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MONTROSE CHEMICAL CORPORATION OF CALIFORNIA

Torrance, California

TASK II

MONOCHLOROBENZENE SURVEY REPORT

of the Plant Contact

April 25-26, 1977

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Center for Occupational and
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June 7, 1977

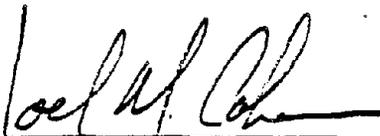
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The following information was considered by representatives of Montrose Chemical Corporation to be of a proprietary nature and was consequently deleted from this report:

The form of which some of the monochlorobenzene is shipped to the plant.



Joel M. Cohen
Industrial Hygienist

MONTROSE CHEMICAL CORPORATION OF CALIFORNIA

Torrance, California

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I INTRODUCTION AND RECOMMENDATION

The purpose of this evaluation is to determine if a more detailed industrial hygiene survey to quantify worker exposure to monochlorobenzene (MCB) is justified, and if it would be meaningful to characterize functional job exposures to the chemical. The focus of this survey report is upon work practices which relate to MCB and probable background levels of this chemical and other chemicals that exist in the worker's environment during production and/or use.

A DDT manufacturing plant located in Torrance, California was visited on April 25-26, 1977 to conduct a preliminary industrial hygiene and epidemiologic evaluation. This plant has a batch/continuous operating manufacturing facility for DDT.

Preliminary determination of background airborne MCB levels in and around the DDT area with a TLV Sniffer and Century Analyzer indicate very low concentrations of MCB. The charcoal collector tube sampling results also indicate very low levels of MCB. These levels are shown in the Appendix.

It was reported that approximately 14-16 employees may be exposed to MCB out of a total plant population of 135 persons. Those employees who work in the MCB receiving areas and DDT rework areas have the opportunity to be exposed to levels of MCB for short durations of time which may be higher than their normal daily dose but still likely to be below the threshold limit value (TLV). The affect of this exposure upon the workers' total dose was not evaluated. Furthermore, other operations such as DDT flaking, bagging, and various mechanic and laboratory job

functions were not evaluated to the extent that job function dose could be determined.

In light of the initial (background level) sampling results, number of workers who may receive a combined exposure to MCB and DDT, and those employees who work in the MCB receiving and rework areas that may have the potential for exceeding the short term exposure limit for MCB, it is recommended that a more detailed industrial hygiene survey, including personnel monitoring, will be necessary to properly characterize job function exposures to monochlorobenzene and DDT. Furthermore, based on visual observations and clinical findings (see note below), the potential exposure levels to DDT far exceed that of MCB.

NOTE: Laws, E. R., et al: Men with Intensive Occupational Exposure to DDT. Arch Environmental Health 15:766, 1966.

II EVALUATION

A. Walk-through

The potential exposures to monochlorobenzene (MCB) during the production of DDT at a Montrose Chemical Corporation of California plant was surveyed. The plant is located within a relatively industrial section of Torrance, California. Since 1947, DDT (trichloro chlorophenyl ethane, in various isomeric forms) has been the sole product of this manufacturing site which occupies about 13 acres of land, of which approximately two acres are devoted to the production process. The Montrose Chemical Corporation is owned equally by the Stauffer Chemical Company and the Chris Craft Company.

The plant has a formalized safety and medical program. Two monthly safety meetings are conducted at the plant, composed of worker and management representatives. These meetings are supplemented by five-minute daily safety talks. Each foreman is required to be trained in first aid. There is also a safety coordinator on the Montrose staff. Montrose has maintained an excellent safety record, with the last lost time accident occurring in March 1975.

Pre-employment physicals are required of every employee. For the past fifteen years, annual physicals have been required which include an electrocardiogram for those employees over the age of forty. A physician working for the Torrance Emergency Center and not employed by Montrose is on call at all times in case of an emergency and to perform the necessary examinations. Biological testing, including blood and urine analysis is performed.

Montrose requires that every employee wear a safety hat, safety glasses, and chemical gloves. Safety shoes are recommended but not required equipment. When the specific task demands, face shields, hearing protection, chemical boots and disposable coveralls are supplied. NIOSH-approved cannister type respirators and MSA air supplied respirators are also available for higher risk exposures. The plant has available locker rooms with showers for the employees. Although a lunchroom area is supplied, food and cigarette smoking restrictions in the production area were observed being broken (specifically a man was observed smoking in the area).

The total plant employs approximately 135 workers of which 101 are hourly employees and 34 are salaried. The plant is in operation seven days a week, however not all processes operate twenty-four hours a day. Most employees work four shift cycles, rotating every four weeks. The shipping and maintenance employees work only day shift (0800-1630). Other processes like the acid recovery area operate two shifts. The plant reportedly has high turnover, although the average employee has remained on the job at this site for about ten years. The hourly personnel are represented by the International Chemical Workers Union, Local 138.

Monochlorobenzene is used in the production of DDT. This facility was constructed in 1946 with production starting in 1947. DDT is produced in a fairly open structure provided with both natural and forced ventilation to keep worker exposures to potential contaminants low. The DDT production process combines MCB with sulfuric acid and chloral (trichloroacetaldehyde) in a reaction vessel on a batch basis. All of the

raw materials are pumped to one of sixteen reactors by pipe from intermediate storage tanks. An exothermic reaction under agitation begins which varies in time from 5 to 36 hours, dependent on production rate. Once the reaction is complete the reaction mixture is pumped to a holding tank for purification in a continuously operating refining unit. Here, the acid is separated from the organic layer. The acid is treated in the acid recovery area to recover MCB, which is recycled back through the process. The DDT is neutralized, washed (i.e., purified), and then crystallized into a flake or Krisp Chip. The DDT product can be sold in this form, or may be ground to a 75% wettable powder. The published total capacity of the DDT production plant is reported to be 6 million pounds per month. During the survey, it was estimated that production was operating at about 60-67% of capacity. Figure I in the Appendix shows the process flow of DDT manufacturing.

