Arson Analysis Newsletter

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S.E.A., Inc.
Attn: Ronald N. Thaman
7349 Worthington-Galena Road
Columbus, OH 43085

The AAN solicits contributions from forensic scientists, arson investigators, attorneys, and interested parties who have some unique or routine analysis which helps in the identification of flammable liquid or explosive residues. Articles herein express the views and opinions of the authors and are not necessarily the views of the AAN or S.E.A., Inc.

"WILL THE REAL LAMP OIL PLEASE STAND UP?"

by

Carlotta S. Stackhouse, M.S.
South Carolina Law Enforcement Division
Columbia, South Carolina 29221

There are over 2000 marketed petroleum products that could be used to accelerate arsonous fires. These products, when used, evaporate to new and sometimes unrecognizable mixtures that lead the forensic chemist to misinterpret resulting chromatograms. Thus, some arson fires are written off as negative.

One of the most common petroleum products used as an accelerant is gasoline. Because of its availability and its inexpensiveness, it is used in about two out of every three arson fires. Identification, even in evaporated form, presents no problem for the arson chemist. However, for that "one" fire that the arsonist used an "unusual" accelerant, the criminalist must rely on past experiences, colleagues' knowledge and an extensive library to identify the unknown hydrocarbon mixture.

Recently, in our laboratory, an unusual hydrocarbon mixture chromatogram was encountered. The suspected accelerant was tentatively identified as that of a medium petroleum distillate. This was because of its boiling range. But, because of its unique pattern (non-traditional hydrocarbon Guassian shape), the type, i.e. paint thinner, charcoal starter,etc., could not be determined. Upon searching our library of petroleum products, we happened upon a chromatogram of lamp oil. The brand name "Farms Lamplight Lamp Oil" (apple scented), gave a fairly good match. Yet, another Farms Lamp Oil product in our library (clear), gave a totally different pattern. Upon purchasing and analyzing two other variations of Farms' products, they gave different patterns also.

Due to the apparent uniqueness of the Farms Lamp Oils, we decided to make a general overview of these and other lamp oil products.

Experimental

Several variations of the Farms Lamplight Lamp Oil were purchased from different stores in the Columbia area for analysis. One Farms Lamp Oil was evaporated to different volumes and analyzed. In each instance, fifty microliters of the concentrated liquid was added to five milliliters of carbon disulfide. The resulting concentration was that of ten microliters per milliliter. A one microliter sample was analyzed on a Perkin Elmer Sigma 2000 Gas Chromatograph equipped with a Flame Ionization Detector. Real time plots were collected on an Perkin Elmer Laboratory Communication Integrator 100 and the data stored on a Perkin Elmer 7500 professional computer for future manipulations.

Results and Discussion

As indicated from resulting chromatograms (Figures 1-7), lamp oil, particularly Farms, is a very unique product that is not a consistent mixture. For example, the two Farms Lamplight Lamp Oils (apple scented) are totally different products in terms of component mixture and boiling range. In Standard 370, Figures 1 and 2, the lamp oil is more of a medium to heavy petroleum distillate following the definition of these distillates. Where as Standard 373, another lamp oil fromthe same manufacturer and same description, is a medium petroleum distillate with a very tight boiling range (105 C - 135 C). Comparison of Standard 371 with Standard 370 (Figure 1) also leads to the conclusion that even though both have a similar boiling range, the component makeup is quite different.

In the evaporation study (Figures 5-7) the Standard 373 is used. It is not until eighty percent evaporation, that the heavy components start to appear. At ninety-nine percent, the lamp oil starts to appear as a heavy petroleum distillate product. Yet when compared with kerosene (Standard 404), Figure 8 may lead the chemist to think of a badly burned/evaporated kerosene sample and not the back end of a decorative lamp oil.

Conclusions

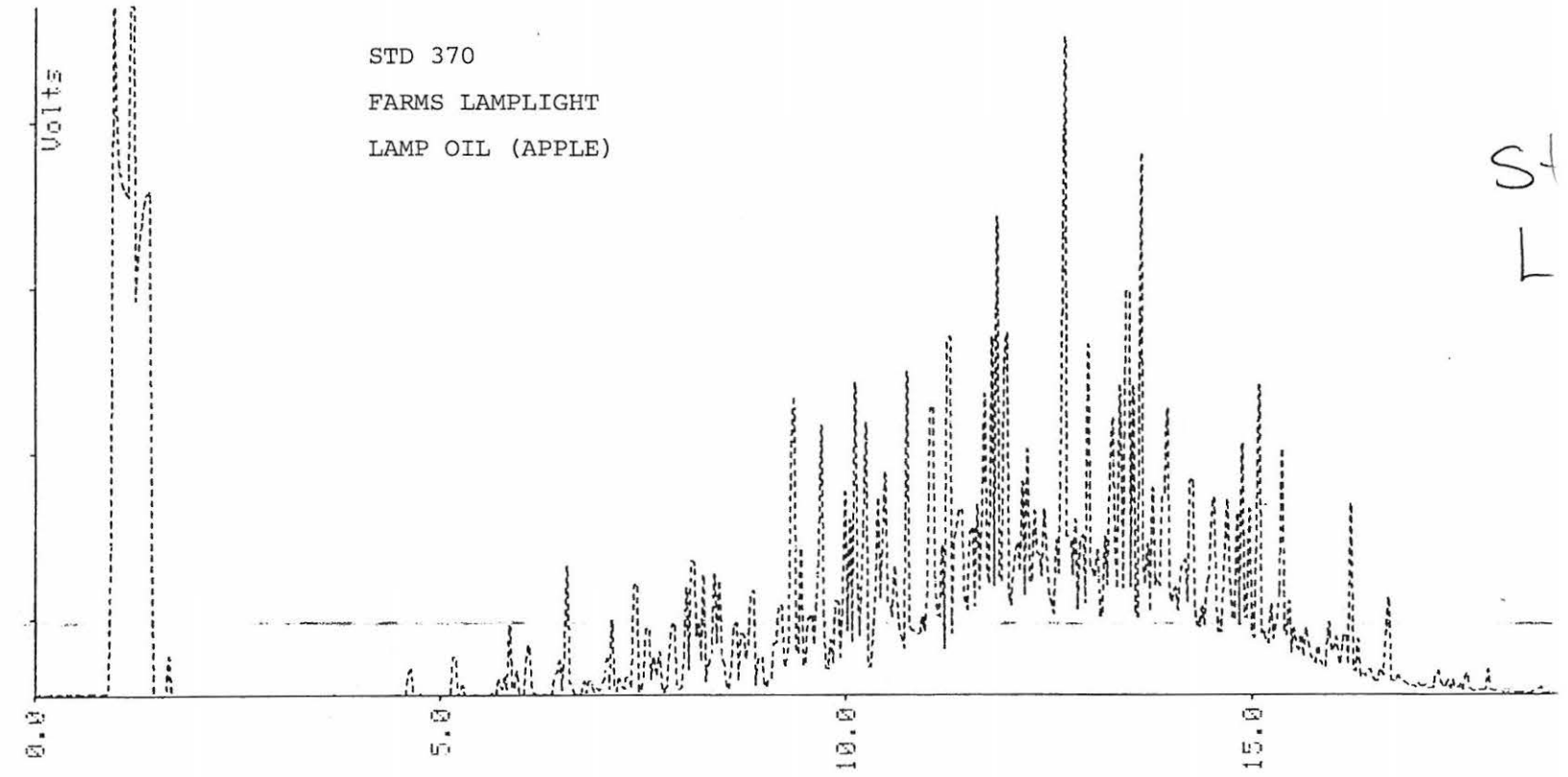
In earlier years, lamp oils were primarily kerosene, a heavy petroleum distillate. But with lamps and lamp oils being used more for decoration and not as a necessity, the lighter fractions of the petroleum products have been substituted.

In this brief overview we have shown that lamp oils are a unique product. Therefore, if it is a suspected accelerant, a control sample should be obtained from the scene and not purchased.

Acknowledgements

Thanks to Ms. Susan E. Wilson and Ms. Patricia B. Martin for their invaluable assistance and Ms. Connie I. Gray for her insights and helpful comments.

