste areas - volatile organic compounds.	For use under explosive conditions - volatile organic compounds
Operating Principle	Photoionization	Photoionization	Photoionization
Performance			
Compound	VOC	VOC	VOC
Ranges	0.1-2000 ppm Linear range 0.1-700 ppm	0.1-2000 ppm Linear range 0.1-700 ppm	0.1 to 2000 ppm Linear range 0.1 to 700 ppm
Response Time	<5 sec to 90% full scale	<5 sec to 90% full scale	<5 sec to 90% full scale
Accuracy			
Repeatability (precision)	±1% of full scale	±1% of full scale	±1% of full scale
Resolution			
Sensitivity	Sensitivity: 0 to 2 ppm Detection limit: 0.1 ppm	Sensitivity: 0 to 2 ppm Detection limit: 0.1 ppm	Sensitivity: 0 to 2 ppm Detection limit: 0.1 ppm
Operating Temperature	0-40°C. To 90% RH.	0-40°C. To 90% RH.	0 to 40°C to 90% RH
Recording Method	LCD display, data logging for up to 255 sites, RS232C interface to PC/printer	Analog meter	Analog meter
Power	Rechargeable, 8-hour, lead-acid gel battery	Rechargeable, 10-hour, lead-acid gel battery	Rechargeable, 8-hour, lead-acid gel battery
Sampling Method	Positive displacement pump	Positive displacement pump	Fan
Dimensions (W x H x L)	Probe: 7.62 x 20.32 cm, Cable: 91.5 cm, Readout: 20.3 x 15.2 x 7.6 cm	Probe: 6.3 x 34.3 cm, Cable: 99 cm, Readout: 21 x 16.5 x 13 cm	Probe: 6.3 x 34.3 cm, Cable: 99 cm, Readout: 21 x 16.5 x 13 cm
Weight	3.16 kg total	4.4 kg total	5.9 kg total
Cost	$4620-5495	$4,995	$4,995
DOE Contact Person	Carroll A. Thomas, LANL, 505/667-3136 Bruce Bettencourt, LLNL, (510)422-5197 both 10.2 eV and 11.7 eV		

Instrument #	49	50	51
Manufacturer	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812	HNU Systems, Inc. 160 Charlemont Street Newton, MA 02161-9987 (617)964-6690 Fax (617)965-5812
Name	Photoionizer	Portable GC	Portable Toxic Gas Analyzers
Model Number	PI-101	311D	EC61
Instrument Category	PID	Portable GC	Electrochemical
Application	Leak detection and surveys. Volatile organic compounds.	Monitoring for volatiles and semi-volatiles	Monitoring for CO2, SO2 or NH3
Operating Principle	Photoionization	Gas chromatography with PID, ECD, FUVAD detectors	Electrochemical
Performance			
Compound	VOC	volatiles and semi-volatiles	CO2, SO2 or NH3
Ranges	0.1 to 2000 ppm Linear range 0.1 to 700 ppm	Autoranging amplifier board with range of 10^5	CO2: 0 to 2000 ppm SO2: 0 to 20 ppm NH3: 0 to 200 ppm
Response Time	<5 sec to 90% full scale		
Accuracy			±5%
Repeatability (precision)	±1% of full scale		
Resolution		Depends on operating parameters	
Sensitivity	Sensitivity: 0-2 ppm Detection limit: 0.1 ppm	PID: 2 pg benzene, ECD: 0.8 pg lindane (Ni63) FUVAD: 0.5 ng propane.	
Operating Temperature	0 to 40°C to 90% RH	Oven: ambient to 200°C Incector and detector: ambient to 250°C	0 to 50°C
Recording Method	Analog meter	Prints chromatograms, results, calibration reports and alarm indications to Bidirectional RS232 port. Analog outputs, 0 to 1 mV and 0 to 10 V.	LCD display, 0 to 2 VDC output for data logger or recorder
Power	Rechargeable, ten hour, lead-acid gel battery	120/215/230 VAC	9 V alkaline battery.
Sampling Method	Fan	Sampling pump	
Dimensions (W x H x L)	Probe: 6.3 x 28.5 cm Cable: 99 cm Readout: 21 x 16.5 x 13 cm	22.2″ x 15″ x 9.7″	3.12″ x 1.38″ x 5.75″
Weight	4.4 kg total	55 lb	8.8 oz
Cost	$4,245	$18,745-22,500	$1,095
DOE Contact Person	Bruce Bettencourt, LLNL, (510)422-5197		

Instrument #	52	53	54
Manufacturer	Industrial Scientific Corp. 1001 Oakdale Road Oakdale, PA 15071 (412)788-4353 Fax (412)788-8853	Industrial Scientific Corp. 1001 Oakdale Road Oakdale, PA 15071 (412)788-4353 Fax (412)788-8853	Industrial Scientific Corp. 1001 Oakdale Road Oakdale, PA 15071 (412)788-4353 Fax (412)788-8853
Name	Multi-Gas Monitor	Multi-Gas Monitor	Multi-Gas Monitor
Model Number	LTX 310	TMX410	TMX412
Instrument Category	Multiple sensor	Multiple sensor	Multiple sensor
Application	Personal monitoring for oxygen, combustible gas and one of the following five toxic gases: CO, Cl2, HCN, H2S, NO, NO2, and SO2	Combustible gases, toxic gases and oxygen	Personal monitoring for oxygen, combustible gas and two of the following five toxic gases: CO, Cl2, H2S, NO2, and SO2
Operating Principle	Multiple sensor Combustibles: catalytic 02 and toxics: electrochemical	Multiple sensor Combustibles: catalytic 02 and toxics: electrochemical	Multiple sensor Combustibles: catalytic 02 and toxics: electrochemical
Performance			
Compound	Combustibles, O2, CO, Cl2, HCN, H2S, NO, NO2, and SO2		Combustibles, O2, CO, Cl2, H2S, NO2, and SO2
Ranges	Combustibles: 0 to 100% LEL CH4: 0 to 5% 02: 0 to 30% Toxics: gas dependent	Combustibles: 0 to 100% LEL CH4: 0 to 5% 02: 0 to 30% Toxics: gas dependent	Combustible: 0 to 100% LEL CH4: 0 to 5% O2: 0 to 30% Toxics: gas dependent
Response Time			
Accuracy			
Repeatability (precision)			
Resolution			
Sensitivity			
Operating Temperature	-15 to 40°C		-15 to 40°C
Recording Method	LCD Display		LCD display, can be upgraded to a data logging instrument
Power	Rechargeable NiCad battery pack	Rechargeable NiCad battery pack	Rechargeable NiCad battery pack
Sampling Method			
Dimensions (W x H x L)	4.75″ x 2.75″ x 1.65″		4.75″ x 2.75″ x 2″
Weight	20.4 oz		26 oz
Cost	$1450-1545	$1770-1940	$1770-1940
DOE Contact Person	Model CO260 Bruce Bettencourt, LLNL, (510)422-5197	Carroll A. Thomas, LANL, 505/667-3136. [Y12]	[PNL]

Instrument #	55	56	57
Manufacturer	Industrial Scientific Corp. 1001 Oakdale Road Oakdale, PA 15071 (412)788-4353 Fax (412)788-8853	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642
Name	Single Gas Monitor	Compact Portable Analyzer	Compact Portable Analyzer
Model Number	STX 70	4160 Series	4180, 4280 and 4360 Series
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Personal monitoring for toxic gases or oxygen	Continuous air monitoring for formaldehyde	Personal air monitoring for HCl, HCN and Hydrazine
Operating Principle	Electrochemical	Electrochemical (Voltametric) Sensor.	Electrochemical (Voltametric) Sensor.
Performance			
Compound	Toxic gases or oxygen	Formaldehyde	HCl, HCN and Hydrazine
Ranges	O2: 0 to 30% Toxics: gas dependent	0-1, 0-5, (0-1)/(0-5), 0-10, (0-1)/(0-10), (0-0.5)/(0-2) ppm	Several ranges are available for each chemical
Response Time		30 sec to 90% of full scale	20 sec to 90% of full scale
Accuracy		±2% of reading	±2% of reading
Repeatability (precision)		±0.5% of full scale	±0.5% of full scale
Resolution		1% of full scale	1% of full scale
Sensitivity		0.5% of full scale	1% of full scale
Operating Temperature	Gas dependent	5 to 50°C	5 to 50°C
Recording Method	Three versions are available: 1. Non-display (alarm only) 2. Display (digital readout in ppm) 3. Data logging (display or non-display)	Analog Meter Analog output	Analog meter (0-100 µA) Analog output
Power	3 V lithium battery	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries
Sampling Method		Built-in sampling pump	Built-in pump
Dimensions (W x H x L)	4″ x 2.5″ x 1.2″	4″ x 7″ x 8.875″	4″ x 7″ x 8.875″
Weight	7.2 oz	4.5 lb	4.5 lb
Cost	$630-945	$2,500	$2500-3500
DOE Contact Person			

Instrument #	58	59	60
Manufacturer	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642
Name	Compact Portable Analyzer	Compact Portable Analyzers	Data Logging Compact Portable Analyzer
Model Number	4200 Series	4000 Series	7160 Series
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Continuous air sampling for ethylene oxide	Continuous air monitoring for toxic gases: CO, Cl2, ClO2, H2S, NO, NO2, and SO2	Continuous air monitoring for formaldehyde
Operating Principle	Electrochemical (Voltametric) Sensor	Electrochemical (Voltametric) Sensor	Electrochemical (Voltametric) Sensor
Performance			
Compound	Ethylene oxide	CO, Cl2, ClO2, H2S, NO, NO2, and SO2	Formaldehyde
Ranges	0-5/0-50 ppm 0-5, 0-10, 0-50 ppm	Gas dependent	0 to 1, 0 to 5 ppm 0 to 10 ppm
Response Time	100 sec to 90% of full scale	20 sec to 90% of full scale	30 sec to 90% of full scale
Accuracy	±2% of reading	±2% of reading	±2% of reading
Repeatability (precision)	±0.5% of full scale	±0.5% of full scale	±1 last significant digit
Resolution	1% of full scale	1% of full scale	±1% of reading
Sensitivity	1% of full scale	0.5% of full scale	1% of full scale
Operating Temperature	5 to 50°C	5 to 50°C	5 to 50°C
Recording Method	Analog Meter Analog output	Analog Meter Analog output	Digital display, data logging capability
Power	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries
Sampling Method	Built-in sampling pump	Built-in sampling pump	Built-in sampling pump
Dimensions (W x H x L)	4″ x 7″ x 8.875″	4″ x 7″ x 8.875″	4″ x 7″ x 8.875″
Weight	4.5 lb	4.5 lb	4.5 lb
Cost	$2,600	$1500-3000	$3,000
DOE Contact Person			