It was reported that a maximum of 16 employees (on the average, 14 employees) work with MCB, to some degree. The job titles of these employees are as follows:

<u>Per Shift</u>	<u>Total Force</u>	<u>Job Title</u>
1	3	Acid recovery operator
1	4	Condensation operator
1	4	Production supervisor (foreman)
1	4	Chemical operator helper (note that the helper works in several areas of the plant and is part of this work force only when needed and not on a continuous basis)

These workers are continuously within the operating areas of the plant. In addition to the employees already mentioned, there are also 30 mechanics.

Monochlorobenzene is delivered by 20,000 gallon tank cars and 5,000 gallon tank trucks to one of two 50,000 gallon storage tanks. The unloading of a tank car was observed by the survey team. Once the car has been positioned correctly, the worker (wearing safety glasses, rubber gloves, and safety hat) first takes a product sample by placing an eight ounce bottle at the end of a three foot rod. He then inserts the rod through an open manhole and fills the bottle. Once the material is accepted, a feed hose is bolted to a flanged port opening for unloading of the contents. The worker who unloads the material then turns on a suction type pump which diverts the MCB to one of the two storage tanks. The unloading of tank trucks is similar to the cars, except that the MCB is pumped first to an intermediate storage tank.

The potential for receiving MCB exposures are greatest whenever a quality control sample is taken and when DDT scrap is added to the rework area. Neither of these operations were observed by the survey team. However, a partial simulation of conditions during the rework operation indicated a short duration (30 minutes) concentration of 6.58 ppm. This level does not necessarily represent actual operator breathing zone levels of MCB and is probably lower than the true exposure level.

B. Discussion

The operation described above used monochlorobenzene in a batch/continuous process for the manufacture of DDT. The DDT process is fed MCB from one of two storage tanks located near the tank car unloading area.

Up to 16 persons, not including maintenance and other salaried personnel may be exposed to MCB. The exposures of these workers were not fully evaluated to the extent of determining job function dose.

A Century Total Organic Vapor Analyzer and J&W TLV Sniffer (combustion meter) were used as environmental sampling instruments along with employing Bendix sampling pumps with charcoal collection tubes as the primary means to characterize levels of MCB. The charcoal tube/sampling pumps were placed in strategic locations as determined by the initial walk-through and readings from the J&W and Century meters. The pump locations were as follows:

1. Near #1 condensation reactor.
2. Near #7 condensation reactor.
3. Near #3 condensation reactor.
4. Near #10 condensation reactor (outside).
5. On the second tier near the operators report booth.
6. Near the East holding tank.
7. Acid recovery plant area, instrument house.
8. Filtration area, MCB settling tank.
9. Filtration area, near #3 washer.
10. Rework area, on platform with manhole open.

All of these areas were examined with the combustion meter and Century analyzer. Those locations where there seemed to be a chance for MCB exposure were investigated closely. That is, quality control sampling points, operator reporting rooms, and the rework area were checked for the presence of MCB.

Although the acid recovery area was not operating at the time of the survey, samples taken throughout the area showed the MCB levels to range from 0.23 to 0.59 ppm in that area. A single sample taken adjacent to the MCB settling tank showed a concentration of 7.15 ppm in a location at which men are not routinely exposed. This concentration reportedly represented a leak in a transfer line near the sampling location.