FIGURE 1


Volts
STD 370
FARMS LAMPLIGHT
LAMP OIL (APPLE)
0.0
5.0
10.0
15.0

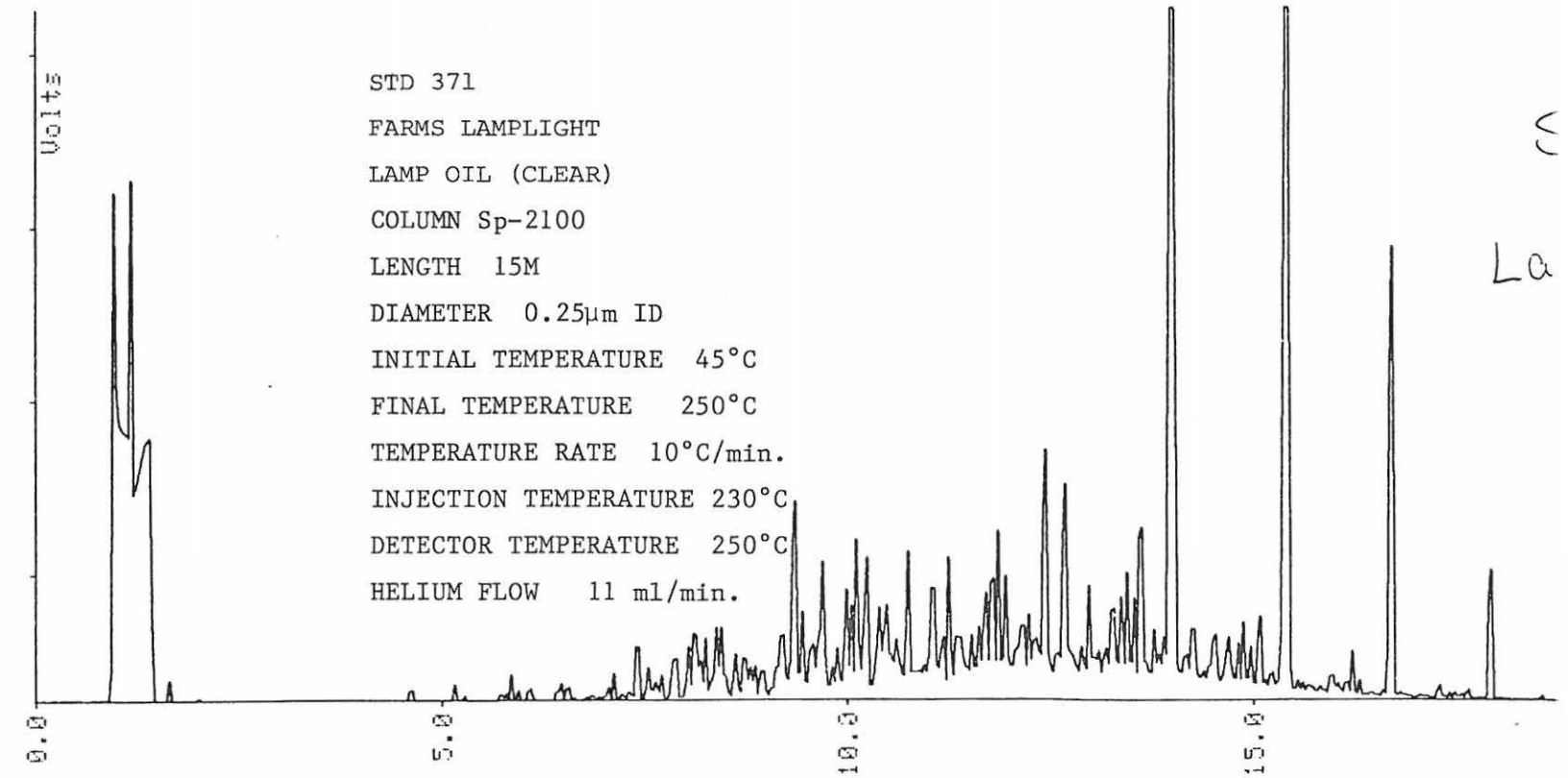
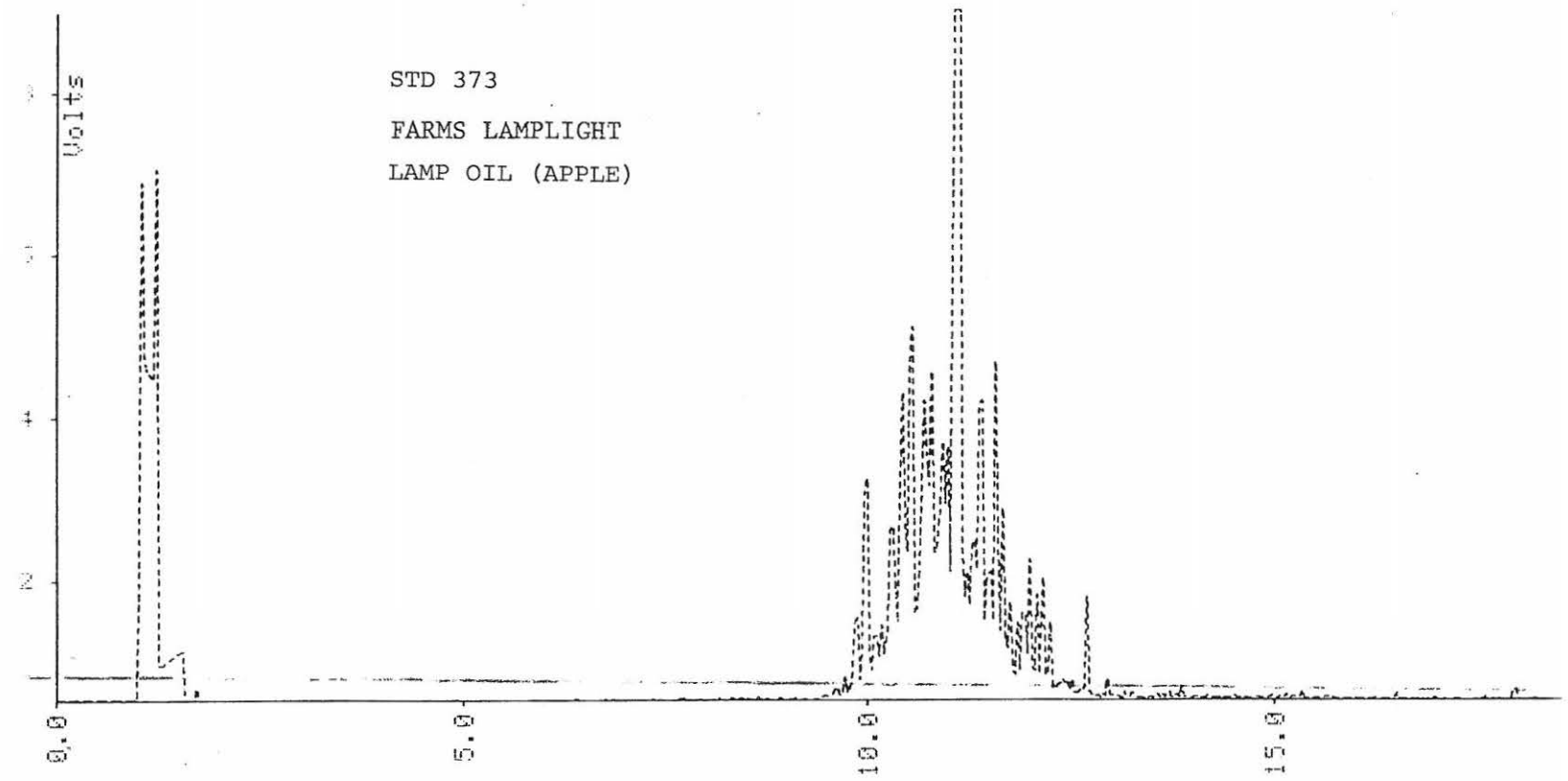

Volts
STD 371
FARMS LAMPLIGHT
LAMP OIL (CLEAR)
COLUMN Sp-2100
LENGTH 15M
DIAMETER 0.25µm ID
INITIAL TEMPERATURE 45°C
FINAL TEMPERATURE 250°C
TEMPERATURE RATE 10°C/min.
INJECTION TEMPERATURE 230°C
DETECTOR TEMPERATURE 250°C
HELIUM FLOW 11 ml/min.
0.0
5.0
10.0
15.0

FIGURE 2


STD 373
FARMS LAMPLIGHT
LAMP OIL (APPLE)
Volts
0.0
5.0
10.0
15.0

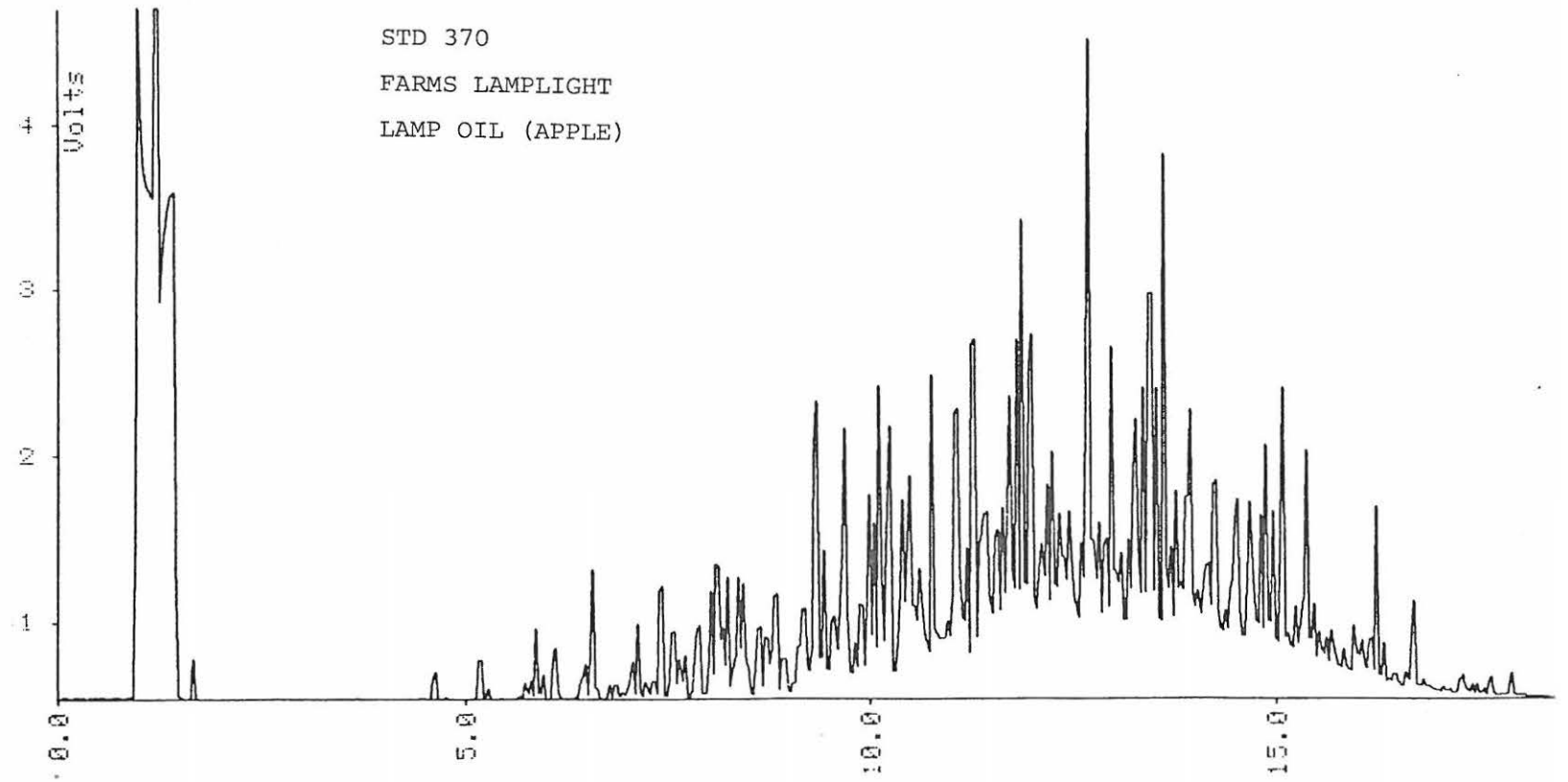
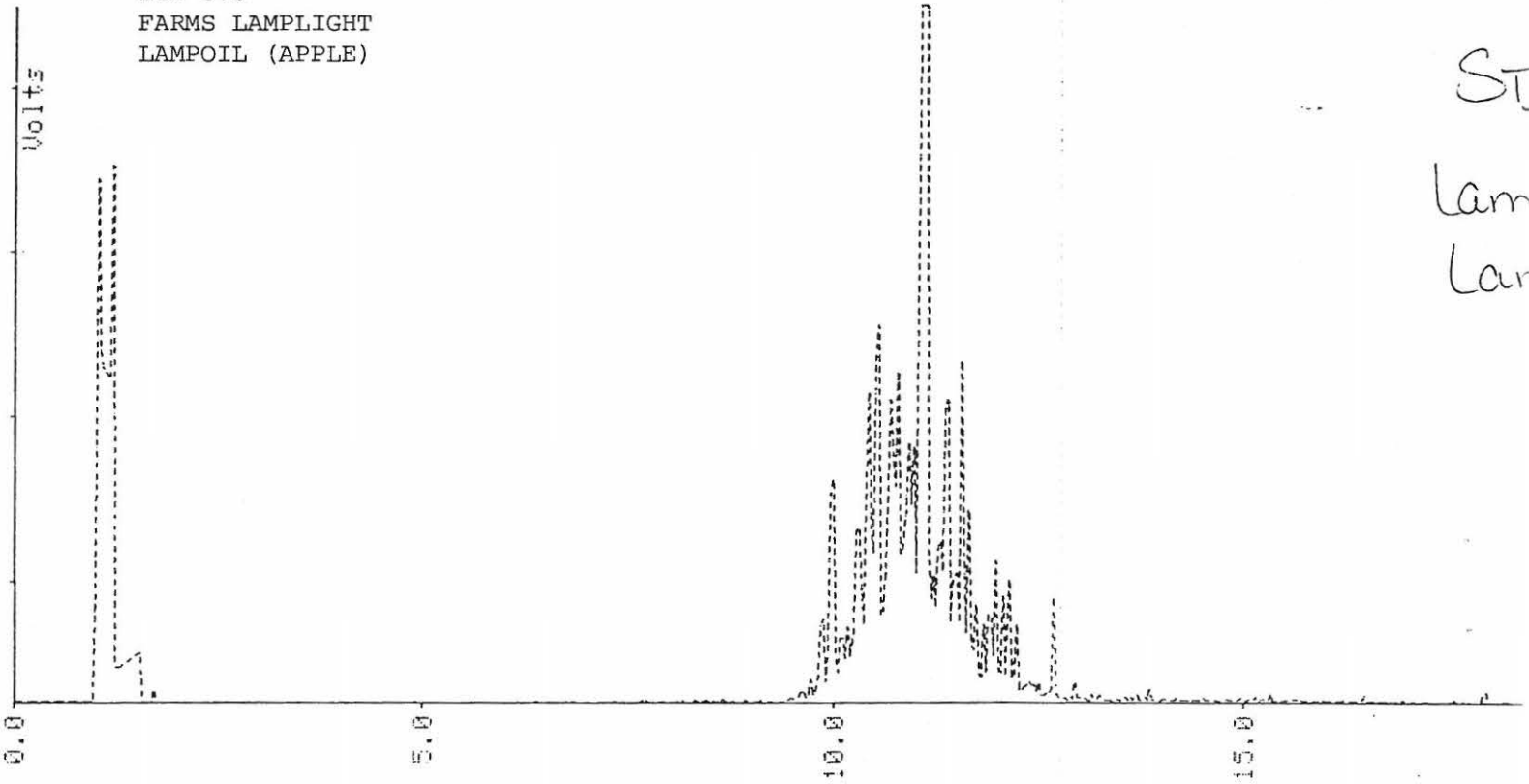