Instrument #	61	62	63
Manufacturer	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642
Name	Data Logging Compact Portable Analyzer	Data Logging Compact Portable Analyzer	Data Logging Compact Portable Analyzers
Model Number	7180, 7280, and 7360 Series	7200 Series	7000 Series
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Personal air monitoring for HCl, HCN and Hydrazine	Continuous air sampling for ethylene oxide	Continuous air monitoring for toxic gases: CO, Cl2, ClO2, H2S, NO, NO2, and SO2
Operating Principle	Electrochemical (Voltametric) Sensor.	Electrochemical (Voltametric) Sensor.	Electrochemical (Voltametric) Sensor.
Performance			
Compound	HCl, HCN and Hydrazine	Ethylene oxide	CO, Cl2, ClO2, H2S, NO, NO2, and SO2
Ranges	Several ranges are available for each chemical.	0 to 10 ppm and 0 to 50 ppm	Gas dependent
Response Time	20 sec to 90% of full scale	100 sec to 90% of full scale	20 sec to 90% of full scale
Accuracy	±2% of reading	±2% of reading	±2% of reading
Repeatability (precision)	±1 last significant digit	±1 last significant digit	±1 last significant digit
Resolution	±1% of reading	1% of reading	±1% of reading
Sensitivity	1% of full scale	1% of full scale	1% of full scale
Operating Temperature	5 to 50°C	5 to 50°C	5 to 50°C
Recording Method	LCD display, data logging capability	Digital display, data logging capability	Digital display, data logging capability
Power	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries
Sampling Method	Built-in sampling pump	Built-in sampling pump	Built-in sampling pump
Dimensions (W x H x L)	4″ x 7″ x 8.875″	4″ x 7″ x 8.875″	4″ x 7″ x 8.875″
Weight	4.5 lb	4.5 lb	4.5 lb
Cost	$3200-4400	$3,400	$2500-3900
DOE Contact Person			

Instrument #	64	65	66
Manufacturer	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642
Name	Personal Alarm Monitor	Personal Alarm Monitors and Dosimeters	Standard Portable Analyzer
Model Number		2000 and 5000 Series	1160 Series
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Personal toxic gas monitoring for CO, Cl2, HCl, HCN, H2S, NO, NO2, and SO2	Personal air monitoring for HCl and HCN	Air monitoring for formaldehyde
Operating Principle	Electrochemical (Voltametric) Sensor	Electrochemical (Voltametric) Sensor	Electrochemical (Voltametric) Sensor
Performance			
Compound	CO, Cl2, HCl, HCN, H2S, NO, NO2, and SO2	HCl and HCN	Formaldehyde
Ranges	Maximum display is 199.9 or 1999 depending on range of instrument.	0 to 10 ppm all models	0-1, 0-5, (0-1)/(0-5), 0-10, (0-1)/(0-10), (0-0.5)/(0-2) ppm
Response Time	15 sec to 90% of full scale	15 sec to 90% of full scale	30 sec to 90% of full scale
Accuracy	±2% of reading	±2% of reading ±1 last significant digit	±2% of full scale
Repeatability (precision)	±1 last significant digit	±1 last significant digit	±0.5% of full scale
Resolution	±1% of reading	1% of reading	1% of full scale
Sensitivity	1% of full scale	1% of full scale	1% of full scale
Operating Temperature		5 to 50°C	5 to 50°C
Recording Method	LCD display, Analogy output	LCD display, Analog output	Analog Meter Analog output
Power		9 V alkaline battery	2 AA alkaline batteries or 4 C NiCad batteries
Sampling Method	Passive	Passive	Built-in pump
Dimensions (W x H x L)	3″ x 2.375″ x 6.5″	3″ x 2.375″ x 6.5″	6″ x 7.25″ x 11.5″
Weight	557 g	557 g	8 lb
Cost	$750-1500	$750-1500	$2,500
DOE Contact Person			

Instrument #	67	68	69
Manufacturer	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642
Name	Standard Portable Analyzer	Standard Portable Analyzers	Standard Portable Analyzers
Model Number	1200 Series	1000 Series	1180, 1280 and 1360 Series
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Continuous air sampling for ethylene oxide	Continuous air monitoring for toxic gases: CO, Cl2, ClO2, H2S, NO, NO2, and SO2	Personal air monitoring for HCl, HCN and Hydrazine
Operating Principle	Electrochemical (Voltametric) Sensor.	Electrochemical (Voltametric) Sensor.	Electrochemical (Voltametric) Sensor.
Performance			
Compound	Ethylene oxide	CO, Cl2, ClO2, H2S, NO, NO2, and SO2	HCl, HCN and Hydrazine
Ranges	0 to 5/0 to 50 ppm 0 to 5, 0 to 10, 0 to 50 ppm	Gas dependent	Several ranges are available for each chemical
Response Time	100 sec to 90% of full scale	20 sec to 90% of full scale	20 sec to 90% of full scale
Accuracy	±2% of full scale	±2% reading	±2% of reading
Repeatability (precision)	±0.5% of full scale	±5% of full scale	±0.5% of full scale
Resolution	1% of full scale	1% of full scale	1% of full scale
Sensitivity	1% of full scale	0.5% of full scale	1% of full scale
Operating Temperature	5 to 50°C	5 to 50°C	5 to 50°C
Recording Method	Analog Meter Analog output	Analog Meter Analog output	Analog meter (0-500 µA) Analog output
Power	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries	2 AA alkaline batteries or 4 C NiCad batteries
Sampling Method	Built-in sampling pump	Built-in sampling pump	Built-in pump
Dimensions (W x H x L)	6″ x 7.25″ x 11.5″	6″ x 7.25″ x 11.5″	6″ x 7.25″ x 11.5″
Weight	8 lb	8 lb	8 lb
Cost	$2,600	$1500-3000	$2500-3500
DOE Contact Person		Model 1142 Bruce Bettencourt, LLNL, (510)422-5197	

Instrument #	70	71	72
Manufacturer	Interscan Corporation P. O. Box 2496 Chatsworth, CA 91313-2496 (800)458-6153 Fax (818)341-0642	Lumidor Safety Products 11221 Interchange Circle South Miramar, FL 33025 (800)433-7220 Fax (305)433-7730	Lumidor Safety Products 11221 Interchange Circle South Miramar, FL 33025 (800)433-7220 Fax (305)433-7730
Name	Toxic Gas Monitor	Gas Pro Max	Gas Pro Plus
Model Number	MLD Series	MPU-18	MPU-16
Instrument Category	Electrochemical	Multiple sensor	Multiple sensor
Application	Continuous air monitoring for toxic gases: CO, Cl2, ClO2, formaldehyde, hydrazine, HCl, HCN, H2S, NO, NO2, SO2	Continuous monitoring of 2,3 or 4 gases simultaneously including oxygen, a combustible gas, and up to two toxic gases such as CO, H2S, SO2 or Cl2	Continuous monitoring of 2,3 or 4 gases simultaneously including oxygen, a combustible gas, and up to two toxic gases such as CO, H2S, SO2 (Cl2 optional)
Operating Principle	Electrochemical (Voltametric) Sensor		
Performance			
Compound	CO, Cl2, ClO2, formaldehyde, hydrazine, HCl, HCN, H2S, NO, NO2, SO2	Combustibles, O2, CO, H2S, SO2 or Cl2	Combustible, O2, CO, H2S, SO2 (Cl2 optional)
Ranges	Gas dependent	Combustible: 0 to 100% LEL H2S: 0 to 800 ppm CO: 0 to 800 ppm O2: 0 to 50 vol% SO2: 0 to 20 ppm	Combustible: 0 to 100% LEL H2S: 0 to 800 ppm CO: 0 to 800 ppm O2: 0 to 50 vol% SO2: 0 to 20 ppm, Cl2: 0 to 10 ppm
Response Time	20 sec to 90% of full scale	Combustible and H2S: <25 sec to 90% CO and O2 <15 sec to 90%	Combustible and H2S: <25 sec to 90% CO and O2 <15 sec to 90%
Accuracy	±2% of reading	±2% full scale	±2% full scale
Repeatability (precision)	±0.5% of full scale		
Resolution	1% of reading		
Sensitivity	1% of full scale		
Operating Temperature	-18 to 50°C	-50 to 50°C	-50 to 50°C
Recording Method	Digital display, 4-20mA output signal	LCD display, datalogger and down loading (through an IR window) to PC capabilities	LC display
Power	105 to 125 VAC	NiCad rechareable battery or 3 AA alkaline batteries	NiCad rechareable battery or 3 AA alkaline batteries
Sampling Method	Built-in sampling pump	Built-in sampling pump	Built-in sampling pump
Dimensions (W x H x L)	8″ x 11.5″ x 6″	7.8″ x 1.8″ x 4″	4.4″ x 8″ x 1.6″
Weight	15 lb	2 lb	22 oz
Cost	$1,900	$1855-2545	$1425-2275
DOE Contact Person			

Instrument #	73	74	75
Manufacturer	Lumidor Safety Products 11221 Interchange Circle South Miramar, FL 33025 (800)433-7220 Fax (305)433-7730	Lumidor Safety Products 11221 Interchange Circle South Miramar, FL 33025 (800)433-7220 Fax (305)433-7730	Matheson Gas Products 30 Sea View Drive Secaucus, NJ 07096 (201)867-4100 Fax (201) 867-4572
Name	Micro MAX	Toxy Beep and Oxy Beep	Badge dosimeters
Model Number	MAX-2G, 3D, 3E, 3F, 4A, 4B, 4C	Tox-1, Tox-2, Ox-1	8005, 8006, and 8007
Instrument Category	Multiple sensor	Multiple sensor	Colorimetric
Application	Diffusion monitoring of combustible gases, O2 and up to two toxic gases	Personal, single gas monitoring	Monitoring personnel exposure to seven gases (NH3, CO, Cl2, NH2NH2, H2S, NO2, O3)
Operating Principle		Multiple sensor 02: galvanic Toxic: electrochemical	Colorimetric
Performance			
Compound	Combustible, O2, CO, H2S, SO2	H2S, CO and O2	NH3, CO, Cl2, NH2NH2, H2S, NO2, O3
Ranges	Combustible: 0 to 100% LEL H2S: 0 to 800 ppm CO: 0 to 800 ppm O2: 0 to 25 vol% SO2: 0 to 20 ppm	H2S: 0 to 1000 ppm CO: 0 to 1000 ppm O2: 0 to 25% vol	Sensitivity: NH3: 25 ppm/5 min CO: 50 ppm/10 min Cl2: 1 ppm/15 min NH2NH2: 0.1 ppm/15 min H2S: 10 ppm/10 min NO2: 5 ppm/15 min O3: 0.1 ppm/15 min
Response Time			
Accuracy	±5% full scale	±1%	
Repeatability (precision)	±5% full scale		
Resolution			
Sensitivity			
Operating Temperature	-20 to 50°C	Gas dependent	
Recording Method	LC display	Alarm, battery life status and gas type display	Color change
Power	Rechargeable NiCad battery pack		
Sampling Method	Passive air monitoring; compact in line pump available for confined space pre-entry testing	Passive air monitoring	Diffusion
Dimensions (W x H x L)	1.8″ x 3″ x 4.75″	3.5″ x 2″ x 1.3″	
Weight	14.6 oz	3.8 oz	0.25 oz
Cost	$870-1795	$350	$21
DOE Contact Person	Bruce Bettencourt, LLNL, (510)422-5197 Model COM-19GR only		