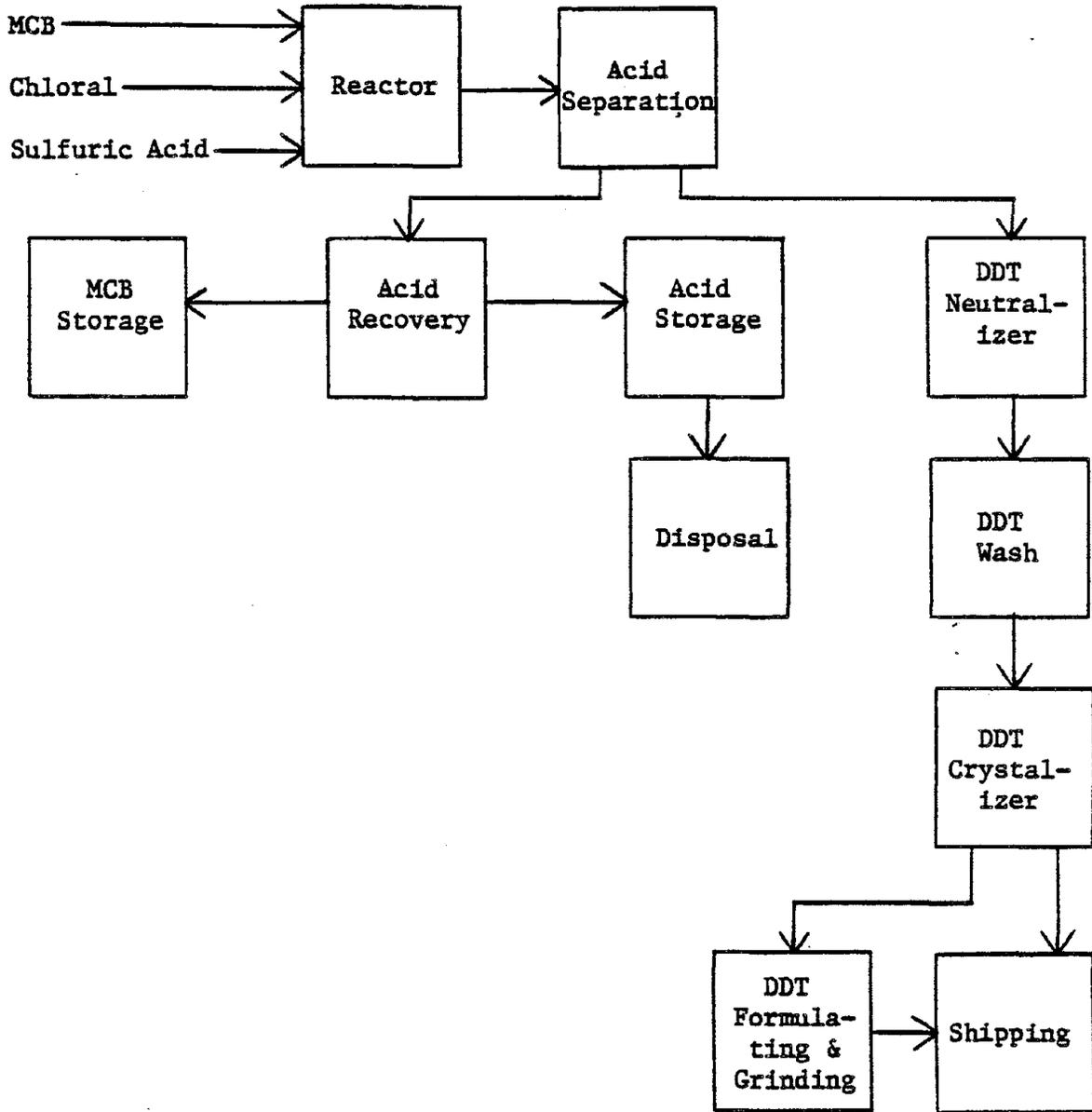
About once a day, a chemical operator helper works in the DDT rework area. Here, the worker shovels one or more bin fulls of DDT sweepings and other forms of DDT, considered scrap into a holding tank of MCB. This task reportedly takes about 30 minutes to complete. A partial simulation of conditions during the rework operation indicated background MCB levels of 6.58 ppm. This level is not indicative of actual operator breathing zone levels of MCB. When this level is compared to other general air samples of MCB in the production area it appears that during the rework operation this worker receives his greatest exposure to MCB for short durations of time.

The initial sampling results of the DDT manufacturing area, DDT rework area, and acid recovery area suggest low background levels of airborne MCB. However, short-term high exposures to MCB may be possible.

APPENDIX

Figure I

DDT PRODUCTION - PROCESS FLOW



CHARCOAL TUBE MCB AIR SAMPLING DATA

Montrose - Torrance, California

Walk-Through Survey Conducted April 25-26, 1977

Sample Location	Time (Min.)	Volume (Liters)	Concentration (ppm)
Near #1 condensation reactor	179	25.1	0.27
Near #7 condensation reactor	176	17.6	0.39
Near #3 condensation reactor	175	17.5	0.30
Near #10 condensation reactor (outside)	110	11.1	0.18
On the 2nd tier, near the operator report booth	173	17.3	0.21
Near the East holding tank	168	19.5	0.66
Filtration area, instrument house	167	16.7	0.23
Acid recovery plant, MCB settling tank	164	16.4	7.15*
Filtration area, near #3 washer	117	10.6	0.59
Rework area, on platform with manhole open	37	3.7	6.58
Blank	-	-	<1µg

*This concentration reportedly represented a leak in a transfer line near the sampling pump location.

NOTE: Front and back sections of the charcoal tube were analyzed for monochlorobenzene.