STD 370
FARMS LAMPLIGHT
LAMP OIL (APPLE)
Volts
0.0
5.0
10.0
15.0

FIGURE 3


STD 373
FARMS LAMPLIGHT
LAMPOIL (APPLE)
Volts
0.0
5.0
10.0
15.0

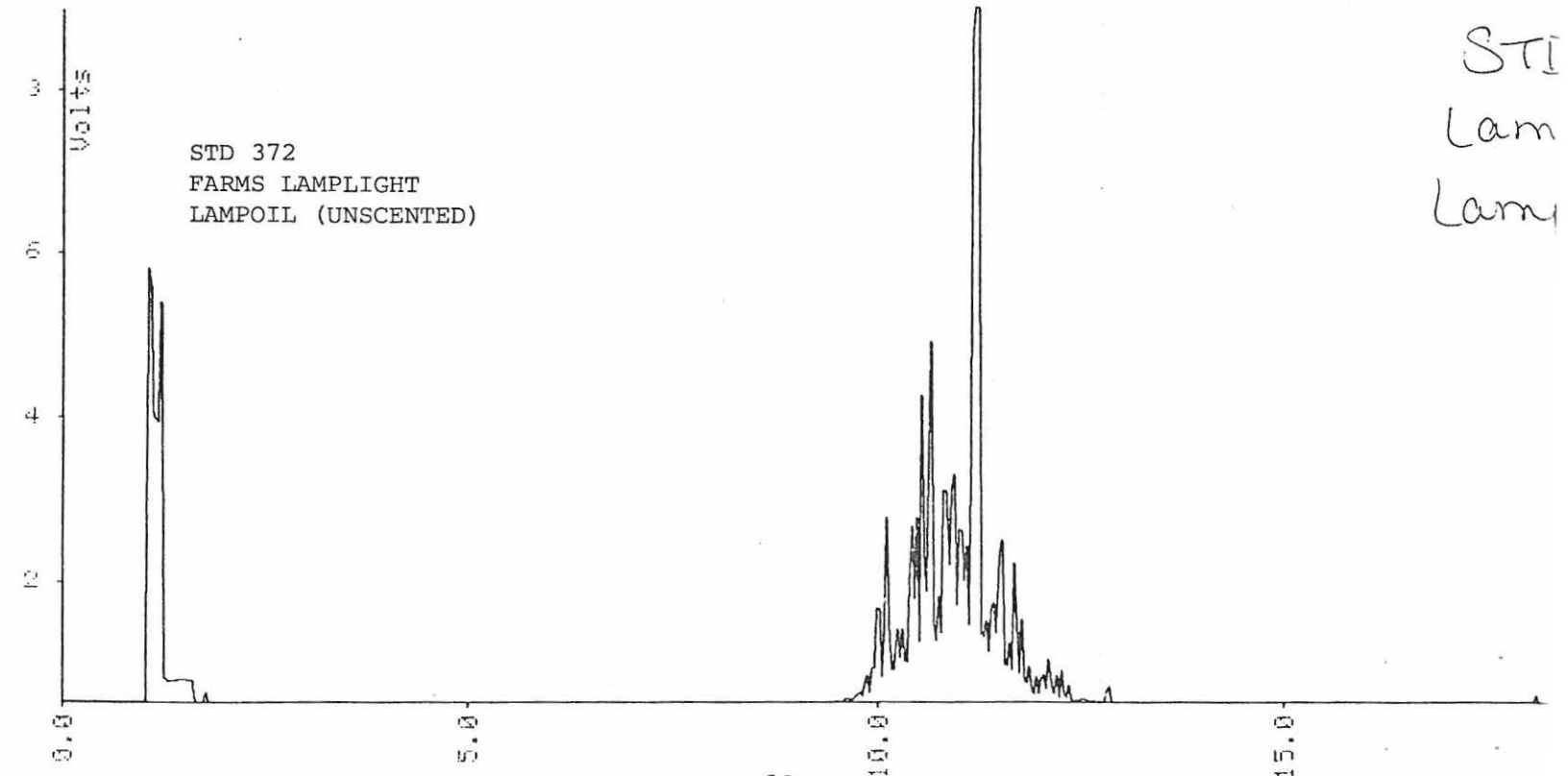
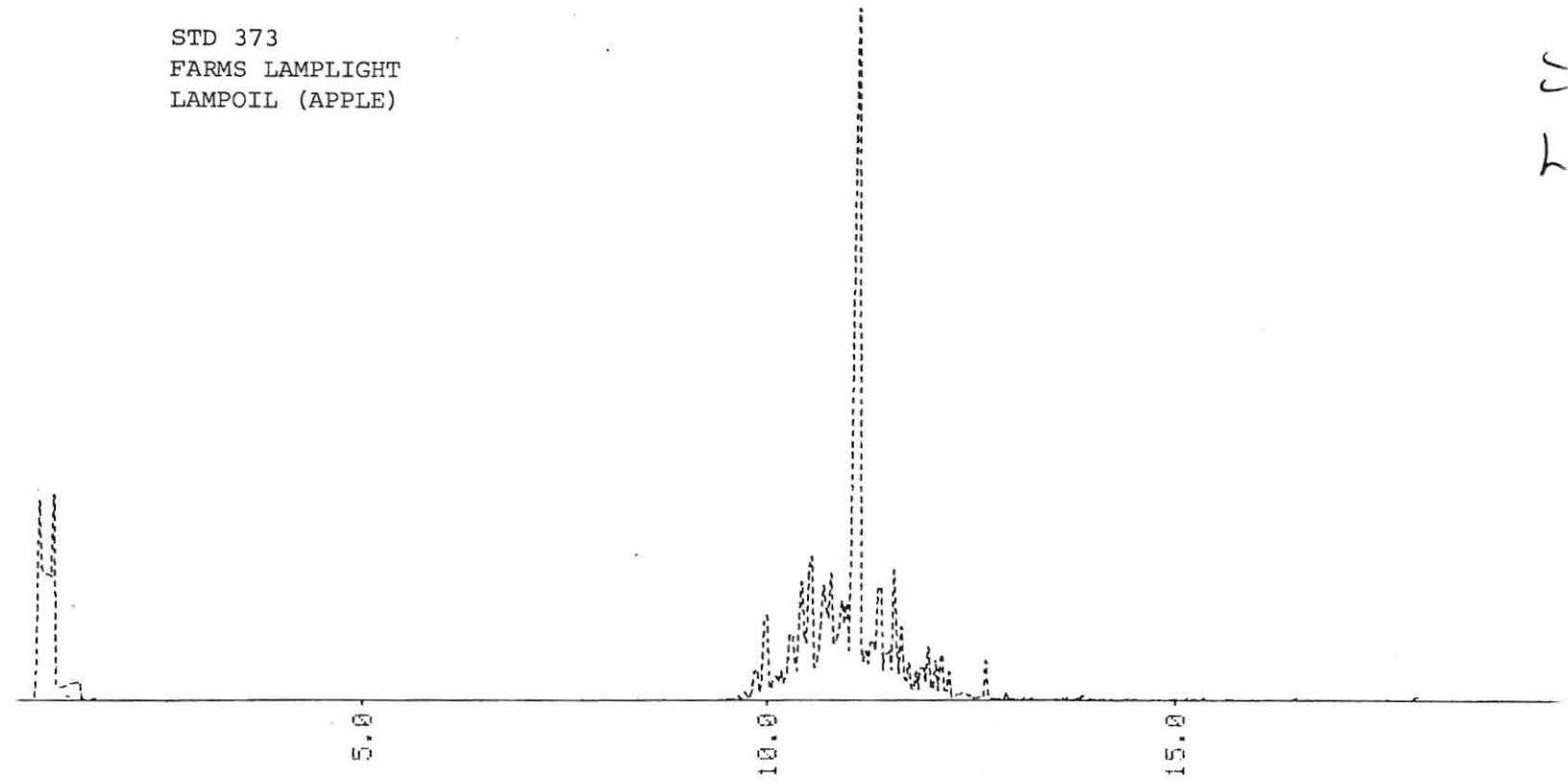