Instrument #	76	77	78
Manufacturer	Matheson Gas Products 30 Sea View Drive Secaucus, NJ 07096 (201)867-4100 Fax (201) 867-4572	Matheson Gas Products 30 Sea View Drive Secaucus, NJ 07096 (201)867-4100 Fax (201) 867-4572	Matheson Gas Products 30 Sea View Drive Secaucus, NJ 07096 (201)867-4100 Fax (201) 867-4572
Name	Combustible Gas Detector	Detector tubes	Gas & Oxygen Deficiency Monitor
Model Number	8059		8063
Instrument Category	Catalytic combustion	Colorimetric	Multiple sensor
Application	Monitoring combustible gas levels in air	Air monitoring for many gases and vapors	Continuous monitoring of combustible gas and oxygen levels in air
Operating Principle	Catalytic combustion type sensor	Colorimetric	Multiple sensor Combustible Gases: catalytic combustion sensor Oxygen Deficiency: electrochemical
Performance			
Compound	Combustible gases	Many toxic gases and vapors	Combustibles and oxygen
Ranges		Depends on the gas or vapor	Combustible Gases: 0 to 100% LEL Oxygen: 0 to 25 vol %
Response Time			
Accuracy			Combustible Gases: 5% full scale Oxygen: ±1% of reading
Repeatability (precision)			
Resolution			
Sensitivity			
Operating Temperature	Temp range: -10 to 40°C		Temp range:-10 to 40°C
Recording Method		Calibration scales are printed on the tubes	Analog meter
Power	4 AA NiCad batteries		4 AA rechargeable NiCad batteries
Sampling Method	Diffusion	Hand-held pumps	Diffusion
Dimensions (W x H x L)	2.5″ x 3.4″ x 1″		3.3″ x 7.5″ x 1.5″
Weight	5.3 oz		1 lb 14 oz (850 g)
Cost	$470	$31.50, 35.50 for 10 tubes	$1,975
DOE Contact Person			

Instrument #	79	80	81
Manufacturer	Matheson Gas Products 30 Sea View Drive Secaucus, NJ 07096 (201)867-4100 Fax (201) 867-4572	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572
Name	Oxygen Deficiency Monitors	Hazardous gas detector	Leak hunter
Model Number	8060 and 8061	8057	8065
Instrument Category	Electrochemical	Solid state	Thermal conductivity
Application	Continuous monitoring of ambient oxygen levels. Model 8061 can be used for remote monitoring.	Monitoring air for many dangerous gases	Leak detection of helium, carbon dioxide, Freon 12 and other non-flammable gases
Operating Principle	Electrochemical (galvanic cell)	Solid-state/thermal conductivity sensor	Thermal conductivity
Performance			
Compound	Oxygen		Helium, Carbon Dioxide, Freon-12, AR
Ranges	0 to 40 vol.% Pressure range: up to 2 atm		
Response Time	2 to 4 sec	5 to 10 sec depending on gas	1 sec
Accuracy	±3% of concentration	Depends on gas	
Repeatability (precision)			
Resolution			
Sensitivity			Helium: 1.0 x E(-5) cc/s CO2: 3.5 x E(-5) cc/s Freon 12: 1.2 x E(-5) cc/s AR: 2.5 x E(-5) cc/s
Operating Temperature	Temp. range: 0 to 45°C	0 to 40°C	0°C to 50°C
Recording Method	LCD display		A segment LCD bar graph display
Power	2 AA rechargeable NiCad batteries	4 AA rechargeable NiCad batteris	4 AA rechargeable NiCad batteries included with charger
Sampling Method	Diffusion	Diffusion	Diffusion
Dimensions (W x H x L)	2.6″ x 4.7″ x 1.1″ (Model 8060) 2.6″ x 6.7″ x 1.1″ (Model 8061)	2.7″ x 6.1″ x 1.2″	3.5″ x 10″ x 14″ (storage case)
Weight	8.8 oz (Model 8060) 10.6 oz (Model 8061)	14 oz	1.5 lb (without storage case)
Cost	$530		
DOE Contact Person			

Instrument #	82	83	84
Manufacturer	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572
Name	Ozone monitor	Portable/personal monitors	Portable/personal monitors
Model Number	8412	MAT 5000 and MAT 5100	MAT 6000
Instrument Category	Solid state	Solid state	Solid state
Application	Measuring trace levels of ozone in ambient air	Air monitoring for combustible, corrosive or toxic gases and vapors. Units are available for more than 140 different gases and vapors.	Air monitoring for combustible gases and hydrogen sulfide
Operating Principle	Thin film semi-conductor (adsorption effect transistor)	Solid-state sensors	Solid-state sensors
Performance			
Compound	Ozone		
Ranges	0.01 to 5 ppm		
Response Time	Less than 2 min to 90% full scale	%LEL type sensors: 10 to 30 sec to 90% full scale PPM type sensors: 30 to 60 sec to 80% full scale	Combustible gases: 10 to 30 sec to 90% full scale H2S: 30 to 60 sec to 80% full scale
Accuracy		±5%	±5%
Repeatability (precision)			
Resolution			
Sensitivity			
Operating Temperature	0 to 40°C	-10 to + 45°C	-10 to + 45°C
Recording Method	LCD display	Analog meter	Analog meter
Power	4 AA rechargeable batteries	One 9.6 V, 2 D 1.25 V rechargeable NiCad batteries supplied with internal charger (Model 5000) or external charger (Model 5100)	One 9.6 V, 2 D 1.25 V rechargeable NiCad batteries supplied with internal charger
Sampling Method	Diffusion	Diffusion	Diffusion
Dimensions (W x H x L)	3.3″ x 7.5″ x 1.6″	Model 5000: 4.2″ x 5.3″ x 0.875″ Model 5100: 3″ x 2″ x 6″	4.2″ x 5.3″ x 7.8″
Weight	17.6 oz (500 g)	Model 5000: 5 lb Model 5100: 1.8 lb	5 lb
Cost			
DOE Contact Person			

Instrument #	85	86	87
Manufacturer	Matheson Gas Products 30 Seaview Drive Secaucus, NJ 07096 (201)867-4100 Fax (201)867-4572	MDA Scientific Inc. 405 Barclay Blvd. Lincolnshire, IL 60069 (800)323-2000 Fax (708)634-1371	MDA Scientific Inc. 405 Barclay Blvd. Lincolnshire, IL 60069 (800)323-2000 Fax (708)634-1371
Name	Multigas Leak Detector	FORMALDEMETER MARK II	ISOLOGGER
Model Number	8067	681000	P-770000
Instrument Category	Thermal conductivity	Electrochemical	Colorimetric
Application	Leak detection of a variety of gases. Calibration data for four different gas groups is stored in memory.	Direct reading formaldehyde monitor	Personal toxic gas monitor
Operating Principle	Thermal conductivity	Electrochemical	Colorimetric Paper tape monitor
Performance			
Compound		Formaldehyde	Diisocyanates, TDI, MDI, HDI
Ranges		0.3 - 99.9 ppm	0-80 ppb
Response Time	less than 1 sec	20 sec	2 min @ < 40 ppb 1 min @ < 80 ppb 30 sec @ <160 ppb 15 sec @ < 320 ppb
Accuracy		±15%	±15% of reading
Repeatability (precision)		±5%	±5%
Resolution		NA	NA
Sensitivity	depends on gas	0.3 ppm	0.2 ppb
Operating Temperature	0C to 50°C	0 to 40°C	0 to 40°C
Recording Method		LCD display	LCD display / RS232
Power	4 AA alkaline batteries	Battery	Battery
Sampling Method		Draw pump	Draw pump
Dimensions (W x H x L)	2.4″ x 2″ x 15″	63 mm x 120 mm x 30 mm	Exposure unit: 3.75″ x 2.75″ x 1.25″ Belt pack 5.5″ x 4.25″ x 1.5″
Weight	18 oz (510 g)	200 g	Exposure unit 7 oz Belt pack 25 oz
Cost		$965	
DOE Contact Person			

Instrument #	88	89	90
Manufacturer	MDA Scientific Inc. 405 Barclay Blvd. Lincolnshire, IL 60069 (800)323-2000 Fax (708)634-1371	Metrosonic Inc. P. O. Box 23075 Rochester, NY 14692 (716)334-7300 Fax (716)334-2635	Metrosonic Inc. P. O. Box 23075 Rochester, NY 14692 (716)334-7300 Fax (716)334-2635
Name	MODEL 3300	Ethylene Oxide Monitor	Multi-Gas Monitor
Model Number	350250, 350000	pm-7900-12	pm-7440
Instrument Category	Electrochemical	Electrochemical	Multiple sensor
Application	Area oxygen monitor	Air monitoring for ethylene oxide	Confined space monitoring for oxygen, combustible and toxic gases (CO, SO2, H2S, Cl2, NO2, NO, HCN, NH3, O3, ETO, H2, HCl)
Operating Principle	Electrochemical cell	Electrochemical	Multiple sensor Toxic gas: electrochemical
Performance			
Compound	Oxygen	Ethylene oxide	Combustibles, oxygen and toxic gases (CO, SO2, H2S, Cl2, NO2, NO, HCN, NH3, O3, ETO, H2, HCl)
Ranges	0-25% 0-100%	0 to 20 ppm	Combustible: 0.1% to 100% LEL O2: 0.1 to 30% O2 CO: 1 to 2000 ppm
Response Time	10 sec at 90%		Gas dependent
Accuracy	±2%		
Repeatability (precision)	±5%	2% of reading ±2 LSD	Combustible: N/A O2: N/A CO: 2% of reading ±2 LSD
Resolution	NA	0.1 ppm	
Sensitivity	5%		Combustible: 0.1% O2: 0.1% CO: 1 ppm
Operating Temperature	0 to 50°C	4 to 140°F	-20 to 55°C
Recording Method	Analog display meter	LCD display, data logging and down loading capabilities	LCD display, data logging and down loading capabilities
Power	Battery	9 V NEDA type 1604A Alkaline Battery	Rechargeable lead-acid battery
Sampling Method	Passive absorption		Optional external pumps (battery operated and hand aspirated)
Dimensions (W x H x L)	13 cm x 8 cm x 13 cm	3.6″ x 8.3″ x 1.2″	5.2″ x 3.6″ x 2.2″
Weight	16 oz	1.5 lb	1.2 lb
Cost	$730 / $675	$1,825	$1,550
DOE Contact Person			