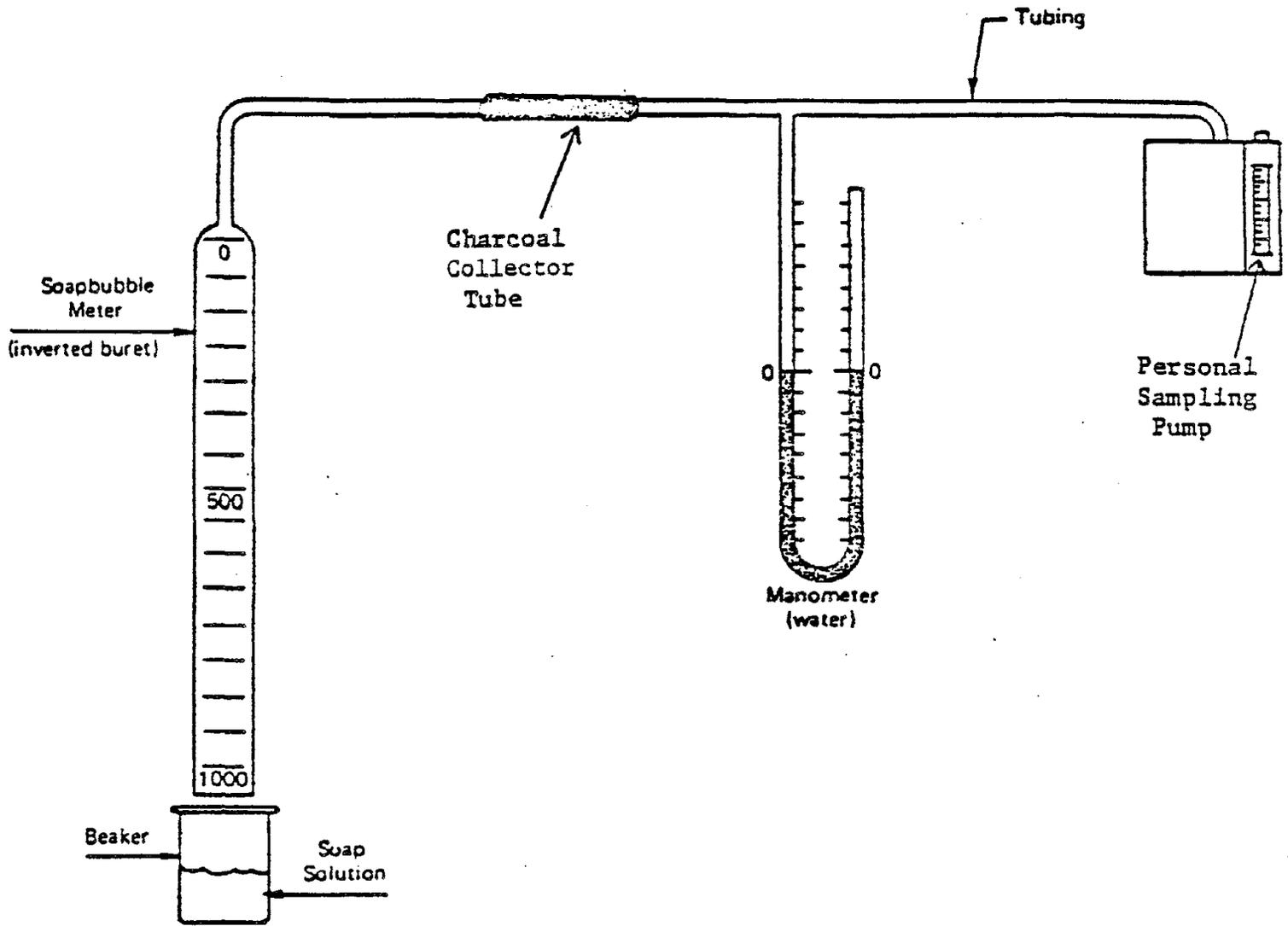
BENDIX PORTABLE SAMPLING PUMP

Principle of Operation

The Bendix BDX-44 pump provides a portable sampling source for the measurement of all dusts, gases, and vapors. The pump houses a double diaphragm pump assembly, operated by a push-button switch. Power is supplied to the pump by a nickel-cadmium battery pack. Since the normal operating flow rate for the Bendix pump is 0.5 to 3.0 liters per minute, a low flow assembly was used to reduce the flow rate such that sampling could be performed at 100-200 milliliters per minute. The low flow configuration includes an adaptor flowmeter, adaptor orifice, flow regulator/pulsation dampener assembly, and low flow flowmeter. All pumps used in the preliminary environmental sampling contained this low flow assembly.

Calibration of Bendix Pump

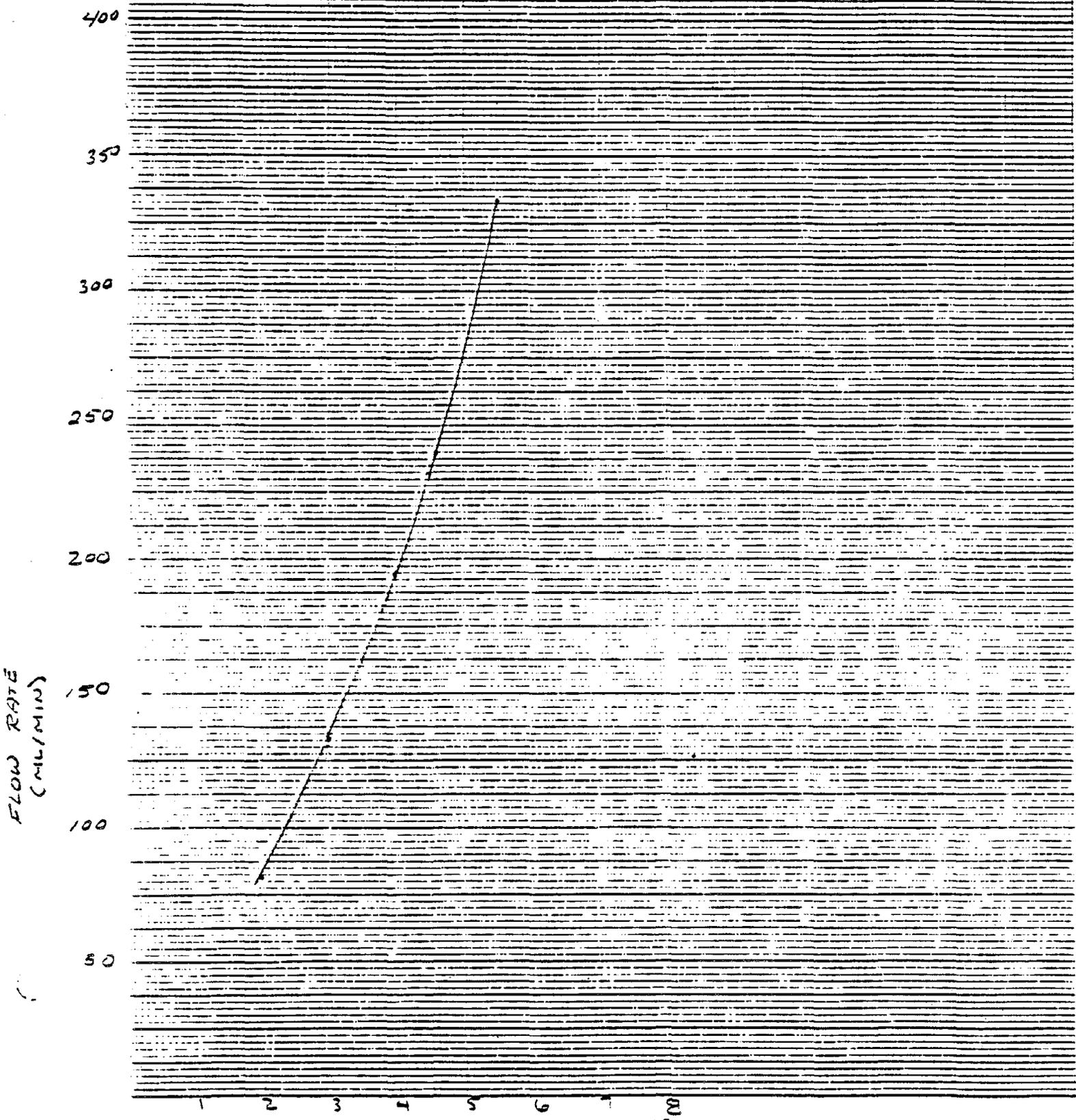
The calibration of the Bendix BDX-44 pump was performed with the use of a bubblemeter (buret set in an inverted position) with a charcoal tube assembly in line. Bubbles were run through the bubblemeter to thoroughly wet the walls. Special care was taken to assure that the bubble would be flat when crossing the top mark. An average of three readings were taken at each flow rate and adjusted to ± 1.5 seconds. Preliminary flow calibrations in the field were made using a precision rotometer using the soap film measurement technique as described above. The rotometer was used to check the flow rates before and after each pump use. The flow rates were validated after returning to SRI, with the soap bubble technique. The average flow (average of starting and final flow) for the total sampling period was used in calculating exposure concentrations.