STD 372
FARMS LAMPLIGHT
LAMPOIL (UNSCENTED)
Volts
0.0
5.0
10.0
15.0

FIGURE 4


STD 373
FARMS LAMPLIGHT
LAMPOIL (APPLE)
5.0
10.0
15.0

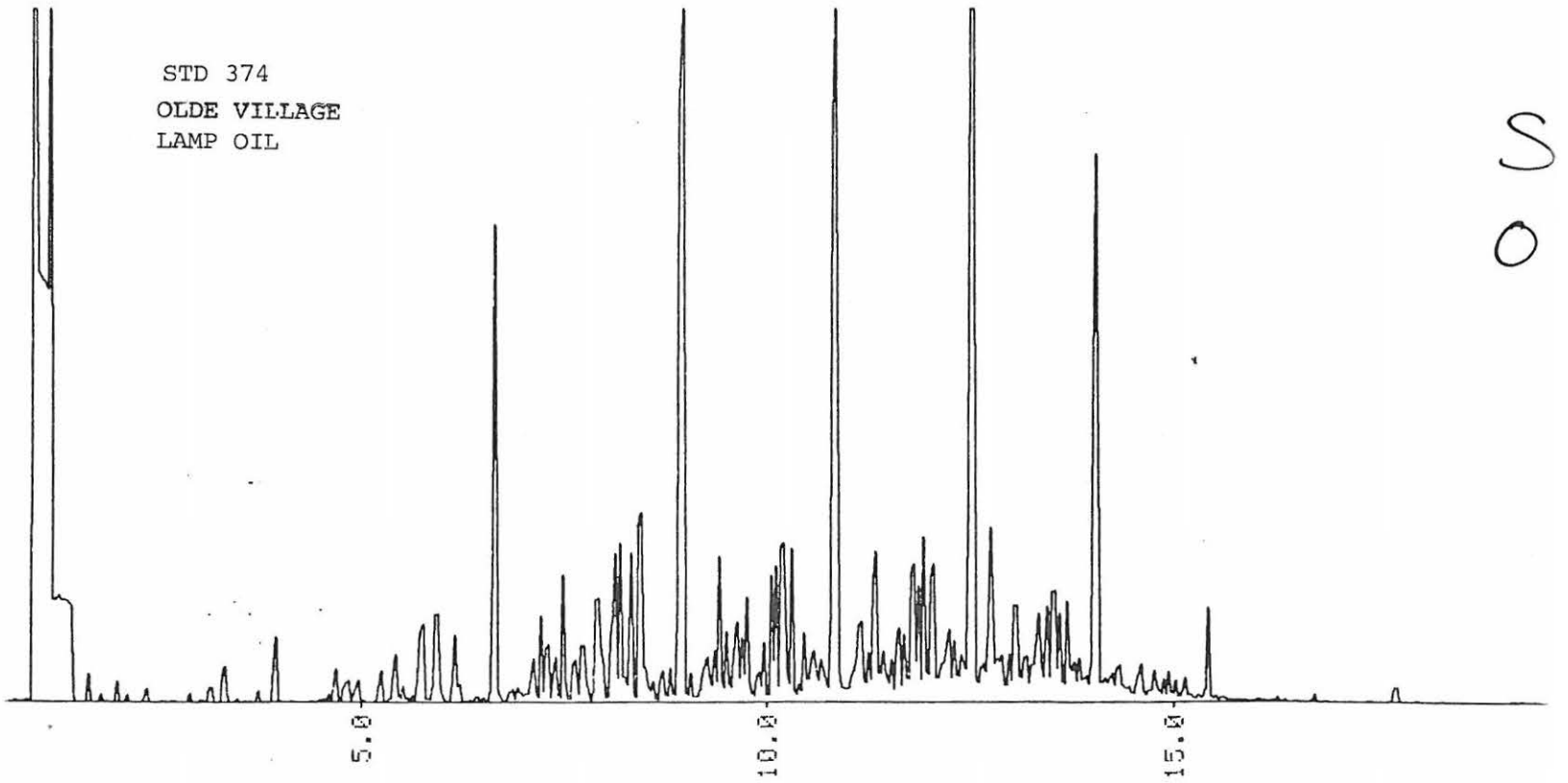
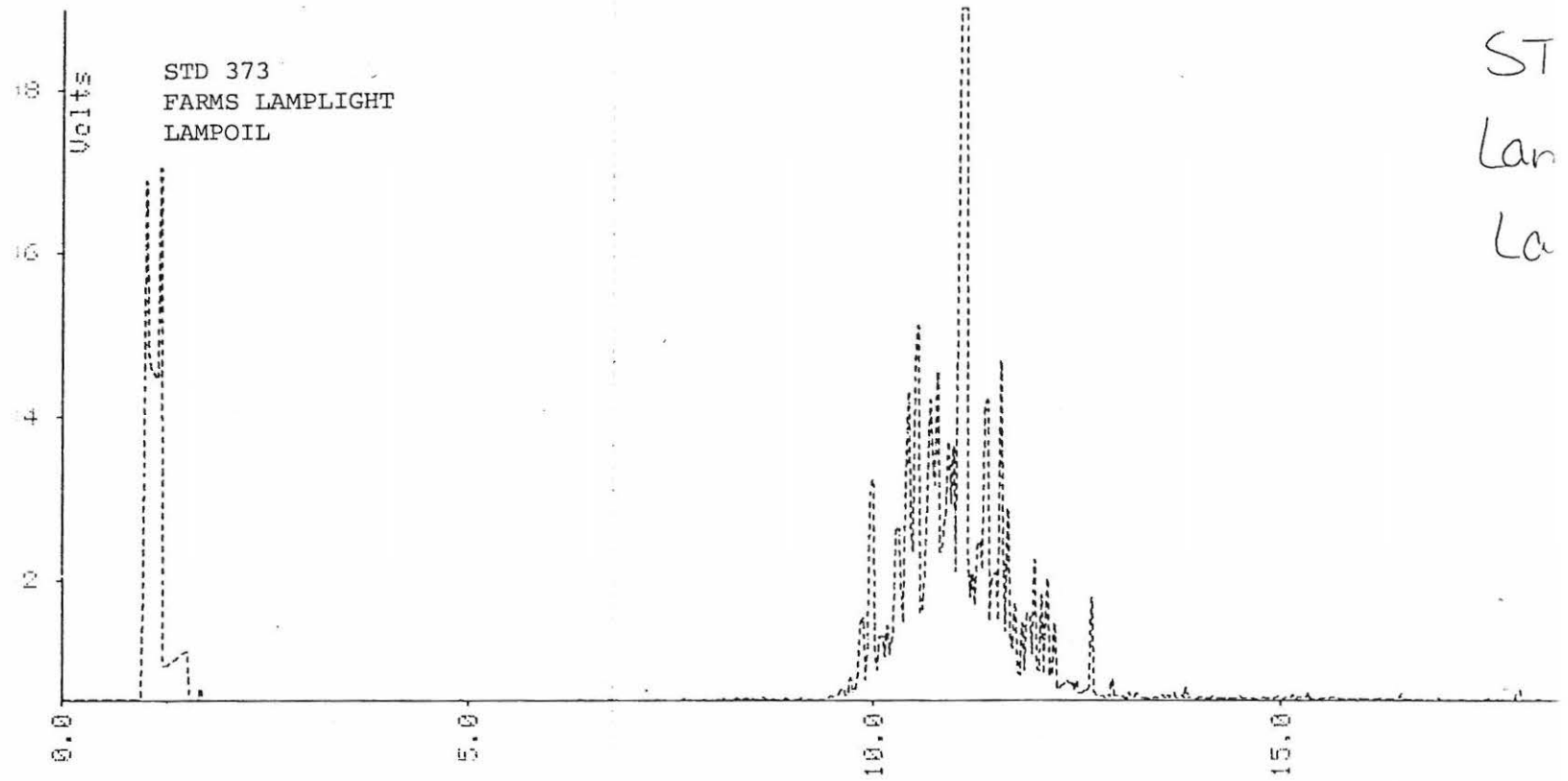