Instrument #	91	92	93
Manufacturer	Metrosonic Inc. P. O. Box 23075 Rochester, NY 14692 (716)334-7300 Fax (716)334-2635	Metrosonic Inc. P. O. Box 23075 Rochester, NY 14692 (716)334-7300 Fax (716)334-2635	MicroSensor Systems Inc. 62 Corporate Court Bowling Green, KY 42103 (502)745-0099 Fax (502)745-0095
Name	Ozone Monitor	Personal Toxic Gas Monitor	Organic Vapor Monitor
Model Number	pm-7900-09	pm-7700	MSI-301
Instrument Category	Electrochemical	Electrochemical	Portable GC
Application	Air monitoring for ozone	Personal air monitoring for oxygen and toxic gases (CO, H2S, SO2, NO, NO2, HCN, NH3, O3, ETO, H2, HCl, Cl2)	Continuous air monitoring for organic vapors
Operating Principle	Electrochemical	Electrochemical	Gas chromatography with solid-state microsensor detector
Performance			
Compound	Ozone	Oxygen and toxic gases (CO, H2S, SO2, NO, NO2, HCN, NH3, O3, ETO, H2, HCl, Cl2)	Organic vapors
Ranges	0 to 5 ppm	O2: 0.1 to 30% O2 CO: 1 to 1000 ppm H2S: 0.1 to 200 ppm	0.001 to 500 ppm (typical)
Response Time			Six minute measurement cycle, typical
Accuracy			10% of reading
Repeatability (precision)	5% of reading ±2 LSD	O2: N/A CO: 2% of reading ±2 LSD H2S: 2% of reading ±2 LSD	10%
Resolution	0.01 ppm		0.001 ppm or 0.1% of reading, whichever is greater
Sensitivity		O2: 0.1% CO: 1 ppm H2S: 0.1 ppm	0 to 0.001 ppm
Operating Temperature		-15 to 55°C	5 to 40°C
Recording Method	LCD display, data logging and down loading capabilities	LCD display, data logging and down loading capabilities	LCD display, data logging, downloading to PC and printer capabilities
Power	9 V NEDA type 1604A Alkaline Battery	9 V battery	12 V rechargeable battery
Sampling Method		Passive sampling	Built-in pump
Dimensions (W x H x L)	3.6″ x 8.3″ x 1.2″	3″ x 4.8″ x 0.9″	14.5″ x 3.5″ x 13″
Weight	1.5 lb	12 oz	12 lb
Cost	$1,825	$1,225	$9300-9900
DOE Contact Person			

Instrument #	94	95	96
Manufacturer	MIE 1 Federal Street, #2 Billerica, MA 01821-3500 (508)663-7900 Fax (508)663-4890	MIE 1 Federal Street, #2 Billerica, MA 01821-3500 (508)663-7900 Fax (508)663-4890	MIE 1 Federal Street, #2 Billerica, MA 01821-3500 (508)663-7900 Fax (508)663-4890
Name	Data RAM	Fiber Monitor	Industrial Dust Sensor
Model Number	Dr-2000	FM 7400	IDS-10
Instrument Category	Optical	Optical	Optical
Application	Portable real-time aerosol monitoring	Real-time monitoring of air-borne fibers such as asbestos, mineral wool, advanced compositer, ceramic and glass	Real-time monitoring for dust, smoke, fumes or mists
Operating Principle	Optical	Electro-optical	Optical
Performance			
Compound	Dust, smoke, fumes or mists	Asbestos, mineral wool, advanced compositer, ceramic and glass fibers	Dust, smoke, fumes or mists
Ranges	Concentration ranges: 0.1 to 999.9 µg/m3 1.0 to 39.99 mg/m3 40 to 399.9 mg/m3	Fiber conc: 0.0001 to 25 fibers/cm3 Fiber length: 2 to 300 µm Fiber diameter: 0.2 to 20 µm	Concentration range: 0.01 to 100 mg/m3 0.1 to 1000 mg/m3 (optional) Particle size range: 0.1 to 10 µm
Response Time	1 sec or 10 sec	Minimum: 1 min Maximum: unlimited	Time constant: 20 sec (0.2 sec optional)
Accuracy	±5% of reading or ±5 µg/m3 whichever is greater	±5% of reading	±0.2% full scale at constant temp
Repeatability (precision)	±0.3 µg/m3 for 10 sec ±1.0 µg/m3 for 1 sec	±200/SQRT(N)% (N, No. of fibers counted)	0.2% of full scale at constant temp
Resolution	0.1 µg/m3, 0.01 mg/m3 and 0.1 mg/m3 respectively.	up to 0.0001 fibers/cm2	0.01 mg/m3 for 20 sec time constant
Sensitivity	0.1 µg/m3	0.0001 fibers/cm3	0.01 mg/m3 for 20 sec time constant
Operating Temperature	0 to 40°C	0 to 40°C	-10 to 50°C
Recording Method	LCD display, digital and analog outputs, data logging capability	LCD display, built-in printer automatically generates hard copy	Analog output (0 to 1.6 V or 4 to 20 mA)
Power	Built-in rechargeable battery	115 or 220 VAC	115 or 220 VAC
Sampling Method	Built-in pump	Built-in pump, total flow rate of 2 liters/min	Passive air sampling
Dimensions (W x H x L)	7.25″ x 5.28″ x 13.63″	13.8″ x 7.5″ x 19.8″	9″ x 7.1″ x 6.3″
Weight	11.7 lb	26.5 lb	9 lb
Cost	$9,275	$19,750	$2,550
DOE Contact Person			

Instrument #	97	98	99
Manufacturer	MIE 1 Federal Street, #2 Billerica, MA 01821-3500 (508)663-7900 Fax (508)663-4890	MSA P.O. Box 427 Pittsburgh, PA 15230 (800)MSA-INST Fax(412)776-3280	MSA P.O. Box 427 Pittsburgh, PA 15230 (800)MSA-INST Fax(412)776-3280
Name	Miniram	EKHO	Explosimeter
Model Number	PDM-3		2A, 3, 4 and 5
Instrument Category	Optical	Portable GC	Catalytic combustion
Application	Personal exposure monitoring of aerosol	Surveying sites for pesticides, herbicides, halocarbons, nitrocompounds and other compounds	Measurement of combustible gas concentrations in air
Operating Principle	Optical	Gas chromatography	Catalytic combustion.
Performance			
Compound	Dust, smoke, fumes or mists	pesticides, herbicides, halocarbons, nitrocompounds and other compounds	Combustible gas
Ranges	Concentration range: 0.01 to 10 mg.m3 0.1 to 100 mg/m3 Particle size range: 0.1 to 10 m		0 to 100% LEL
Response Time	10 sec	20 to 30 sec analysis time typical	
Accuracy	±0.02 mg/m3 at constant temp		
Repeatability (precision)	±0.02 mg/m3		
Resolution	±0.02 mg/m3	1000 theoretical plates column efficiency	
Sensitivity	0.02 mg/m3	0.001 ppb	
Operating Temperature	0 to 50°C	Ranges to: 40,100,150 and 175°C.	
Recording Method	LCD display, analog and digital outputs	Displays retention time and peak height. Can also be connected to a PC to write to a file	Analog meter
Power	Built-in rechargeable battery	Rechargeable lead-acid battery	6 carbon-zinc D cells
Sampling Method	Passive air sampling	Manual injection using syringes or a small portable collection device	Aspirator bulb
Dimensions (W x H x L)	4″ x 4″ x 2″	19″ x 14″ x 6″	3.38″ x 5.38″ x 5.5″
Weight	16 oz	28.5 lb	4 lb
Cost	$3,245		
DOE Contact Person	Carroll A. Thomas, LANL, 505/667-3136 Bruce Bettencourt, LLNL, (510)422-5197		Model 20 Bruce Bettencourt, LLNL, (510)422-5197

Instrument #	100	101	102
Manufacturer	MSA P.O. Box 427 Pittsburgh, PA 15230 (800)MSA-INST Fax(412)776-3280	MSA P.O. Box 427 Pittsburgh, PA 15230 (800)MSA-INST Fax(412)776-3280	MTI Analytical Instruments 41762 Christy Street Fremont, CA 94538 (800)762-9833 Fax (510)651-2498
Name	GasCorder	Passport PID	Micro GC
Model Number			M200, M200H Series
Instrument Category	FID or PID	PID	Portable GC
Application	Monitoring low concentrations of volatile organic compounds	Personal and survey monitoring of volatile organic compounds	Air monitoring for volatile and semi-volatile organics. Transportable instrument.
Operating Principle	Flame ionization or photoionization detectors	Photoionization	Gas chromatography Detector: silicon micro-machined, universal SSD (solid state thermal conductivity)
Performance		Req. data sheet 08-01-39	
Compound	VOC	VOC	VOC (M200) Compounds which are volatile at 110C (M200H)
Ranges	FID: 0.1 to 10000 ppm PID: 0.1 to 2000 ppm	0.1 to 2000 ppm	1 ppm to 100%
Response Time		3 sec to 90% of final reading	Gas dependent varies from 10 to 100 sec
Accuracy		±10% for 0.1 to 200 ppm	±2% for >10 ppm ±5% for <10 ppm
Repeatability (precision)			±2% RSD at const. temp. and pressure
Resolution			
Sensitivity		0.1 ppm isobutylene equivalents	1 ppm
Operating Temperature		32 to 105°F	0 to 50°C
Recording Method	LCD display, built-in drive for recording data	LC display, data logging capabilities	Notebook computer or PC
Power	Two rechargeable lead acid gel cell batteries or 115 VAC	Rechargeable NiCad, optional D or alkaline	12 VDC power supply
Sampling Method		Flow rates 200 50 cm3/min	Built-in pump
Dimensions (W x H x L)	FID: 17″ x 11.2″ x 8″ PID: 17″ x 8″ x 8″	4″ x 4″ x 8″	10″ x 6″ x 14″ (M200) 10″ x 6″ x 16″ (M200H)
Weight	FID: 18.5 lb PID: 10 lb	3 lb	12 lb (M200) 14 lb(M200H)
Cost			$14,000-16,000
DOE Contact Person		[ORNL]	

Instrument #	103	104	105
Manufacturer	MTI Analytical Instruments 41762 Christy Street Fremont, CA 94538 (800)762-9833 Fax (510)651-2498	MTI Measurement Systems, Inc. 327 Messner Drive Wheeling, IL 60090 (800)547-2900 Fax (708)808-9976	MTI Measurement Systems, Inc. 327 Messner Drive Wheeling, IL 60090 (800)547-2900 Fax (708)808-9976
Name	Portable micro gas chromatograph	MSTOX	Shuttle
Model Number	P200, P200H	8600	
Instrument Category	Portable GC	Electrochemical	Electrochemical
Application	Analyzing compounds which are volatile at 110°C. Portable Instrument	Personal toxic gas monitoring. Available for many gases.	Personal gas monitoring for CO, H2S and O2 deficiency
Operating Principle	Gas chromatography Detector: Silicon micro-machined, universal SSD (solid state thermal conductivity)	2 or 3-electrode electrochemical sensor.	Electrochemical sensor
Performance			
Compound	Compounds which are volatile at 110C (P200H, VOC (P200)	Toxic gases	CO, H2S and O2 deficiency
Ranges	1 ppm to 100%	0 to 50 ppm H2S 0 to 25% 02 0 to 300 ppm CO	0 to 50 ppm H2S 0 to 25% O2 0 to 300 ppm CO
Response Time	Gas dependent varies from 10 to 100 sec	30 sec to 90% of gen concentration	30 sec to 90% of gas concentration
Accuracy	±2% for >10 ppm ±5% for <10 ppm	±10%	±10%
Repeatability (precision)	2% RSD at const. temp. and pressure	< 5%	<5%
Resolution		Gas dependent	
Sensitivity	1 ppm	1 ppm for H2S	1ppm for H2S
Operating Temperature	0 to 50°C	- 4 to 104°F - 40 upon request	- 40 to 104°F
Recording Method	Analog output, 0 to ±1 VDC and 0 to ±10 VDC, GC read out; RS-232	3.5 digit LCD display	LCD display
Power	12 V rechargeable lead-acid battery or 12 VDC power supply	Alkaline or NiCad rechargeable battery	3 V battery
Sampling Method	Built-in pump	Passive	
Dimensions (W x H x L)	14″ x 6″ x 14″ (Model P2000) 14″ x 6″ x 16″ (Model P2000H)	1.875″ x 3.625″ x 0.75″ (D)	1.75″ x 4.5″ x 1.25″
Weight	23 lb (Model P2000) 29 lb (Model P2000-H)	3.3 oz	3 oz
Cost	$17,000-21,000	$740-1000	$325-395
DOE Contact Person			