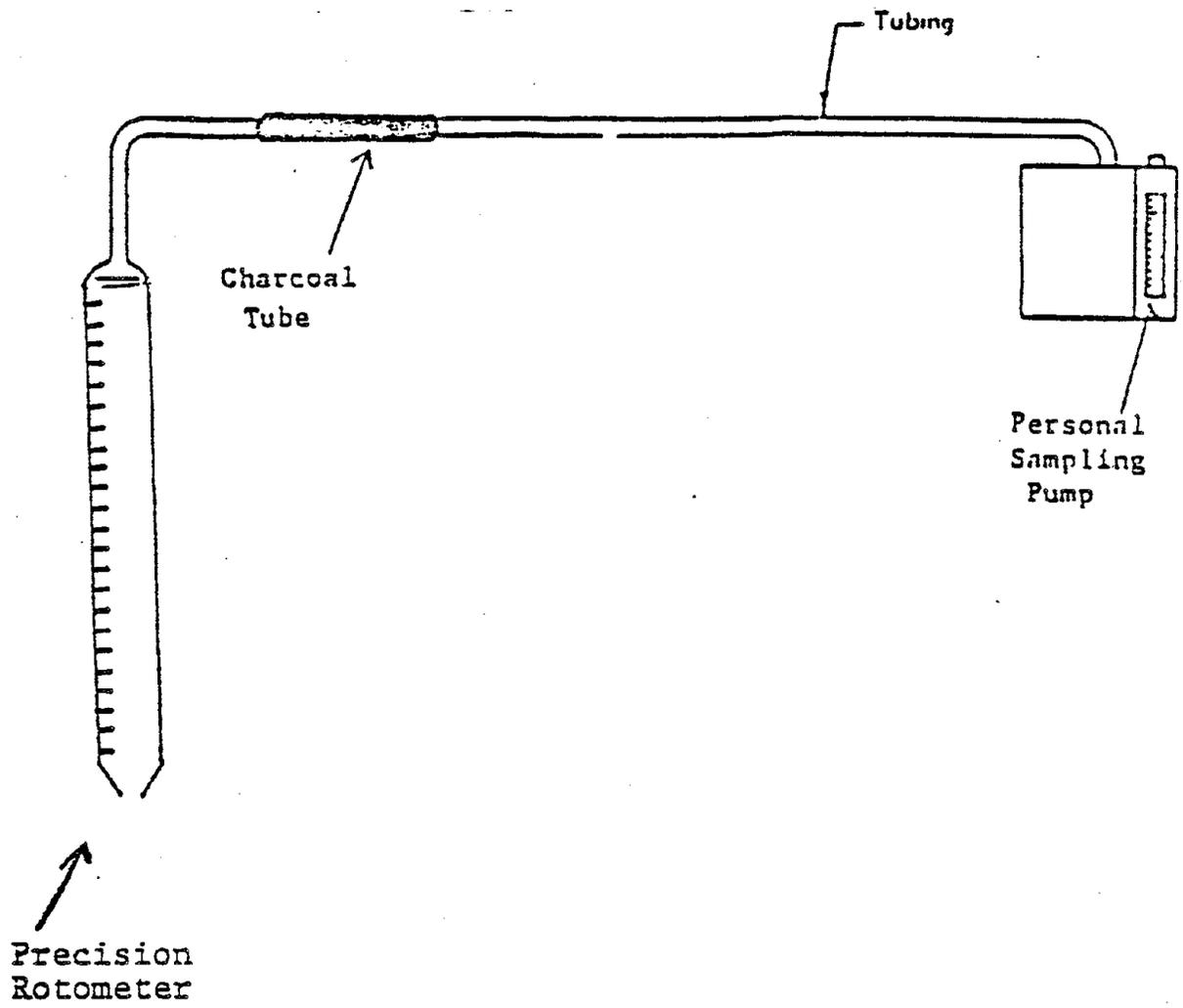


Taken from a NIOSH Criteria for a Recommended Standard to Chromium (VI)