STD 374
OLDE VILLAGE
LAMP OIL
5.0
10.0
15.0

FIGURE 5


STD 373
FARMS LAMPLIGHT
LAMPOIL
Volts
0.0
5.0
10.0
15.0

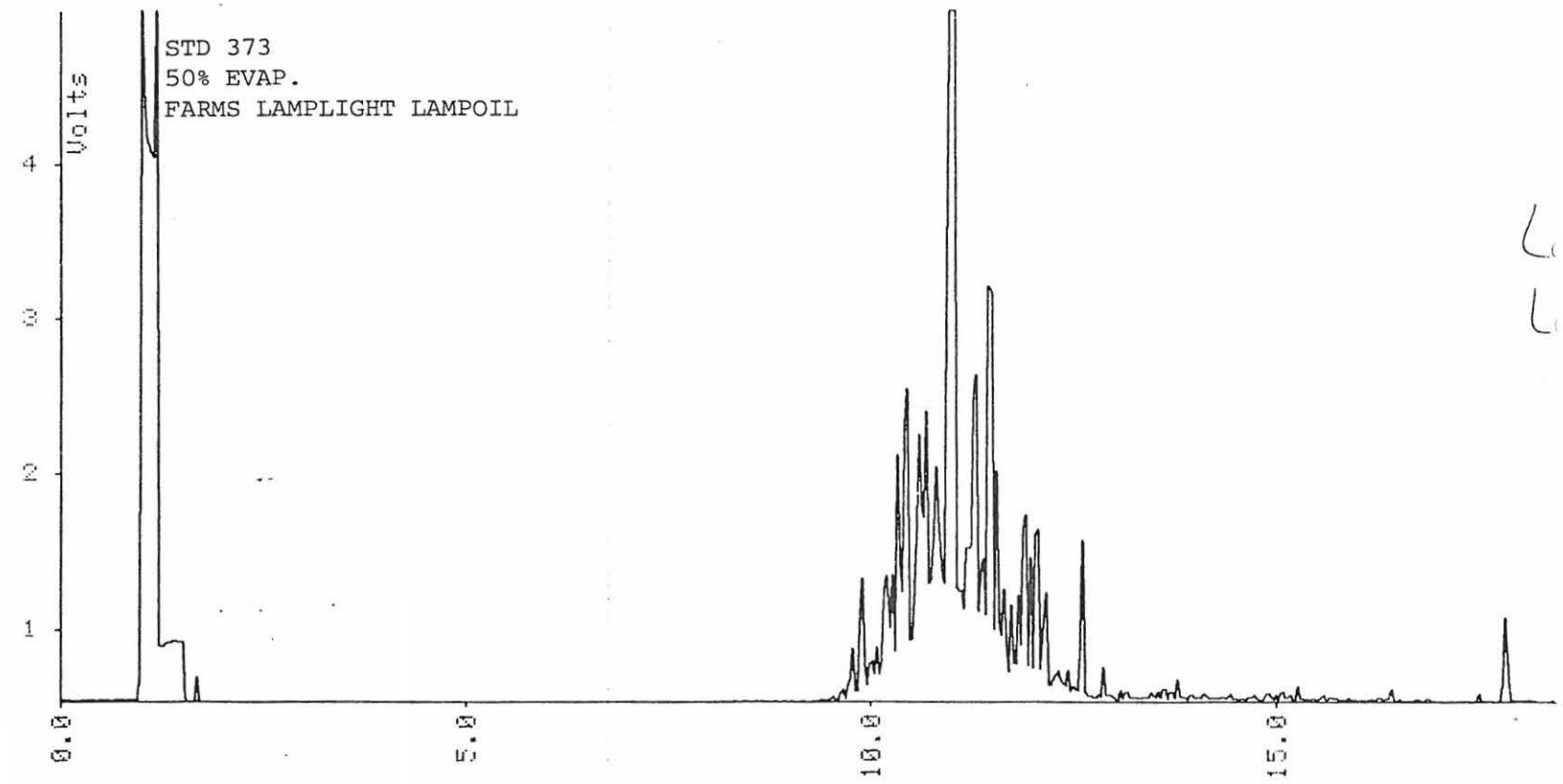
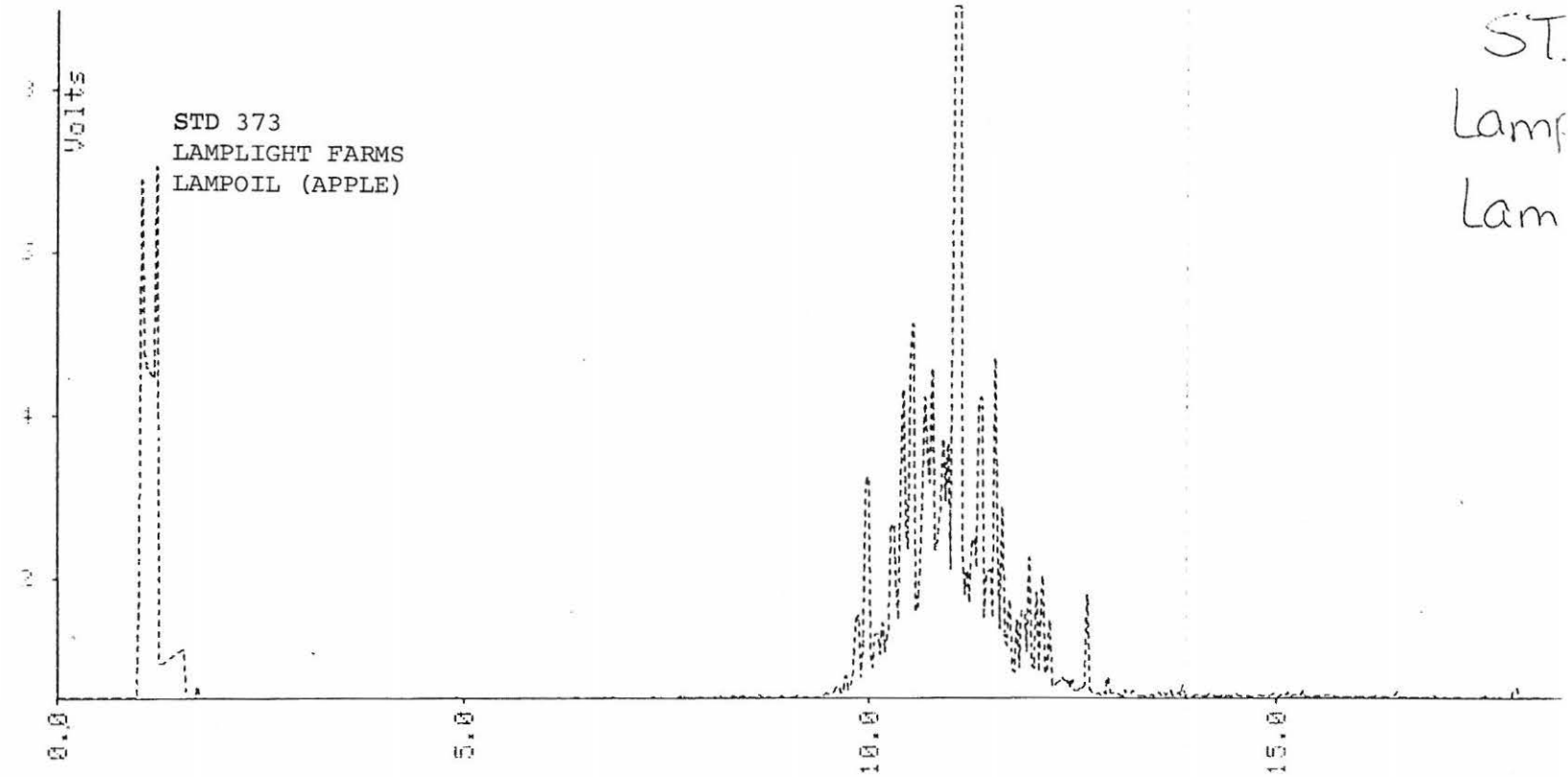