Instrument #	106	107	108
Manufacturer	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207
Name	Datalogger	Detector tubes	Mini pac 02
Model Number	190	See Draeger Catalog	
Instrument Category	Electrochemical	Colorimetric	Multiple sensor
Application	Personal toxic gas monitoring for CO, H2S SO2, NO2	Toxic gas detection	Personal oxygen monitoring
Operating Principle	Three-electrode electrochemical sensor.	Colorimetric tubes	Multiple sensor Galvanic, electrochemical
Performance			
Compound	CO, H2S, SO2, NO2	Toxic gases	O2
Ranges	CO: 0 to 999 ppm H2S: 0 to 200 ppm SO2: 0 to 50 ppm NO2: 0 to 50 ppm	Gas dependent	0 to 25 vol%
Response Time	CO: < 60 sec H2S: < 60 sec SO2: < 60 sec NO2: < 60 sec		
Accuracy	CO: ±2 ppm or 3% H2S: ±2 ppm or 3% SO2: ±2 ppm NO2: ±2 ppm		±0.5 vol%
Repeatability (precision)	CO: ±2 ppm H2S: ±1 ppm SO2: ±0.1 ppm NO2: ±0.1 ppm		
Resolution	CO: 1 ppm H2S: 1 ppm SO2: 0.1 ppm NO2: 0.1 ppm		0.1 vol%
Sensitivity			
Operating Temperature	0 to 40°C		
Recording Method	Datalogging and downloading to a PC or printer capabilities	Concentration scales on the tubes	LCD display, analogy output
Power	9 V alkaline battery		9 V alkaline battery
Sampling Method	Diffusion	External pumps	Diffusion
Dimensions (W x H x L)	4.9″ x 2.″4 x 1.1″		4.9″ x 2.4″ x 1.1″
Weight	6.8 oz		6.8 oz
Cost	$969-1015	$39-60 for 10 tubes	$459
DOE Contact Person	David Gettelfinger, MMES(K-25), (615)574-4621	David Gettelfinger, MMES(K-25), (615)574-4621 Bruce Bettencourt, LLNL, (510)422-5197	

Instrument #	109	110	111
Manufacturer	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207
Name	Multi Pac	Multiwarn Indoor-Air CO2	Multiwarn Industrial
Model Number			
Instrument Category	Electrochemical	IR	IR
Application	Continuous monitoring of 2, 3 or 4 gases including combustibles, oxygen and toxic gases (NH3, Cl2, HCN, CO, SO2, H2S, NO, NO2 and broad band toxic)	Conducting measurements for determining acceptable indoor air quality for the ASHRAE standard. Can be combined with a CO sensor.	Confined space air monitoring for CO2 and O2
Operating Principle	Electrochemical	Non-dispersive infrared CO2 Sensor	Non-dispersive infrared CO2 Sensor
Performance			
Compound	Combustibles, O2, NH3, Cl2, HCN, CO, SO2, H2S, NO, NO2	CO2 and CO	CO2 and O2
Ranges	Combustibles: 0 to 99% LEL O2: 0 to 25% Vol CO: 0 to 999 ppm H2S: 0 to 199 ppm	CO2: 10 to 9990 ppm CO: 0 to 500 ppm	Single gas model CO2: 0 to 100 vol% Two gas model: CO2: 0 to 5 vol% O2: 0 to 25 vol%
Response Time		CO2: < 60 sec CO: < 60 sec	
Accuracy			
Repeatability (precision)		±5%	
Resolution			
Sensitivity			
Operating Temperature			
Recording Method	LCD display, datalogger and data management software	LCD display, internal data logging provides profile up to 7 days	LCD display, internal data logging
Power	NiCad rechargeable battery	NiCad rechargeable battery	NiCad rechargeable battery
Sampling Method		Diffusion, optional internal pump	
Dimensions (W x H x L)	8″ x 4″ x 2″	4.9″ x 7.5″ x 2.5″	4.9″ x 7.5″ x 2.5″
Weight	1.75 lb	3.1 lb	3.1 lb
Cost	$1695-2095	$2,800	$3,800
DOE Contact Person			

Instrument #	112	113	114
Manufacturer	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	National Draeger Inc. 101 Technology Drive, P. O. Box 120 Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207
Name	Pac EX	Personal Toxic Gas Monitors	Portable Multi-gas Monitors
Model Number		190	Dualarm/Trialarm/Quadalarm
Instrument Category	Catalytic combustion	Electrochemical	Multiple sensor
Application	Air monitoring for combustible gases	Personal toxic gas monitoring for CO, H2S SO2, NO2	Confined space air monitoring for combustible gas and O2 (Dualarm); combustible gas, O2 and CO or H2S (Trialarm); combustible gas, O2, H2S and CO (Quadalarm)
Operating Principle	Catalytic combustion, heat conductivity	Three-electrode electrochemical sensor.	Multiple sensor Combustible gases: poison resistant pellistor O2: galvanic fuel cell H2S and CO: 3-electrode electrochemical
Performance			
Compound	Combustible gases	CO, H2S, SO2, NO2	Combustible gas, O2, H2S and CO
Ranges	0 to 100% LEL 0 to 5 vol% CH4 5 to 100 vol% CH4	CO: 0 to 999 ppm H2S: 0 to 200 ppm SO2: 0 to 50 ppm NO2: 0 to 50 ppm	Combustible: 0 to 99%LEL O2: 0 to 25% vol CO: 0 to 999 ppm H2S: 0 to 199 ppm
Response Time	T90<20 sec	CO: < 60 sec ; H2S: < 60 sec SO2: < 60 sec ; NO2: < 60 sec	Combustible: < 30 sec ; O2: < 30 sec CO: < 60 sec ; H2S < 60 sec
Accuracy		CO: ±2 ppm or 3% H2S: ±2 ppm or 3% SO2: ±2 ppm NO2: ±2 ppm	Combustible: ±5% LEL O2: ±3% or 0.5% vol CO: ±2 ppm or 3% H2S: ±2 ppm or 3%
Repeatability (precision)		CO: ±2 ppm; H2S: ±1 ppm SO2: ±0.1 ppm; NO2: ±0.1 ppm	
Resolution	1%, 0.01% and 1% respectively	CO: 1 ppm H2S: 1 ppm SO2: 0.1 ppm NO2: 0.1 ppm	Combustible: 1% LEL O2: 0.1% O2 CO: 1ppm H2S: 1 ppm
Sensitivity			
Operating Temperature	-20 to 55°C	0 to 40°C	
Recording Method	LCD display	LCD display	Back-lighted LCD display
Power	NiCad rechargeable battery	9 V alkaline battery	NiCad rechargeable battery
Sampling Method	Diffusion, optional aspirator	Diffusion	Diffusion, optional external pump
Dimensions (W x H x L)	5.6″ x 2.6″ x 1.1″	4.9″ x 2.4″ x 1.1″	7.1″ x 3.35″ x 1.8″
Weight	13 oz	6.8 oz	1.54 lb
Cost	$850	$627-665	$1695-2095
DOE Contact Person			

Instrument #	115	116	117
Manufacturer	National Draeger Inc. 101 Technology Drive, Pittsburg, PA 15230 (412)787-8383 Fax (412)787-2207	Neotronics of No. America, Inc. P.O. Box 370 Gainsville, GA 30503-0370 (404)535-0600 Fax (404)532-9282	Neotronics of No. America, Inc. P.O. Box 370 Gainsville, GA 30503-0370 (404)535-0600 Fax (404)532-9282
Name	Passive dosimeters	Exotox	Minigas
Model Number		40, 50, 60 and 75	
Instrument Category	Colorimetric	Multiple sensor	Electrochemical
Application	Long term air monitoring for 18 organic and inorganic gases	Personal monitoring for up to 5 gases simultaneously: flammables, O2, CO, NO2, SO2, H2S, CO2 Cl2.	Personal monitoring for up to four gases (flammable, oxygen, CO, H2S)
Operating Principle	Colorimetric		Electrochemical
Performance			
Compound	18 organic and inorganic gases	Flammables, O2, CO, NO2, SO2, H2S, CO2 or Cl2	Flammable, oxygen, CO, H2S
Ranges	Gas dependent	O2: 0 to 32% vol; CO: 0 to 999 ppm; NO2: 0 to 99.9 ppm; H2S: 0 to 499 ppm, SO2: 0 to 99.9 ppm; Cl2: 0 to 99.9 ppm; CO2: 0 to 5% vol; Flammables: 0 to 100% LEL	Flammable: 0 to 99% LEL or 0 to 4.9% vol ; Oxygen: 0 to 25% vol CO: 0 to 999 ppm; H2S: 0 to 499 ppm
Response Time			Flammable: 40 sec; O2: 20 sec; CO: 60 sec ; H2S: 60 sec
Accuracy			Flammable: ±3% LEL @<50 LEL and ±5% @>50 LEL Oxygen: ±0.3% vol; CO: ±5 ppm @ 100 ppm ; H2S: ±5 ppm @ 50 ppm
Repeatability (precision)			Flammable: ±2% LEL; O2: ±0.3% vol CO: ±5 ppm at 100 ppm; H2S: ±2 ppm at 50 ppm
Resolution			Flammable: 1% LEL; Oxygen: 0.1% vol; CO: 1 ppm; H2S: 1 ppm
Sensitivity			Flammable: 1% LEL; O2: 1% vol CO: 1 ppm; H2S: 1 ppm
Operating Temperature	10 to 30°C		-20 to 50°C
Recording Method		Digital display, model 75 provides on-board data logging	LCD display, data logging capability
Power			Rechargeable NiCad or dry cell (4 x AAA) battery pack
Sampling Method		Models 60 and 75 offer an optional internal pump	External electric sample pump, flow rate: 300 cm 3/min
Dimensions (W x H x L)		Exotox 40: 2″ x 4″ x 7″ Exotox 50: 2.25″ x 4″ x 8″ Exotox 60/75: 3″ x 4.25″ x 6.25″	70 x 46 x 165 mm (rechargeable) 70 x 46 x 152 mm (dry cell)
Weight		39, 48, and 26 oz	850 g and 720 g
Cost	$53 for 10 tubes		$945-1695
DOE Contact Person	David Gettelfinger, MMES(K-25), (615)574-4621 Bruce Bettencourt, LLNL, (510)422-5197		Carroll A. Thomas, LANL, (505)667-3136