* BENTON BOX-14
L₂-FLOW CONFIGURATION
WITH BRASS ORIFICE





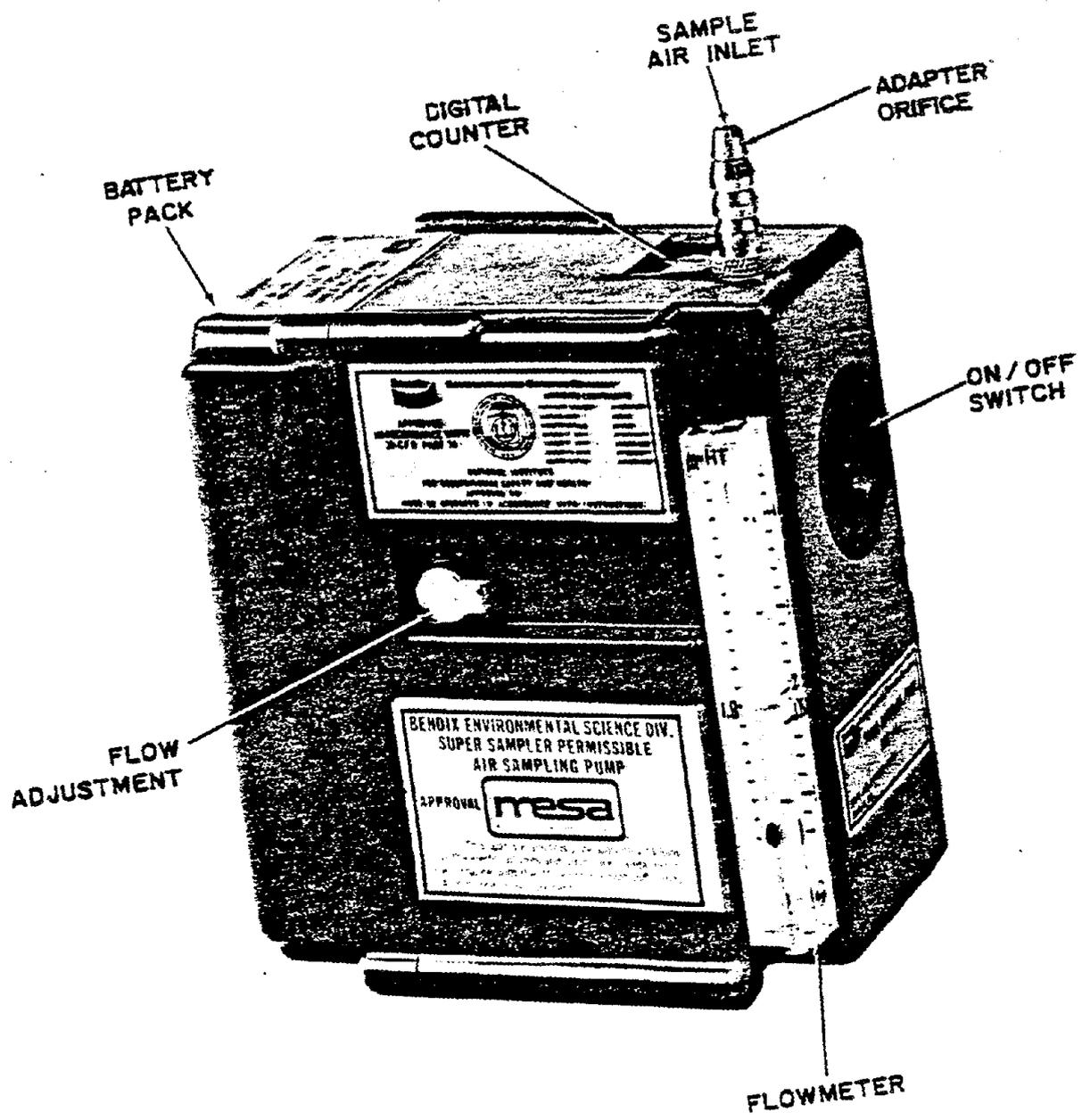


Figure 1. BDX 44 Pump

TLV SNIFFER

The TLV Sniffer is a portable instrument that can detect combustible gases and vapors with a sensitivity range of from 1 to 10,000 ppm. A ppm meter located on the front panel allows for instant determination of many kinds of gases and volatile flammable vapors.

Principle of Operation

To detect and measure concentrations of combustible gas in air, the TLV Sniffer catalytically oxidizes gas in a pumped-in sample of air by means of a catalyst-coated resistance element. The resistance of this element changes with changes in heat that are proportional to the amount of oxidized gas, thereby altering the electrical balance of the catalytic element as compared to the resistance of a reference element. Both catalyst-coated ("active") element and reference element are incorporated in a Wheatstone Bridge circuit in such a way as to produce an electrical output proportional to their differences in resistance. Since any changes in air sample temperature and humidity affect both active and reference elements equally, the electrical signal output is proportional to the concentrations of combustible gas or vapor in the sample of air (expressed in volumetric terms as ppm).

Operational Functions

The TLV Sniffer has a ppm meter and range knobs allowing readings of 0-100, 0-1,000, and 0-10,000 ppm. After a 10-minute warm-up, the instrument is successfully zeroed at each scale range and then may be used with its hand-held attached probe to index possible hazard as readings are compared to published standard Threshold Limit Values. The TLV Sniffer is especially useful for locating hard-to-find gas leaks, with the probe moved in the direction indicated by rising meter readings to point out quickly the source of escaping gas. (Taken from Instrument Manual, TLV Sniffer, Bacharach Instrument Co.)