STD 373
50% EVAP.
FARMS LAMPLIGHT LAMPOIL
Volts
0.0
5.0
10.0
15.0

FIGURE 6


Volts
STD 373
LAMPLIGHT FARMS
LAMPOIL (APPLE)
0.0
5.0
10.0
15.0

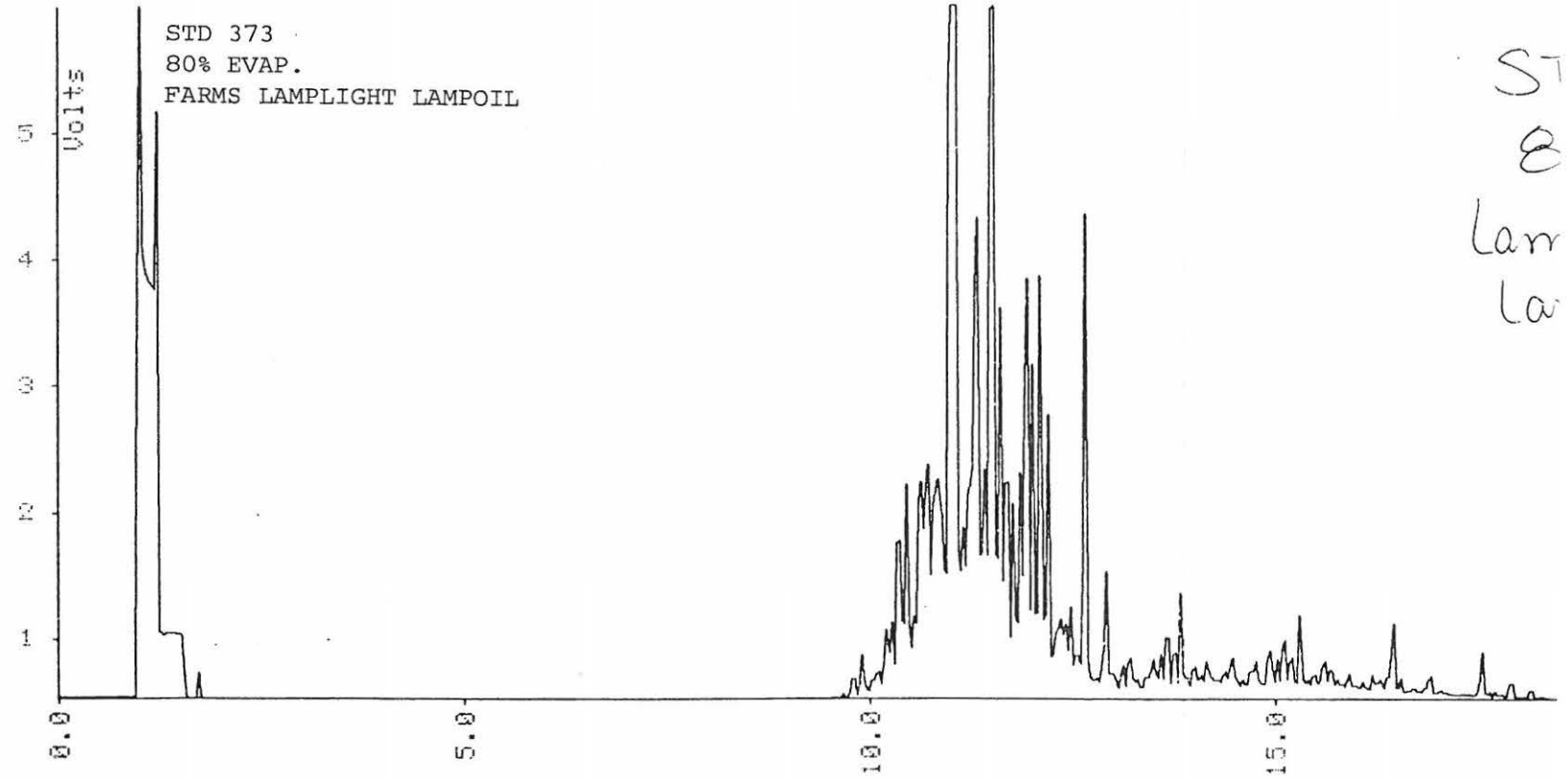
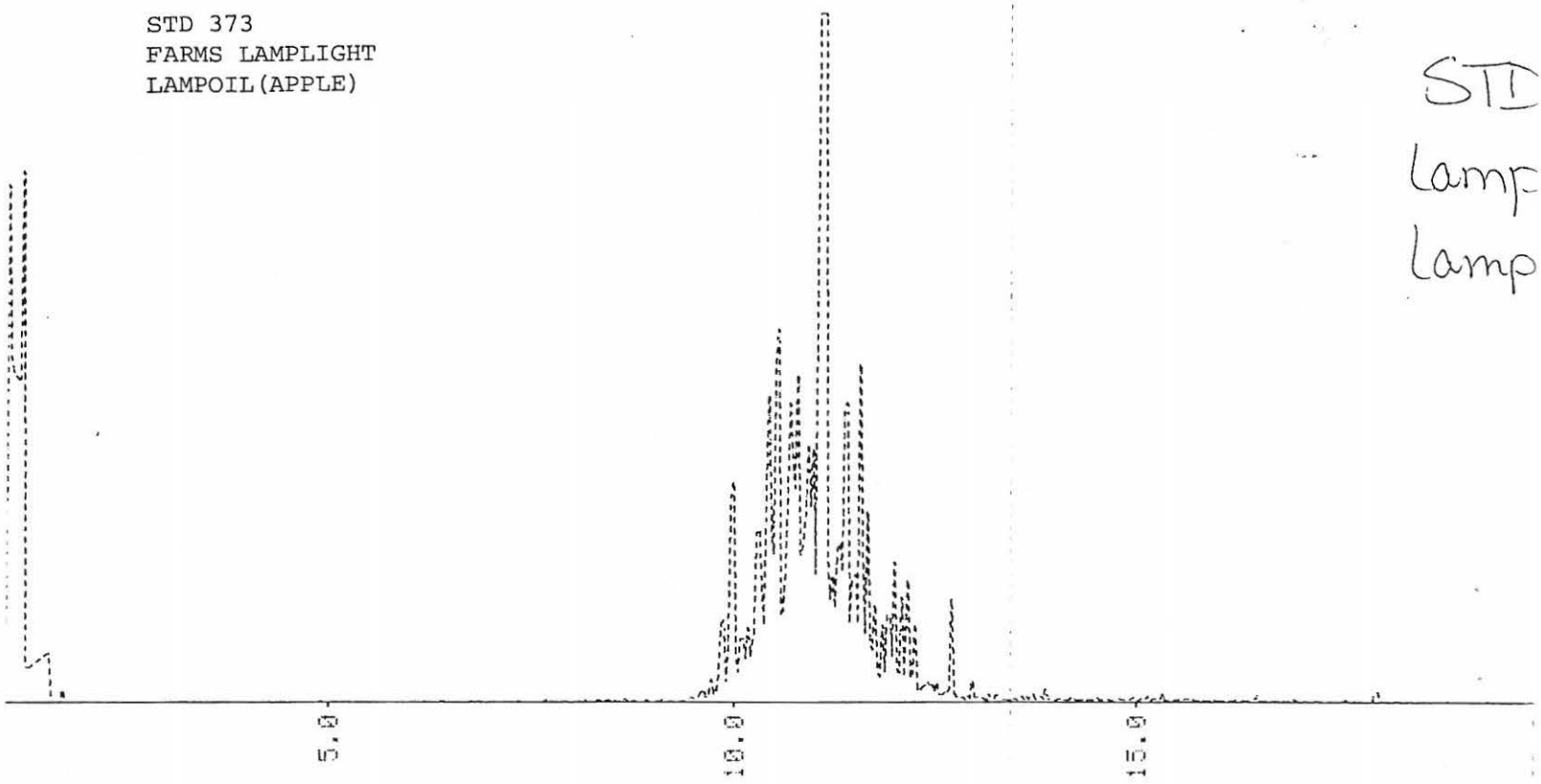