Instrument #	118	119	120
Manufacturer	Neotronics of No. America, Inc. P.O. Box 370 Gainsville, GA 30503-0370 (404)535-0600 Fax (404)532-9282	OI Analytical P. O. Box 9010 College Station, TX 77842-9010 (409)690-1711 Fax (409)690-0440	PhotoVac International Inc. 25-B Jefryn Boulevard West Deer Park, NY 11729 (516)254-4199 Fax (516)254-4284
Name	Neotox	Field/Fixed Site GC System	10S plus
Model Number		FM-2000	
Instrument Category	Electrochemical	Portable GC	Portable GC/PID
Application	Personal monitoring for a single gas (O2, CO, NO2, H2S, SO2 or Cl2)	Automatic continuous air monitoring for volatile organic compounds. Requires AC power.	Gas chromatographic monitoring of toxic gases
Operating Principle	Electrochemical	Gas chromatography with choices of FID, PID, FPD, FID/FPD, PID/FID detectors	Gas chromatography, photoionization Second detector option
Performance			
Compound	O2, CO, NO2, H2S, SO2 or Cl2	VOC	Toxic gases and vapors
Ranges	O2: 0 to 32% vol CO: 0 to 999 ppm NO2: 0 to 99.9 ppm H2S: 0 to 499 ppm SO2: 0 to 99.9 ppm, Cl2: 0 to 99.9 ppm	PID: 1 ppb to 10 ppm FID: 5 ppb to 500 ppm FPD: <0.5 ppt to 100 ppm	Low ppb to hundreds of ppm
Response Time	Gas dependent		1 to 20 min, application dependent
Accuracy	Gas dependent		Application dependent
Repeatability (precision)	Gas dependent		Application dependent
Resolution	Gas dependent		0.1 ppb
Sensitivity	Gas dependent		0.1 ppb
Operating Temperature	-20 to 50°C		3 to 40°C
Recording Method	Digital display	Standard RS-232-C (bidirectional), MINI-NET data communications network for remove data reporting from up to 50 monitoring systems	Built-in computer, menu-driven software and instant access memory cards for method and data storage
Power	4 AA alkaline or rechargeable NiCad	110 VAC	Rechargeable battery or AC
Sampling Method		Solid sorbent sample preconcentration for low concentrations; loop sampling for high concentrations	Built-in pump or with syringe
Dimensions (W x H x L)	4″ x 2.38″ x 1.06″	12″ x 12″ x 10″	18.3″ x 14.4″ x 6″
Weight	5.25 oz	18 lb	Less than 30 lb
Cost	$450-1095	$19,750	$19,700
DOE Contact Person			David Gettelfinger, MMES(K-25), (615)574-4621

Instrument #	121	122	123
Manufacturer	PhotoVac International Inc. 25-B Jefryn Boulevard West Deer Park, NY 11729 (516)254-4199 Fax (516)254-4284	PhotoVac International Inc. 25-B Jefryn Boulevard West Deer Park, NY 11729 (516)254-4199 Fax (516)254-4284	Quest Technologies 510 Worthington Street Oconomowoc, WI 53066 (800)245-0779 Fax (414)567-4047
Name	Microtip	Snapshot	Envirocheck
Model Number	IS-3000, HL-2000 and several other models		
Instrument Category	PID	Portable GC	Electrochemical
Application	Real-time monitoring of toxic gases and vapors	Gas chromatographic monitoring of toxic gases	Personal air monitoring for O2 or any of the nine toxic gases (CO, H2S, Cl, HCl, HCN, NH3, SO2, NO, NO2)
Operating Principle	Photoionization	Gas chromatography, photoionization	Electrochemical
Performance			
Compound	Toxic gases and vapors	Toxic gases and vapors	O2, CO, H2S, Cl, HCl, HCN, NH3, SO2, NO, NO2
Ranges	0.1-2000 ppm up to 20,000 ppm with dilution probe	Benzene: 0 to 50 ppm Toluene: 0 to 200 ppm C8 aromatics: 0 to 200 ppm	O2: 0 to 30% vol Toxic: gas dependent
Response Time	< 3 sec	4 to 10 min	
Accuracy	for isobutylene ±2 ppm for 0 to 100 ppm ±10% for 100 to 1000 ppm ±15% for 1000 to 2000 ppm	±15% within 1 decade of calibration	±5% of reading
Repeatability (precision)	±1% for isobutylene		1 to 5% of reading
Resolution	0.1 ppm	0.1 ppm	O2: 1% Toxic: gas dependent
Sensitivity	0.1 ppm for isobutylene	Benzene: 0.1 ppm Toluene: 1.0 ppm Total C8 aromatics: 1.0 ppm	Gas dependent
Operating Temperature	0 to 40°C	10 to 40°C	-10 to 45°C
Recording Method	Data logging	LC display, datalogging and downloading to a PC or printer	LCD display
Power	Rechargeable battery	Rechargeable battery	9 V alkaline battery
Sampling Method	Built-in pump	Built-in pump	Passive
Dimensions (W x H x L)	16.9″ x 9.5″ x 5.75″	14″ x 9″ x 5″	4.5″ x 2.5″ x 1.25″
Weight	5.25 lb	8.5 lb	11.6 oz
Cost	$4,300	$9,600	$595-795
DOE Contact Person	Carroll A. Thomas, LANL, (505)667-3136 [PNL]		

Instrument #	124	125	126
Manufacturer	Quest Technologies 510 Worthington Street Oconomowoc, WI 53066 (800)245-0779 Fax (414)567-4047	RAE Systems 680 West Maude Avenue, Suite1 Sunnyvale, CA 94086 (408)481-4999 Fax (408)481-4998	Sam Dick Industries P.O. Box 70498 Seattle, WA 98107 (206)789-5410 Fax (206)789-5414
Name	Envirotrack	MicroRAE Turbo	Portable Detector
Model Number		PGM-22K	XPO-317
Instrument Category	Multiple sensor	PID	Multiple sensor
Application	Air monitoring for two, three or four gases simultaneously	Personal organic vapor exposure monitoring	Air monitoring for combustible gases, oxygen and toxic gases
Operating Principle	Multiple sensor Combustible gases: catalytic O2 and toxic gases: electrochemical	PID with 10.6 ev lamp	Multiple sensor Combustible: Catalytic combustion Oxygen: Galvanic cell Toxic gases: Reagent discoloration
Performance			
Compound	Combustible, O2 and two toxic gases (#154)	VOC	Combustibles, O2 and toxic gases
Ranges	O2: 0 to 30% vol Combustible 0 to 100% LEL Toxic: gas dependent	0 to 999.9 ppm 1000 to 1999 ppm	Combustibles: 0 to 100% LEL Oxygen: 0 to 25% vol CO: 0 to 500 ppm H2S: 0 to 60 ppm
Response Time		<5 sec to 90% point when exposed to 100 ppm isobutylene	<30 sec
Accuracy	±5% of reading	2 ppm or 10% of reading. Calibrated to 100 ppm isobutylene equivalent.	Combustibles: ±5% of full scale O2: ±0.7% or less Toxic gases: ±35 % of reading
Repeatability (precision)	1 to 5% of reading	0.2 to 0.5 ppm	±%5 of full scale
Resolution	O2, combustible: 1% Toxic: gas dependent	0.1 ppm	1%
Sensitivity	Gas dependent	0.1 ppm	Combustible: 5 to 10% LEL O2: 5%
Operating Temperature	-10 to 45°C	-10 to 40°C	-10 to 40°C
Recording Method	LCD display, data logging and down loading capabilities	7 digit LCD with LED backlight Stores 48 S values plus TWA and peak values for direct read back	Analog meter
Power	2 C NiCad or alkaline batteries	6 V	4 x UM-3 alkali batteries
Sampling Method	Passive, optional external pump	Fan draws air sample in and out of the detector chamber	Built-in aspirating suction pump
Dimensions (W x H x L)	6″ x 3″ x 1.5″	2.7″ x 1.3″ x 6.2″	8.4 x 19 x 4 cm
Weight	22 oz	11.4 oz with battery	850 g
Cost	$1299-2128	$2500-3000	$1,400
DOE Contact Person			

Instrument #	127	128	129
Manufacturer	Scott Aviation 309 W. Crowell Street Monroe, NC 28112 (704)282-8400 Fax (704)282-8423	Scott Aviation 309 W. Crowell Street Monroe, NC 28112 (704)282-8400 Fax (704)282-8423	Scott Aviation 309 W. Crowell Street Monroe, NC 28112 (704)282-8400 Fax (704)282-8423
Name	Scott-Alert	Scott-Alert	Scott-Alert
Model Number	S101, S103, and S105	S102, S106, and S108	S104, S107 and S109
Instrument Category	Multiple sensor	Multiple sensor	Multiple sensor
Application	Air monitoring for oxygen and combustible gas	Air monitoring for oxygen, combustible gas and hydrogen sulfide	Air monitoring for carbon monoxide, oxygen and combustible gases
Operating Principle			
Performance			
Compound	Combustible gases and oxygen	Combustible gas (106,108) Oxygen (108) H2S (102,106,108)	Combustible gas (107,109) Oxygen (109) Co (104,107,109)
Ranges	Combustible gas: 0 to 100% LFL Oxygen: 0 to 2.5%	Combustible gas: 0 to 100% LFL Oxygen: 0 to 25% H2S: 0 to 199 ppm	Combustible gas 0-100% LFL Oxygen 0-25% vol CO 0-199 ppm
Response Time	Combustible gas: 10 sec to 63% Oxygen: 20 sec to 63%	Combustible gas: 10 sec to 63% Oxygen: 20 sec to 63% H2S: 45 sec to 63%	Combustible gas: 10 sec to 63% Oxygen: 20 sec to 63% Co: 25 sec to 63%
Accuracy	Combustible gas: ±3% from 0 to 50% LFL Oxygen: ± 8%	Combustible gas: ± 3% from 0 to 50% LFL Oxygen: ± 0.8% H2S: ± 5 ppm from 0 to 50 ppm; ± 5% of full scale from 51 to 199	Combustible gas: ± 3% from 0-50% LFL Oxygen: ± 8% CO: ±5 ppm from 0-50 ppm; ±10% FS from 51-199 ppm
Repeatability (precision)			
Resolution			
Sensitivity			
Operating Temperature	Combustible gas: -10 to 60°C Oxygen: 0 to 40°C	Combustible gas: 10 to 60°C Oxygen: 0 to 40°C Co: 0 to 40°C	Combustible gas: 10 to 60°C Oxygen: 0 to 40°C Co: 0 to 40°C
Recording Method	LCD display	LCD display	LCD display
Power	7.2 V NiCad rechargeable battery	7.2 V NiCad rechargeable battery	7.2 V NiCad rechargeable battery
Sampling Method			
Dimensions (W x H x L)	3.125″ x 1.625″ x 6.25″	3.125″ x 1.625″ x 6.25″	3.125″ x 1.625″ x 6.25″
Weight	18 oz	18 oz	18 oz
Cost			
DOE Contact Person			