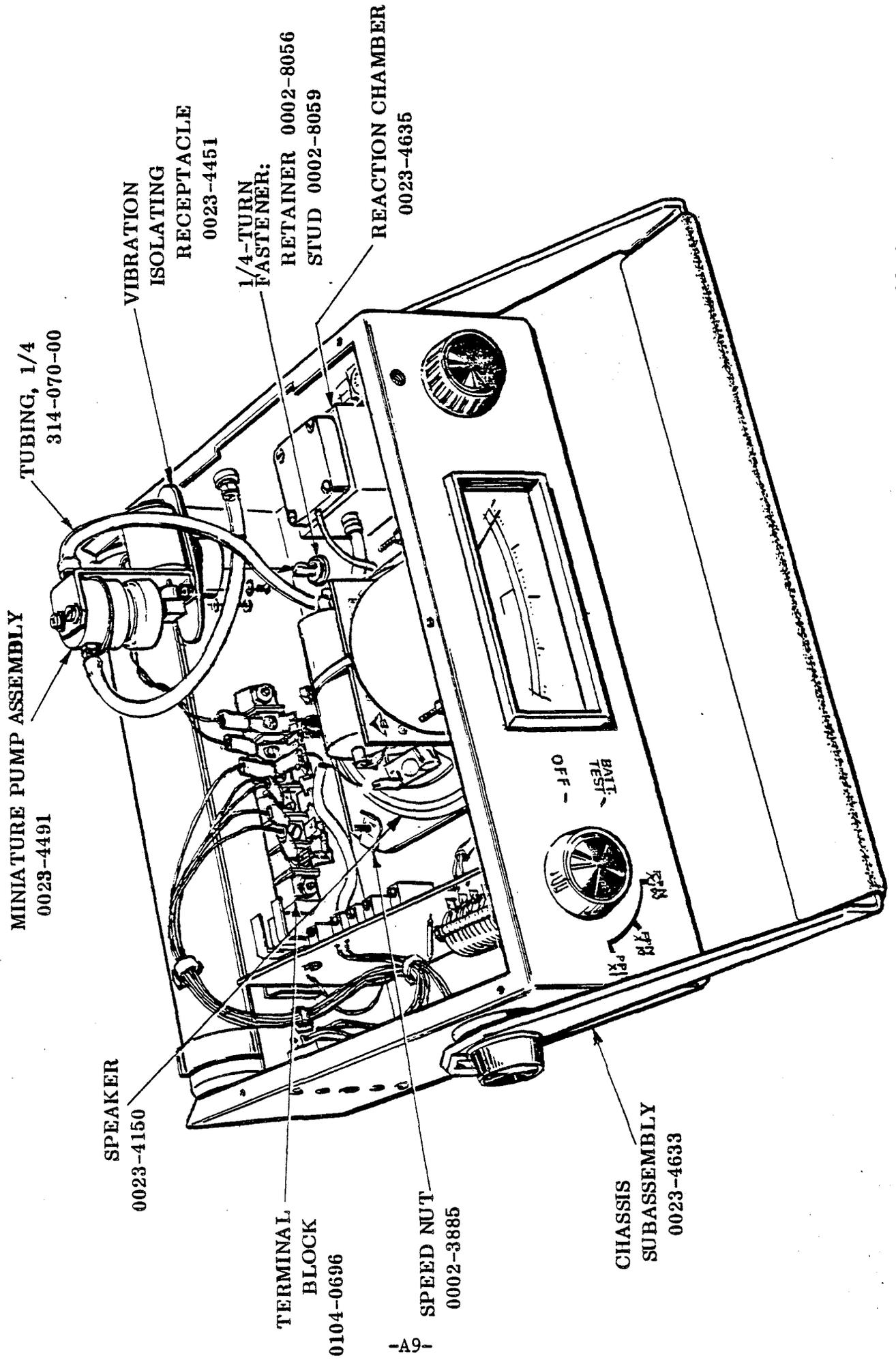


Figure 4-1. TLV Sniffer Chassis Subassembly Showing Miniature Pump Assembly in Disassembled Position

CENTURY ORGANIC VAPOR ANALYZER

Principle of Operation

The Century Organic Vapor Analyzer is a portable instrument designed to detect organic gases and vapors with a sensitivity range of 0-1,000 ppm. The instrument utilizes the principle of hydrogen flame ionization for detection and measurement of organic vapors. The sample is drawn into the flame area by the instrument's pump. When organic compounds enter the flame, positive carbon ions are formed causing an increase in electrical conductivity of the flame. This change is detected and the output is directly proportional to the concentration of organic matter in the flame. The rate of ion generation is a function of the quantities and structure of the compounds in the sample.

Calibration of the Century Organic Vapor Analyzer

Calibration of the Century OVA-128 was performed following instructions in the manufacturer's Operating and Service Manual (pp 24-29, B12-B15). Known concentration of gases were prepared according to the method of Saltzman, "Preparation of Known Concentrations of Air Contaminants" in The Industrial Environment - It's Evaluation and Control, NIOSH, 1973 and also specified in the operating manual.

Organic Vapor Analyzer

After the required 10 minutes warm-up period, and meter zeroing has been accomplished, a sample of known concentration was drawn through the hand-held probe. The meter response was recorded. This procedure was repeated for several known concentrations appropriate to develop a calibration curve. A conversion factor was calculated using the recorded relative meter response and the known time concentration.

CENTURY ORGANIC VAPOR ANALYZER (continued)

Gas Chromatographic Mode

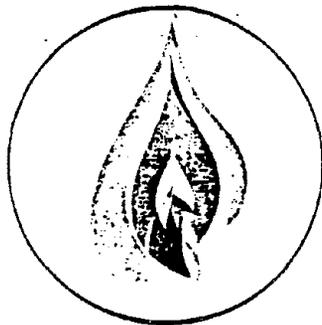
As above, a sample of known concentration is drawn into the warmed and zeroed instrument. When the meter indicates a stable reading the sample was injected into the column. Analysis of retention time and peak height was made from the strip chart recording. This procedure was replicated for several concentrations. In addition, mixtures of two gases were sampled to determine if any interference was observable. The qualitative (determined by retention time) and quantitative (peak height) vapor analysis was used to prepare charts of conversion factors and identification times.