Volts
STD 373
80% EVAP.
FARMS LAMPLIGHT LAMPOIL
0.0
5.0
10.0
15.0

FIGURE 7


STD 373
FARMS LAMPLIGHT
LAMPOIL(APPLE)
5.0
10.0
15.0

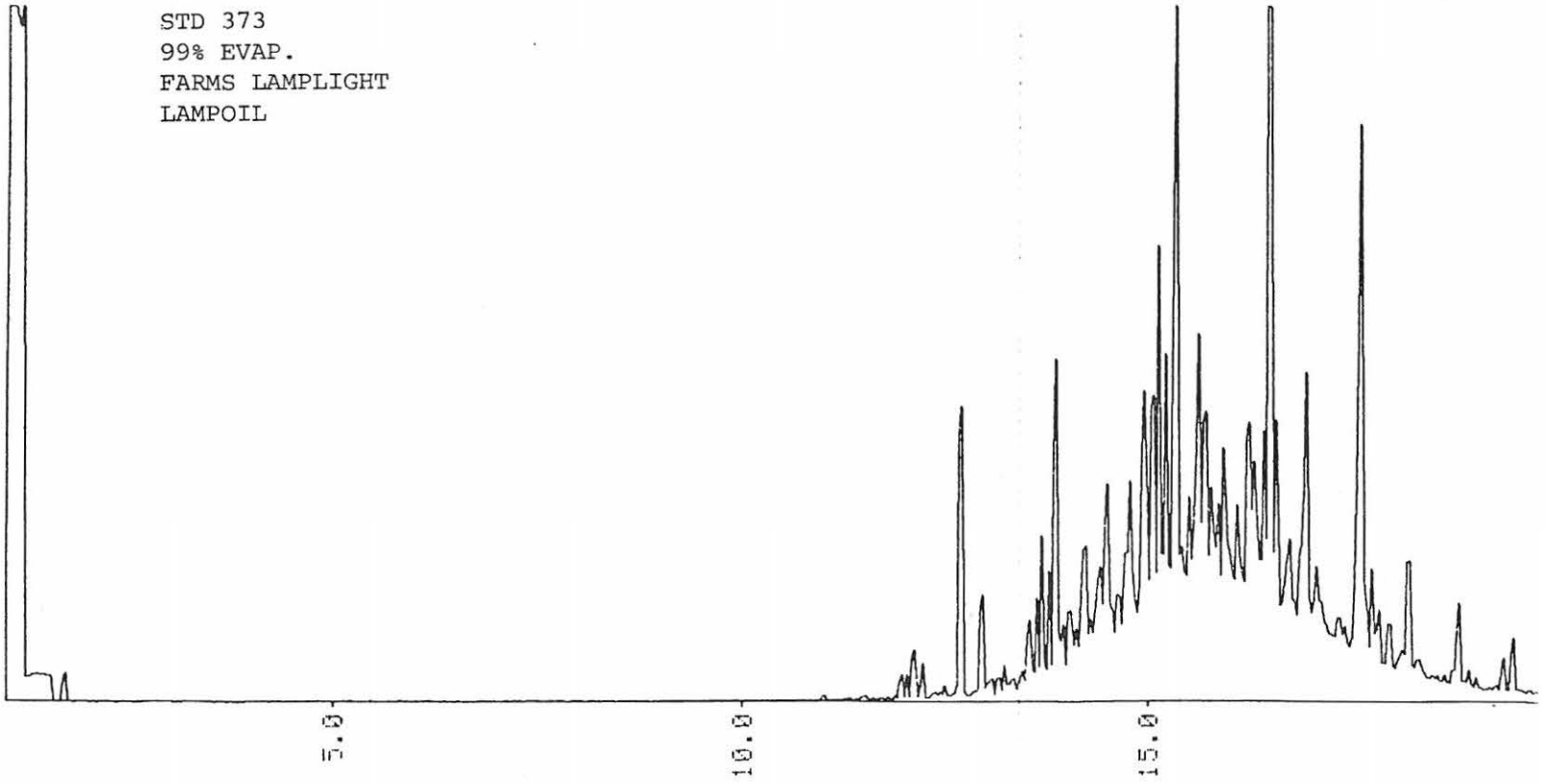
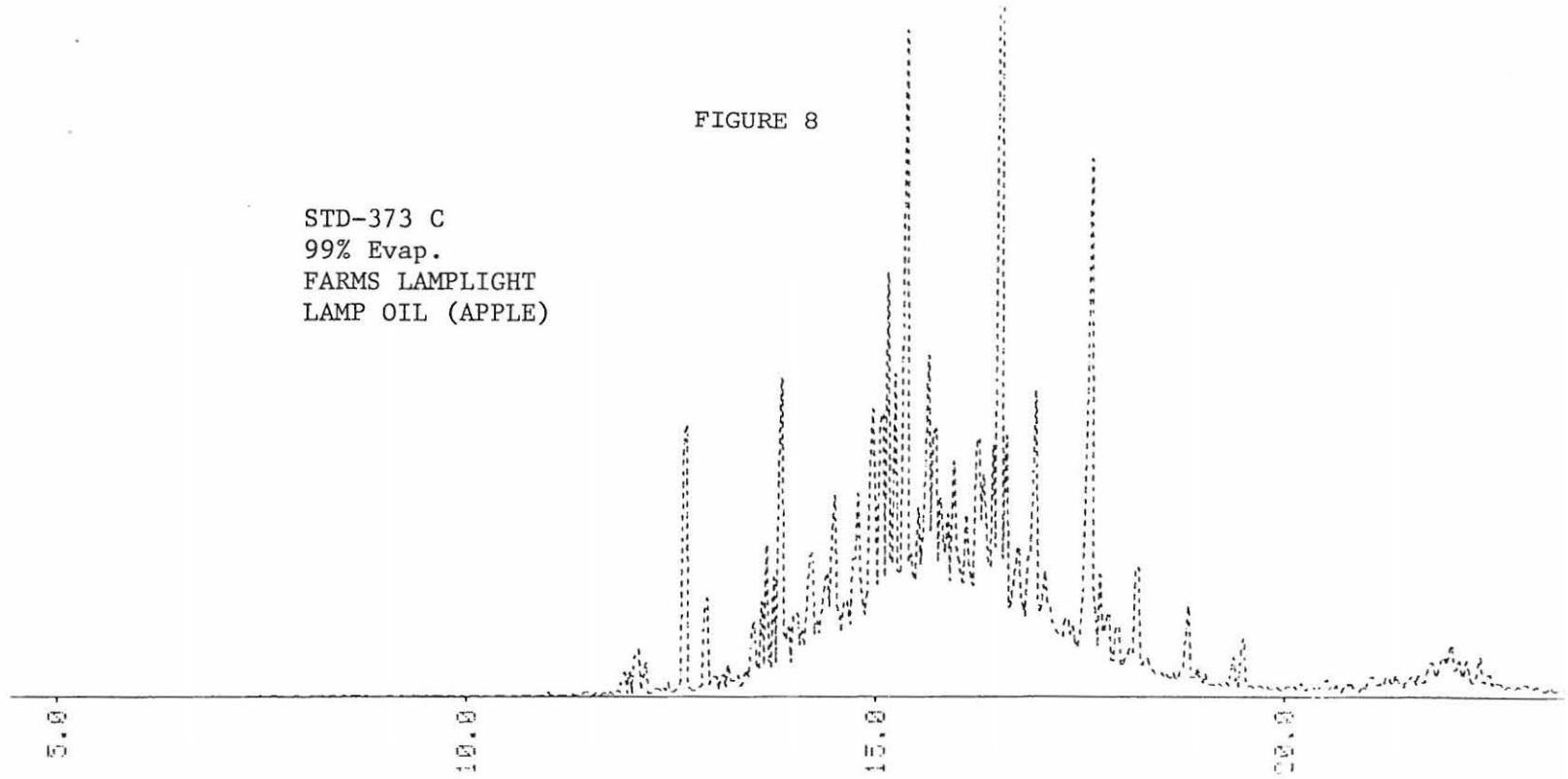
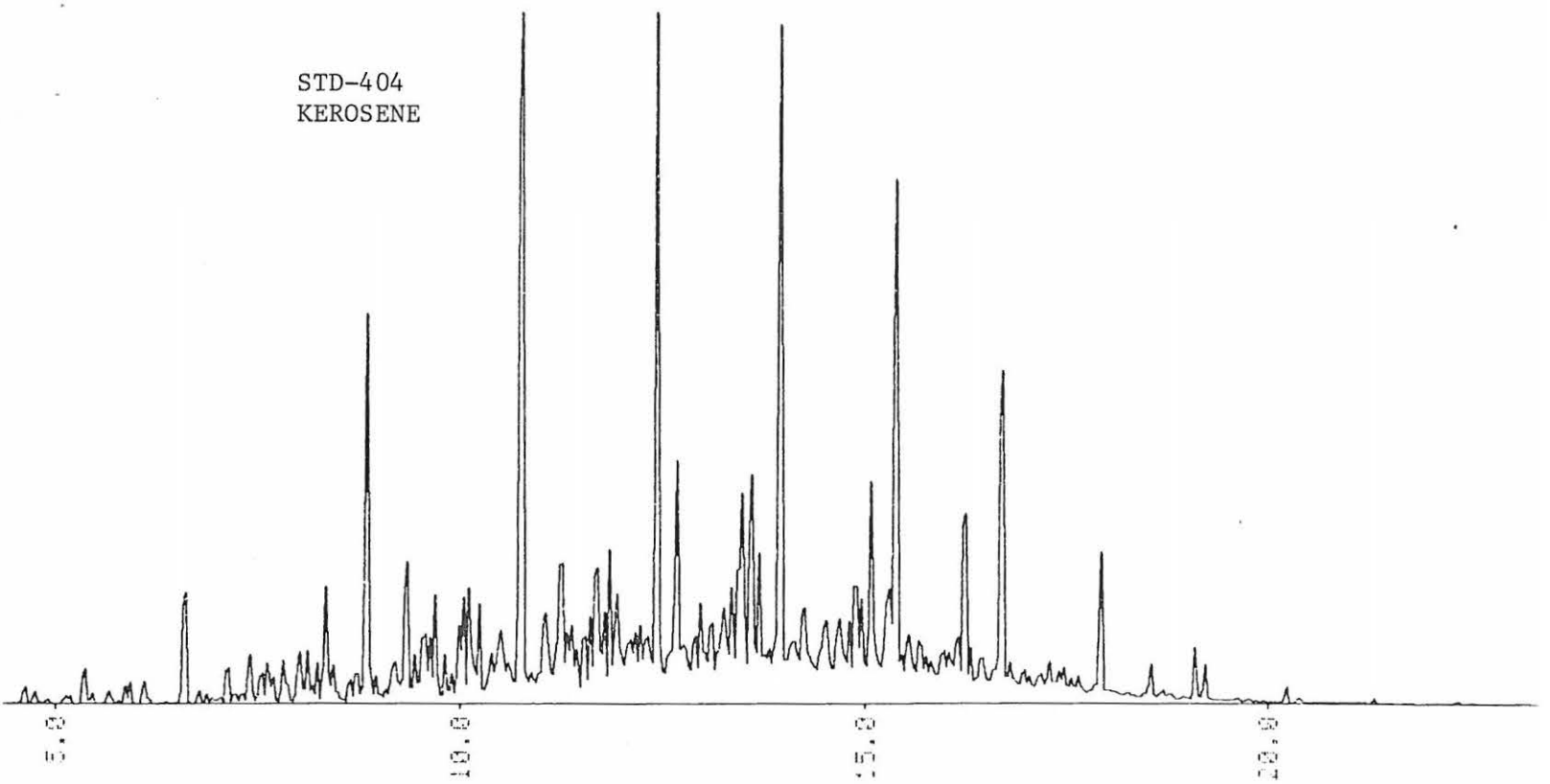

STD 373
99% EVAP.
FARMS LAMPLIGHT
LAMPOIL
5.0
10.0
15.0

FIGURE 8

STD-373 C
99% Evap.
FARMS LAMPLIGHT
LAMP OIL (APPLE)



STD-404
KEROSENE



FIELD SAMPLING OF ARSONS AREA BY THE ADSORPTION TUBE METHOD

by

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Jerusalem, ISRAEL

* * * * * * *

Abstract

The use of a charcoal adsorption tube for collecting accelerants residue in five fire scenes is reported. This method is found to be most efficient and correlates well with the usual analysis of debris from the same site.

INTRODUCTION

The most popular method for the investigation of suspected arson case is, currently, the gas chromatographic analysis of debris which are collected in the field and sent to the laboratory (1, 2). Although this method has some drawbacks (2) it was recently developed so as to achieve higher sensitivity and relative simplicity (3, 4). The adsorption tube (A.T.) method, recently applied for analyzing fire debris, offers high sensitivity, reproducibility, simplicity and additional advantages (5, 6). Nevertheless, this method requires that the debris be collected and brought to the laboratory for analysis.

One of the commercial instruments which was developed to detect accelerants at the arson site itself is based on infrared spectroscopy (7) but it does not analyze the type of accelerant.

One recent work (5) which deals with adsorption-tube analysis of headspace describes the collection and concentration of accelerants vapours on Tenax in a fire scene and mentions the precautions needed during sampling and transporting the tubes. This method was found to be applicable to field sampling of an arson atmosphere.

The aim of this work was to apply the experience which was gained regarding the charcoal adsorption-tube analysis of fire debris (6) to field sampling. This simple method will eliminate the large amount of arson samples which are heaped-up in the arson investigation laboratory and which might be contaminated by each other.

EXPERIMENTAL

The adsorption tube is composed of a glass tube (20 mm length, 2 mm internal diameter) into which 6-7 active charcoal (400 m^2/g) granules (1-2 mm diameter) are introduced. The tube is connected to a sniffer (Personal Air Sampling, Model 7107, Xonics Inc.) which pumps about 80 ml/min of air through the tube.

The suspected area is sampled by pumping air with the sniffer for about 5 minutes. After sampling, the tube is kept in a closed glass vessel and sent to the laboratory for analysis of accelerants. Analysis is performed as previously described (6). The active charcoal is equilibrated with 50-60 µl of CS_2 and the solvent is injected into a gas-chromatograph.

Gas chromatography was carried out using 1/8 inch x 6 meters of stainless steel column packed with 5% OV 101, in an Aerograph model 2400 gas-chromatograph, fitted with flame ionization detector. The column was programmed from 60°C to 250°C at 10°C/min.

RESULTS

Five recently investigated arson cases are reported. In all cases, sampling of the suspected area by the A.T. method was performed as well as collecting some fire debris and sending them to the arson investigation laboratory for analysis by the headspace as well as the A.T. method.

Case 1.

A private car was burnt in February 1982, at 1:00 a.m. We were called to investigate the case the next morning at 11:00 a.m. It is worth emphasizing that the weather was stormy and the car was standing in an open field. Two sampling tubes were used. Over each one we passed about 400 ml of air from between the seats and from the luggage of the burnt car. Some charred remains were sampled, put in nylon bags and brought to the laboratory for analysis, using both methods: Headspace analysis and A.T. (6). The sampling tube was also analyzed. Fig. 1 shows the gas chromatograms obtained from the analysis of the car airspace (fig. 1a) and the debris headspace (fig. 1b). As can be clearly seen the analysis of the sampling tube (fig. 1a) reveals the presence of kerosene (fig. 1c) in the atmosphere. The common headspace analysis is not that clear although the attenuation of the gas-chromatograph is 20 times higher (fig. 1b). Sampling of the debris by the A.T. method (6) also revealed large quantities of kerosene.

Case 2.

A car (Volvo) was burnt in Jerusalem in June 1982, at 10:30 p.m. Sampling of the atmosphere of the car was performed using the sampling tube as well as collection of some debris. Kerosene was detected at low detector sensitivity in the sampling tube and in the headspace analysis of the arson debris.

Case 3.