Instrument #	130	131	132
Manufacturer	Scott Aviation 309 W. Crowell Street Monroe, NC 28112 (704)282-8400 Fax (704)282-8423	Sensidyne 16333 Bay Vista Drive Clearwater, FL 34620 (800)451-9444 Fax (813)539-0550	Sensidyne Inc. 1633 Bay-Vista Dr. Clearwater, FL 34620 (800)451-9444 Fax (813) 539-0550
Name		GasTec tubes	Laser Dust Monitor
Model Number	Scott S109		LD-1
Instrument Category	Multiple sensor	Colorimetric	Optical
Application	Combustible gases, toxic gases and oxygen	Air monitoring for over 240 gases and vapors	Real time monitoring for airborne dusts, fumes, mists and aerosols
Operating Principle		Colorimetric	Optical (light scatter)
Performance			
Compound	Combustibles, O2, CO	Over 240 toxic gases	Airborne dusts, fumes, mists and aerosols
Ranges	Combustible: 0 to 100% LEL O2: 0 to 25% vol CO: 0 to 199 ppm	Depends on the gas or vapor	0.001-100 mg/m3 0.001-10 mg/m3
Response Time	25 sec to 63% of step change of applied gas concentration		Sample time: 0.1, 1, 2, 5 and 10 min
Accuracy			±10%
Repeatability (precision)			
Resolution			
Sensitivity			0.001 mg/m3
Operating Temperature	0 to 40°C		0 to 40°C
Recording Method		Calibration scales are printed on the tubes	Analog meter, 0 to 1000 mg/m3, LCD display
Power			8 AA Batteries
Sampling Method		Hand-held pumps	Built-in pump, flow rate of 3.4 LPM
Dimensions (W x H x L)			18.5 x 10.5 x 6.3 cm
Weight			3.3 lb
Cost		$50 for 10 tubes	$4,975
DOE Contact Person	MMES (K-25) Bruce Bettencourt, LLNL, (510)422-5197 Model D-11		

Instrument #	133	134	135
Manufacturer	Sensidyne Inc. 1633 Bay-Vista Dr. Clearwater, FL 34620 (800)451-9444 Fax (813) 539-0550	Sensidyne Inc. 1633 Bay-Vista Dr. Clearwater, FL 34620 (800)451-9444 Fax (813) 539-0550	Sensidyne Inc. 1633 Bay-Vista Dr. Clearwater, FL 34620 (800)451-9444 Fax (813) 539-0550
Name	Mini Monitors	Portable Gas Detection Instrument	Portable Gas Detection Instrument
Model Number		SS2000	SS4000
Instrument Category	Electrochemical	Electrochemical	Electrochemical
Application	Personal air monitoring for CO, H2S, NO2, O2 and SO2	Air monitoring for toxic gases: Br2, Cl2, CO2, F2, H2, HCl, HCN, HF, NH3, SO2	Air monitoring for Arsine (AsH3) phosphine PH3), and silane (SiH4)
Operating Principle	Electro chemical diffusion type	Diffusion type electro chemical sensors	Electro chemical sensors
Performance			
Compound	CO, H2S, NO2, O2 and SO2	Br2, Cl2, CO2, F2, H2, HCl, HCN, HF, NH3, SO2	AsH3, PH3 and SiH4
Ranges	CO: 0 to 400 ppm H2S: 0 to 100 ppm O2: 0 to 4% vol NO2: 0 to 20 ppm SO2: 0 to 4 ppm	Gas dependant	SiH4: 0 to 10 & 0 to 30 AsH3: 0 to 10 & 0 to 5 PH3: 0 to 10 & 0 to 5
Response Time	CO: <3 sec H2S: <3 O2: <10 NO2: <5 SO2: <5	Gas dependent	<10 sec for 10 ppm
Accuracy	±5%	±10%	±8%
Repeatability (precision)	CO, H2S: ±5% O2: 0.05% NO2, SO2: ±5%	±10%	±5%
Resolution	1 ppm for CO and H2S 0.1% for O2; 0.1 ppm for NO2 and SO2	Gas dependent	SiH4: 0.5 & 2 ppm AsH3 & PH3: 0.05 & 0.2 ppm
Sensitivity	CO, H2S: 1 ppm; O2: 0.1%; NO2, SO2: 0.1 ppm	Gas depdendent	
Operating Temperature	14 to 104°F	0 to 40°C for most gases	0 to 40°C
Recording Method	LCD display	Analog meter, 1-5 VdC recorder output	Analog meter
Power	2 AA batteries	Rechargeable NiCad batteries	3 AA batteries
Sampling Method	Passive sampling	Passive sampling	Built-in sampling pump, flow rate 200 ml/min
Dimensions (W x H x L)	3″ x 4.75″ x 1″	4.4″ x 8.5″ x 6.8″	4.1″ x 5.9″ x 2.8″
Weight	0.5 lb (for CO, H2S & O2 monitors); 0.6 lb (for NO2, & SO2)	3.4 lb	3.4 lb
Cost	$680-1100	$1450-1690	$3,750
DOE Contact Person			

Instrument #	136	137	138
Manufacturer	Sensor Technology 3 Whatney Irvine, CA 92718 (714)452-9000 Fax (714)452-9009	Sensor Technology 3 Whatney Irvine, CA 92718 (714)452-9000 Fax (714)452-9009	Sensor Technology 3 Whatney Irvine, CA 92718-2806 (714)452-9000 Fax (714)452-9009
Name			Select-A-Gas
Model Number	AG 5000, AG 5100	AG 6000	IQ-1000
Instrument Category	Solid state	Solid state	Multiple sensor
Application	Monitoring for over 100 toxic/combustible gases	Simultaneous monitoring for combustible gases and H2S	Monitoring over 100 toxic and combustible gases
Operating Principle	Metal oxide sensor	Metal oxide sensor	Multiple sensor Solid state, catalytic and electrochemical, accepts up to 4 sensors.
Performance			
Compound	Over 100 toxic/combustible gases	Combustible gases and H2S	Over 100 toxic and combustible gases
Ranges	Varies with gas	Combustibles: 0 to 100% LEL H2S: varies	Gas dependent
Response Time	30 sec to 90% of full scale	30 sec to 90% of full scale	30 sec to 90% of full scale
Accuracy	±5% of full scale	±5% of full scale	±5% of full scale
Repeatability (precision)	±5% of full scale	±5% of full scale	±5% of full scale
Resolution			
Sensitivity	1 to 2% of full scale	1 to 2% of full scale	1 to 2% of full scale
Operating Temperature	-10 to 45°C	-10 to 45°C	0 to 50 °C. RH: 95%, noncondensing
Recording Method	Analog meter, optional 0 to 100 mV analog output	Analog meter	LCD display, data logging, interface to a printer or PC
Power	Rechargeable NiCad battery	Rechargeable NiCad battery	6 D alkaline or NiCad batteries
Sampling Method	Passive, optional sampling pump	Passive, optional sampling pump	Diffusion or built-in pump
Dimensions (W x H x L)	0.875″ x 5.3″ x 4.2″ (AG 5000) 3″ x 2″ x 6″ (AG 5100)	0.875″ x 1.666″ x 4.2″	5.125″ x 5.5″ x 11″
Weight	5 lb (AG 5000) 1.8 lb (AG 5100)	5 lb	7 lb
Cost	$840-1375	$1,395	$2,850
DOE Contact Person			

Instrument #	139	140	141
Manufacturer	Sentex Systems, Inc. 553 Broad Avenue Ridgefield, NJ 07657 (201)945-3694 Fax (201)941-6064	Sentex Systems, Inc. 553 Broad Avenue Ridgefield, NJ 07657 (201)945-3694 Fax (201)941-6064	Sentex Systems, Inc. 553 Broad Avenue Ridgefield, NJ 07657 (201)945-3694 Fax (201)941-6064
Name	Scentograph	Scentogun	Scentoscreen
Model Number			
Instrument Category	Portable GC	PID	Portable GC
Application	Air monitoring for volatile and semi-volatile organic compounds	Air monitoring for volatile organic compounds	Air monitoring for volatile and semi-volatile organic compounds
Operating Principle	Gas chromatography with five detector options: (1) argon ionization (2) micro argon ionization (3) electron capture (4) thermal conductivity (5) photoionization	Photoionization detector	Gas chromatography with five detector options: (1) argon ionization (2) micro argon ionization (3) electron capture (4) thermal conductivity (5) photoionization
Performance			
Compound	VOC	VOC	VOC
Ranges		0 to 200ppm 200 to 2,000ppm	
Response Time		90% full response in <2sec	
Accuracy			
Repeatability (precision)			
Resolution		0.1ppm and 1ppm	
Sensitivity	(1) argon ionization/EC: 1ppb benzene & 0.1ppb chlorinated (2) micro argon ionization: 1ppb benzene (3) electron capture: 1ppt chlorinated (4) thermal conductivity: 100ppm methane (5) photoionization: 1ppb benzene Dual column capability	0.1ppm benzene	(1) argon ionization/EC: 1ppb benzene & 0.1ppb chlorinated (optional) (2) micro argon ionization: 1ppb benzene (3) electron capture: 1ppt chlorinated (4) thermal conductivity: 100ppm methane (5) photoionization: 1ppb benzene
Operating Temperature			
Recording Method	Detachable Lap-top PC with 20 Mbyte hard drive, parallel port for printer.	LCD display. Data logging capability.	Detachable Lap-top PC with 20 Mbyte hard drive, parallel port for printer.
Power	12 V rechargeable battery	Rechargeable lead acid battery	12 V rechargeable battery
Sampling Method	Built-in pump, or manual injection into heated injection port	Built-in pump, 400 ml/min rate	Built-in pump, or manual injection into heated injection port
Dimensions (W x H x L)	20.5″ x 6″ x 20″		13.5″ x 6.5″ x 19.5″
Weight	48 lb	6.5 lb with battery and belt	30 lb
Cost	$21,000	$4,000	$12,500
DOE Contact Person			

Instrument #	142	143	144
Manufacturer	Spectrex Corp. 3580 Haven Avenue Redwood City, CA 94063 (415)365-6567 Fax (415)365-5845	Spectrex Corp. 3580 Haven Avenue Redwood City, CA 94063 (415)365-6567 Fax (415)365-5845	Spectrex Corp. 3580 Haven Avenue Redwood City, CA 94063 (415)365-6567 Fax (415)365-5845
Name	Pocket Ozone Detector	Pocket Toxic Gas Detector	VOC Monitor
Model Number	A-20Z	A-20	SXC-20
Instrument Category	Solid state	Solid state	Solid state
Application	Measurement of ozone concentration in air. This model will also respond to most organic gases and vapors.	Monitoring for organic gases and vapors	Monitoring for volatile organic compounds
Operating Principle	Semi Conductor Sensor	Semi Conductor Sensor	Semi Conductor Sensor
Performance			
Compound	Ozone	VOC	VOC
Ranges	0 to 10 ppm Linear range 0 to 3 ppm	5 to 1000 ppm	5 to 1000 ppm
Response Time	3 sec	2 sec	10 sec
Accuracy	±5%	±5%	±5%
Repeatability (precision)	±5%	±5%	±5%
Resolution	2% of full scale	2 ppm	2% of full scale
Sensitivity	0.1 ppm	low ppm levels	5 ppm
Operating Temperature	0 to 40°C	0 to 40°C and 0 to 90% RH	0 to 40°C
Recording Method	LCD Display	LCD display	Color-bar display, built-in data logger
Power	Rechargeable NiCad battery	Rechargeable NiCad battery	Battery operated or 110 V
Sampling Method	Passive	Passive	Built-in pump, adjustable flow rate
Dimensions (W x H x L)	2″ x 4″ x 1″	2″ x 4″ x 1″	4.2″ x 4.6″ x 2.4″
Weight	5 oz	5 oz	Less than 2 lb
Cost	$695	$425	$1,600
DOE Contact Person			