INTRODUCTION

Century Organic Vapor Analyzers (OVA's) are highly sensitive instruments allowing detection and analysis of trace quantities of organic vapors in air. Totally portable, yet having the capability to measure concentrations to less than 0.5 PPM, the Century OVA has found wide acceptance in manufacturing, chemical and other industries. Agencies such as OSHA and NIOSH use them. Insurance people and arson investigators find OVA's ideally suited to their needs.

The OVA takes the flame ionization detector (FID) used in the most sophisticated laboratory gas chromatographs and packages it in a 12 pound, go-anywhere instrument. A man can survey continuously for at least eight hours before refueling and battery recharging is needed.

This unique instrument is now available, fully certified by Factory Mutual, for use in Class I, Division I, and Groups A, B, C and D environments! Other domestic and foreign certifications are pending.



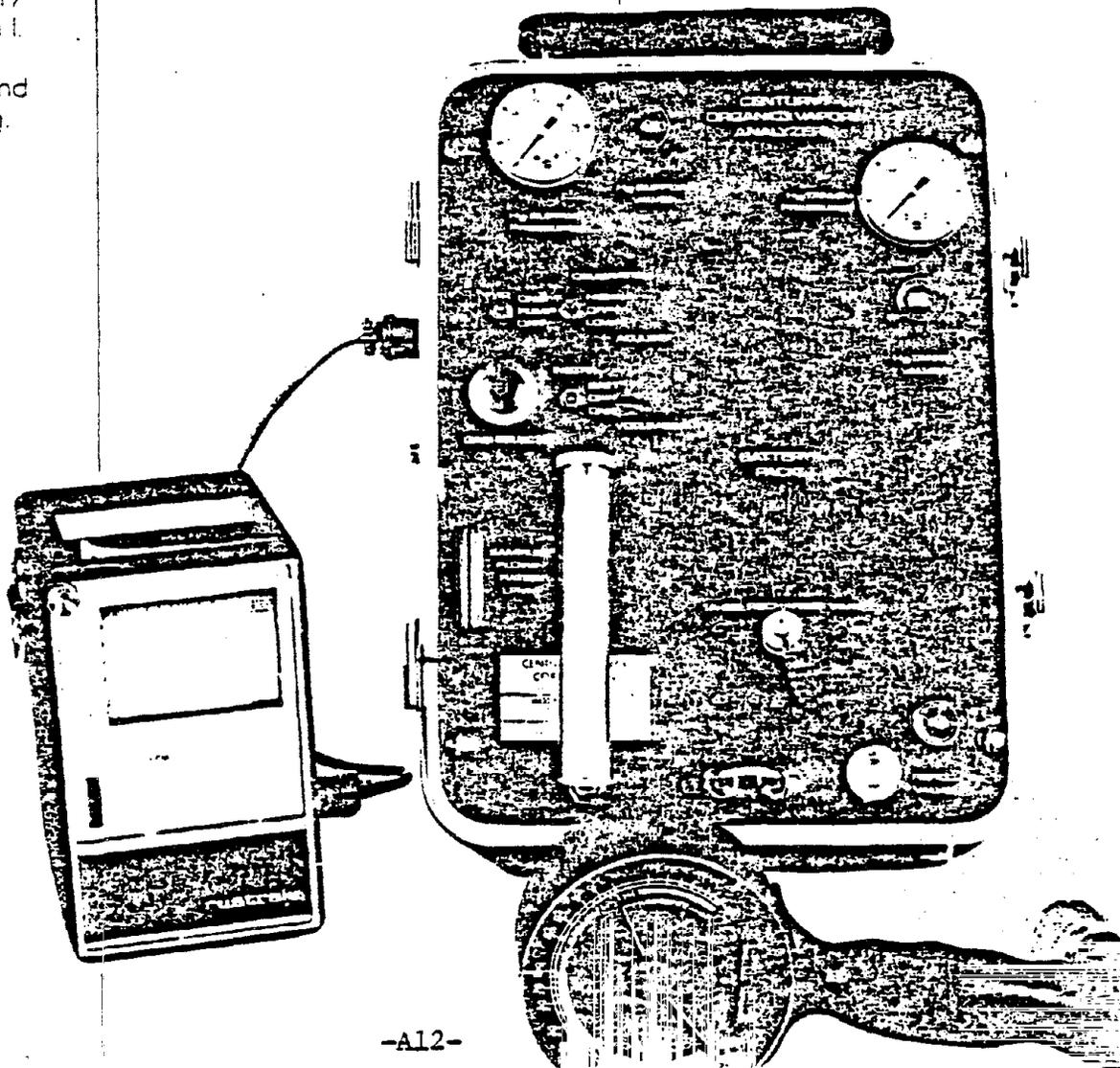
PRINCIPLE OF OPERATION

Flame ionization detectors are a precise means to detect organic vapors such as benzene, methane, styrene and vinyl chloride.

A small hydrogen flame is burned in a chamber and the sample being measured is circulated in close proximity to the flame. Carbon-containing ions are formed whenever traces of organics are present in the sample. These ions are forced to migrate to an

electrode by an electrical field in the detector chamber. This results in a small current which is amplified, conditioned and then displayed on a hand-held meter or on a strip chart recorder.

The characteristics of flame ionization allow organics to be measured without interference in the presence of water vapor, NO_x, carbon monoxide, carbon dioxide and other in-organics.





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STANFORD RESEARCH INSTITUTE

SRI PROJECT NO. _____

SUBJECT CENTURY CALIBRATION - MONOCHLOROBENZENE SHEET NO. _____ OF _____

DATE 4-18-77 NAME P. DIAMOND / J. COHEN (PROBLEM NO. _____)

MONOCHLOROBENZENE

CONCENTRATION (PPM)