Instrument #	145	146	147
Manufacturer	Survivair 3001 South Susan Street Santa Ana, CA 92704 (800)821-7236	Survivair 3001 South Susan Street Santa Ana, CA 92704 (800)821-7236	Survivair 3001 South Susan Street Santa Ana, CA 92704 (800)821-7236
Name	Multi-gas monitor	Multi-gas monitor	Single gas monitor
Model Number	SVA-522 series	SVA-542 series	SVA-500 series
Instrument Category	Multiple sensor	Multiple sensor	Electrochemical
Application	Simultaneous monitoring of 2, 3, or 4 gases, combustible gases, oxygen and up to two toxic gases (CO, H2S, or SO2)	Simultaneous monitoring of 2, 3, or 4 gases. Combustible, oxygen and up to two toxic gases (CO, H2S, or SO2).	Air monitoring for O2, CO, H2S, SO2, or Cl2
Operating Principle	Multiple sensor Combustible: catalytic O2 and Toxics: metal oxide sensor	Multiple sensor Combustibles: catalytic O2 and Toxics: metal oxide sensor	Electrochemical.
Performance			
Compound	Combustible gases, oxygen, CO, H2S, or SO2	Combustibles, oxygen, CO, H2S, or SO2	O2, CO, H2S, SO2, or Cl2
Ranges	Combustible: 0 to 100% LEL O2: 0 to 50% Vol CO: 0 to 800 ppm H2S: 0 to 800 ppm SO2: 0 to 20 ppm Humidity: 0 to 98%	Combustible: 0 to 100% LEL O2: 0 to 50% Vol CO: 0 to 800 ppm H2S: 0 to 800 ppm SO2: 0 to 20 ppm Humidity: 0 to 98%	O2: 0 to 50% Vol CO: 0 to 999 ppm H2S: 0 to 500 ppm SO2: 0 to 20 ppm Cl2: 0 to 10 ppm Humidity: 0 to 98%
Response Time	Time in sec to 90% Combustible: <1 O2: <15, CO: <20, H2S: <20, SO2: <25.	Time in sec to 90% Combustible: <1 O2: <15, CO: <20, H2S: <20, SO2: <25.	
Accuracy	±2% full scale	±2% full scale	
Repeatability (precision)			
Resolution	Combustibles: 1% LEL Toxics: 1 ppm	Combustibles: 1% LEL Toxics: 1 ppm	
Sensitivity	Combustibles: 1% LEL Toxics: 1 ppm	Combustibles: 1% LEL Toxics: 1 ppm	
Operating Temperature	-15 to 50°C	-15 to 50°C	-15 to 50°C
Recording Method	LCD display	LCD display, internal data logging and IR downloading into a PC	LCD display
Power	Rechargeable NiCad or disposable alkaline battery	Rechargeable NiCad or disposable alkaline battery	9 V alkaline battery
Sampling Method	Internal sampling pump	Internal sampling pump	Passive
Dimensions (W x H x L)	8″ x 4.4″ x 1.6″	0.875″ x 4″ x 1.8″	4.6″ x 2.7″ x 1″
Weight	22 oz	2 lb	6 oz
Cost	$1310-1825	$1855-2425	$650-895
DOE Contact Person			

Instrument #	148	149	150
Manufacturer	Telaire Systems, Inc. 6489 Calle Real Goleta, CA 93117 (805)964-1699 Fax (805)964-2129	Thermo Environmental Instruments, Inc. 8 West Forge Parkway Franklin, MA 02038 (508)520-0430 Fax (508)520-1460	Thermo Environmental Instruments, Inc. 8 West Forge Parkway Franklin, MA 02038 (508)520-0430 Fax (508)520-1460
Name	Telaire CO2 Monitor	Organic Vapor Meter Data Logger	Portable Hydrocarbon Vapor Meter
Model Number	1050	580B	680
Instrument Category	IR	PID	FID
Application	Air monitoring for carbon dioxide	Portable air monitoring for organic vapors	Air monitoring for organic vapors
Operating Principle	Infrared spectroscopy	Photoionization detector	Flame Ionization Detector
Performance			
Compound	CO2	Organic vapors	Organic vapors
Ranges	0 to 1999 ppm	0 to 200 ppm 200 to 2000 ppm	0 to 100 ppm and 0 to 20,000 ppm
Response Time	20 sec	2 sec at 400 ml/min sample flow rate	4 sec at 800 ml/min sample flow rate (10% to 90% of final reading)
Accuracy	±5% of reading or 50 ppm, whichever is greater	±2% of reading	±2% of reading
Repeatability (precision)	±20 ppm	±2% of calibration	±2% of calibration
Resolution	1ppm	0.1 ppm and 1.0 ppm	0.1 ppm and 1.0 ppm
Sensitivity	20 ppm	0.1 ppm benzene in air on 0-200 ppm scale	0.5 ppm methane
Operating Temperature	0 to 50°C	-18 to 35°C	-18 to 35°C
Recording Method	LCD display, 0 to 2 V linear analog output	LCD display, data logging, downloading to PC and printer capabilities	LCD display, data logging, downloading to PC and printer capabilities
Power	Internal rechargeable battery	Internally rechargeable battery	Internally rechargeable battery
Sampling Method	Diffusion	Built-in positive displacement sampling pump, nominal flow 400 ml/min	Built-in sampling pump, sampling rate 800 ml/min
Dimensions (W x H x L)	3.8″ x 3.0″ x 7.5″	5.75″ x 6.75″ x 10″	11.5″ x 12.5″ x 2.6″
Weight	22 oz	6 lb	Side pack: 10.5 lb gun: 12 oz
Cost	$500	$4,620	$7,200
DOE Contact Person	Model 1310 Bruce Bettencourt, LLNL, (510)422-5197	David Gettelfinger, MMES(K-25), (615)574-4621 [Y12]	

Instrument #	151	152	153
Manufacturer	Thermo Environmental Instruments, Inc. 8 West Forge Parkway Franklin, MA 02038 (508)520-0430 Fax (508)520-1460	TSI, Inc., Envir. Meas. & Contr. Div. P.O. Box 64394 St. Paul, MN 55164 (800)926-8378 Fax (612)490-2874	TSI, Inc., Envir. Meas. & Contr. Div. P.O. Box 64394 St. Paul, MN 55164 (800)926-8378 Fax (612)490-2874
Name	Organic Vapor Meter Data Logger	Dust Track	RCL monitor
Model Number	580S		
Instrument Category	PID	Optical	Proprietary
Application	Portable air monitoring for organic vapors, intrinsically safe	Air monitoring for aerosols	Air monitoring for chlorinated organic vapors
Operating Principle	Photoionization detector	Optical	Proprietary rare earth detector
Performance			
Compound	Organic vapors	Aerosols	Chlorinated organic vapors
Ranges	0 to 200 ppm 200 to 2000 ppm	0.001 to 100 mg/m3 Particle size range: 0.1 to 15 m	Sub ppm to 500 ppm
Response Time	2 sec at 400 ml/min sample flow rate	1 to 30 sec time constant	
Accuracy	±2% of reading		±25% of reading
Repeatability (precision)	±2% of calibration		
Resolution	0.1 ppm and 1.0 ppm	1% of reading or 0.001 mg/m3 whichever is greater.	
Sensitivity	0.1 ppm benzene in air on 0 to 200 ppm	1 µg/m3	
Operating Temperature	-18 to 35°C	0 to 50°C	
Recording Method	LCD display, data logger, down loading to PC and printer capabilities	LCD display, datalogging capability, downloading via an RS 232 port	LCD display, 0 to 1 V analog output, datalogging capability
Power	Internally rechargeable battery	4 "C" alkaline batteries or AC	Rechargeable battery or AC
Sampling Method	Built-in positive displacement pump, nominal flow 400 ml/min	Built-in pump with flowrate of 1.4 to 2.4 L/min	
Dimensions (W x H x L)	7.5" x 5.75" x 10"	0.875" x 5.9" x 3.4"	6.5" x 6" x 0.4"
Weight		3.3 lb	12 lb
Cost	$5,345	$3,295	$8,700
DOE Contact Person	David Gettelfinger, MMES(K-25), (615)574-4621		

Appendix B

Industrial Hygiene Direct Reading Chemical Air Sampling Instrument Index by Category

Instrument Category	Instrument #
Badge	42
Catalytic combustion	76
Catalytic combustion	99
Catalytic combustion	112
Colorimetric	4
Colorimetric	31
Colorimetric	41
Colorimetric	43
Colorimetric	75
Colorimetric	77
Colorimetric	87
Colorimetric	107
Colorimetric	115
Colorimetric	131
Electrochemical	18
Electrochemical	19
Electrochemical	22
Electrochemical	25
Electrochemical	27
Electrochemical	29
Electrochemical	39
Electrochemical	51
Electrochemical	55

Instrument Category	Instrument #
Electrochemical	56
Electrochemical	57
Electrochemical	58
Electrochemical	59
Electrochemical	60
Electrochemical	61
Electrochemical	62
Electrochemical	63
Electrochemical	64
Electrochemical	65
Electrochemical	66
Electrochemical	67
Electrochemical	68
Electrochemical	69
Electrochemical	70
Electrochemical	79
Electrochemical	86
Electrochemical	88
Electrochemical	89
Electrochemical	91
Electrochemical	92
Electrochemical	104
Electrochemical	105
Electrochemical	106
Electrochemical	109
Electrochemical	113

Instrument Category	Instrument #
Electrochemical	117
Electrochemical	118
Electrochemical	123
Electrochemical	133
Electrochemical	134
Electrochemical	135
Electrochemical	147
FID	44
FID	150
FID or PID	100
Gold film	6
Gold film	7
IR	20
IR	21
IR	23
IR	33
IR	34
IR	35
IR	110
IR	111
IR	148
Multiple sensor	1
Multiple sensor	2
Multiple sensor	3
Multiple sensor	8
Multiple sensor	9

Instrument Category	Instrument #
Multiple sensor	10
Multiple sensor	11
Multiple sensor	12
Multiple sensor	13
Multiple sensor	14
Multiple sensor	15
Multiple sensor	16
Multiple sensor	17
Multiple sensor	24
Multiple sensor	26
Multiple sensor	28
Multiple sensor	30
Multiple sensor	36
Multiple sensor	37
Multiple sensor	38
Multiple sensor	40
Multiple sensor	45
Multiple sensor	52
Multiple sensor	53
Multiple sensor	54
Multiple sensor	71
Multiple sensor	72
Multiple sensor	73
Multiple sensor	74
Multiple sensor	78
Multiple sensor	90

Instrument Category	Instrument #
Multiple sensor	108
Multiple sensor	114
Multiple sensor	116
Multiple sensor	124
Multiple sensor	126
Multiple sensor	127
Multiple sensor	128
Multiple sensor	129
Multiple sensor	130
Multiple sensor	138
Multiple sensor	145
Multiple sensor	146
Optical	5
Optical	94
Optical	95
Optical	96
Optical	97
Optical	132
Optical	152
PID	46
PID	47
PID	48
PID	49
PID	101
PID	121
PID	125

Instrument Category	Instrument #
PID	140
PID	149
PID	151
Portable GC	32
Portable GC	50
Portable GC	93
Portable GC	98
Portable GC	102
Portable GC	103
Portable GC	119
Portable GC	122
Portable GC	139
Portable GC	141
Portable GC/PID	120
Proprietary	153
Solid state	80
Solid state	82
Solid state	83
Solid state	84
Solid state	136
Solid state	137
Solid state	142
Solid state	143
Solid state	144
Thermal conductivity	81
Thermal conductivity	85

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