On July 1982, a fire broke out in a taxi garage at 11:00 p.m. The technicians sampled the atmosphere near the fire core using the sampling tubes and collected some broken bottles and charred papers. The headspace analysis of the debris hardly revealed any traces of gasoline while the analysis of the sampling tubes detected large quantities of gasoline.

Case 4.

On July 1982, a car was burnt at 02.15 a.m. Large quantities of gasoline were detected by the sampling tube.

Case 5.

Another car was burnt in September 1982, in a closed garage at 03:45 a.m. Technicians reached the place only at 10:00 a.m. and sampled the atmosphere inside the car, using the Sniffer and the sampling tube. Gas chromatograph analysis of the desorbed compounds clearly revealed some xylenes and toluene constituents which are used as paint diluents.

DISCUSSION

The new sampling technique which uses the charcoal adsorption tube for sampling suspected arson areas is described. In all five cases which were examined, it is obvious that the sampling method used is very efficient. Sampling the atmosphere in the arson area succeeds in revealing accelerant traces even in cases where the presently used headspace analysis of the fire debris fails. In cases where the headspace analysis detected traces of hydrocarbons the same results can be obtained by the method described with significantly higher sensitivity.

The method was used in field cases, and was found to be most useful even in cases which seem to be unsuitable for air sampling, e.g. open field and stormy weather.

The method eliminates the necessity of hermetically sealing all the samples submitted to the arson investigation laboratory and obviates the need of storing large amounts of debris.

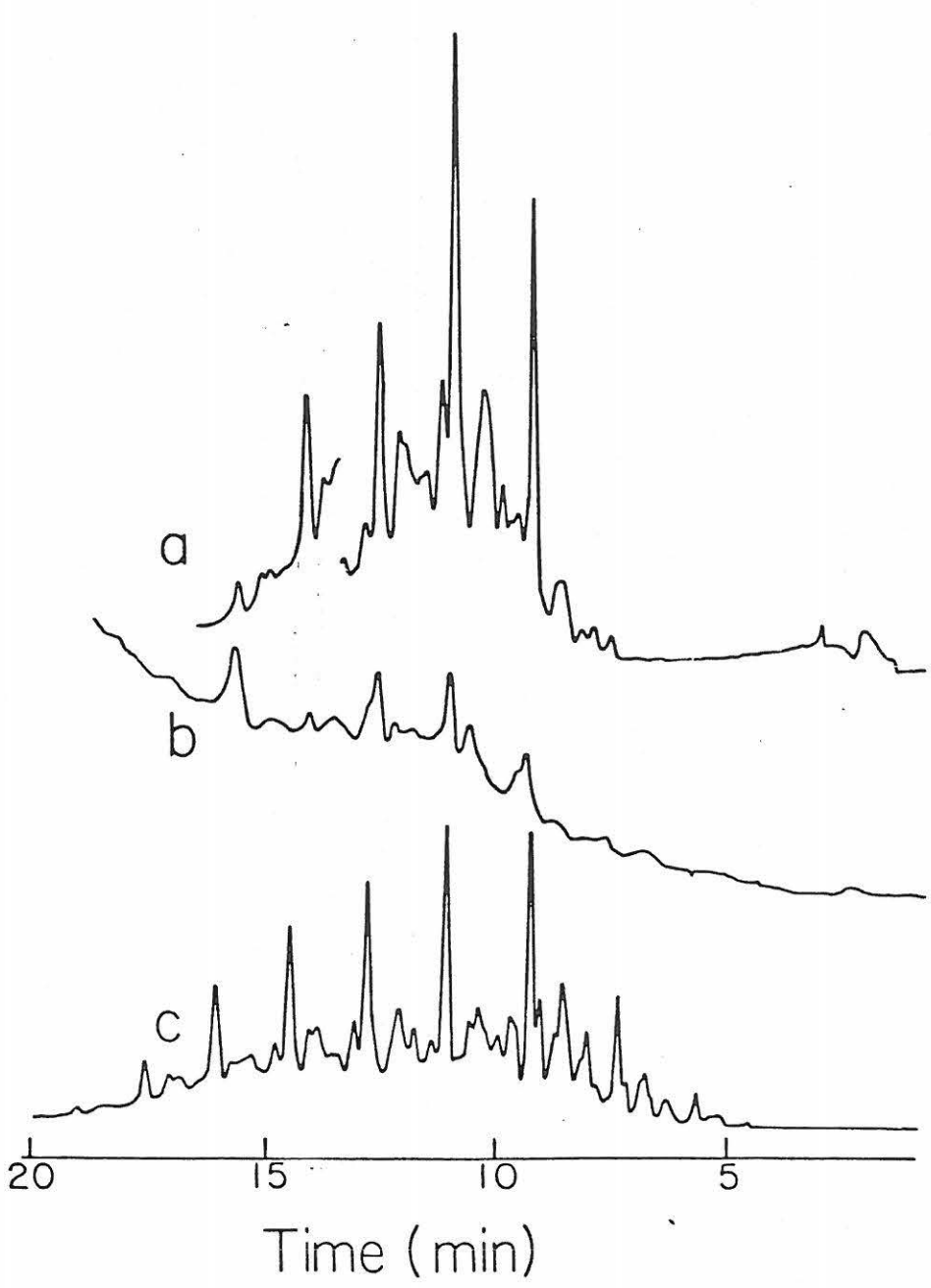

Figure 1: Gas chromatograms of samples from Case 1: Attenuation values are given for each chromatogram in brackets.

(a) Cars' atmosphere analysis [16×10^{-10}]

(b) Headspace analysis of some debris collected from the fire scene [8×10^{-11}]

(c) 1µℓ of liquid kerosene [256×10^{-10}].

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6. Frenkel,M., Tsaroon S., Aizenshtat Z., Kraus S., Daphna D., Enhanced Sensitivity in Analysis of Arson Residues: An Adsorption-Tube Gas-Chromatograph Method, J. Forens. Sci., 29(3), 1984, 723-731.

7. U.S. patent no. 4,323,777. Infrared Industries, Inc., "Arson Probe", 1980.

AA Notes

*** SOUTHERN ASSOCIATION OF FORENSIC SCIENTISTS' FALL MEETING

The Southern Association of Forensic Scientists' fall meeting for 1988 will be held on September 7, 8, 9, 10, 1988, at the Adams Mark Caribbean Gulf Resort, Clearwater Beach, Florida. Please contact Karen Cudlin, Pinellas County Sheriff's Forensic Lab (phone 813-584-7345) for information regarding this meeting.

*** ARSON LABORATORY ANALYST - (Job Opening)

The Florida office of the State Fire Marshal is seeking qualified applicants for a crime laboratory analyst position in their arson laboratory. This position requires a bachelor's degree from an accredited college or university with a major in forensic science, criminalistics, or in a physical or natural science and one year of professional experience in a forensic laboratory. The salary starts at $25,421.76 annually. Send resume to: Don Steverson, Office of the State Fire Marshal, Suite 479, Larson Building, Tallahassee, Florida 32301 (phone 904-488-9825).

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*** BUREAU OF ATF ANNOUNCES EXPLOSIVES CLASS

The Bureau of Alcohol, Tobacco and Firearms will conduct a course in the Systematic Analysis of Low Explosives in 1987 for state and local forensic chemists. The class is scheduled for September 21-25, 1987. Enrollment is limited to ten students.

The one week course, conducted at ATF's National Laboratory Center (NLC) in Rockville, MD, will emphasize practical skills in the recovery and identification of low explosives and their residues. Students will learn to examine a case from beginning to end. Material covered will include:

- recognizing low explosives based on blast damage and explosive effects
- gathering and documenting evidence at a bomb crime scene
- describing the chemical composition of low explosives and post-blast residues
- microscopically recognizing explosives in explosion debris
- analyzing bomb debris chemically (using extraction procedures, spot tests, organic and inorganic thin layer chromatography, and infrared spectrophotometry)
- developing an appropriate chemical analysis scheme for many of the low explosives frequently encountered
- recognizing post-blast bomb components

The course is designed for state and local forensic scientists who perform or will be performing laboratory analyses of explosive debris. Since examiner experience varies widely each selected applicant will be sent a self-test and reading material on explosives and explosions. The self-test will not be lengthy. It must be returned to the ATF National Laboratory Center by a specified date. Failure to return the test will result in the applicant forfeiting his or her class slot.

There will be no tuition, registration, or course material fee. The ATF Laboratory will arrange a group rate ($66 per night including tax) for all selected students at a hotel convenient to the NLC. All transportation, lodging, and per diem costs must be borne by the local department or individual. The U.S. Government per diem rate for the Washington, DC metropolitan area is $112/day. Attendees should budget accordingly.

Those persons interested in applying for the school can obtain an application by contacting Rick Tontarski or Rick Strobel at ATF NLC, 1401 Research Boulevard, Rockville, MD 20850 (202)294-0420.

EMPLOYMENT

O·P·P·O·R·T·U·N·I·T·Y

PERSONNEL DEPARTMENT 300 W. WASHINGTON Phoenix AZ 85003

CRIMINALIST I

SALARY	$24,128 - $32,490 annualized.
DUTIES	A Criminalist I performs laboratory comparative analyses on drugs and narcotics, and blood specimens for alcohol content. Duties also include the training of Police Officers in the use of alcohol-breath testing equipment and serving as an expert witness in court.
EXPERIENCE	Requires a Bachelor's degree in Chemistry, Criminalistics, or a related field. Any other combination of experience and education which provides the knowledge, skills and abilities to perform the work may be substituted.
ALSO REQUIRED	Must have a good driving record and be able to obtain an Arizona Operator's license. Use of personal vehicle must be authorized by the City and requires personal insurance coverage. Must meet polygraph and background standards appropriate to non-sworn employees of the Police Department. Working irregular hours, shifts, weekends, holidays and evenings may be required.
RESIDENCE	Waived. Anyone hired has twenty-four months after date of hire to move into Maricopa County.
EVALUATION	(WRITTEN/ORAL) - If an oral board interview is used, scores will be a combination of the interview and written exam. If an interview is not used, scores will be based solely on the written exam. Only the highest qualified applicants will be invited to the exam. A passing grade in each part is required. THIS ELIGIBLE LIST WILL EXPIRE TWELVE (12) MONTHS FROM THE DATE OF CERTIFICATION. Residents of Maricopa County apply Personnel Department Office. Residents outside Maricopa County call (602) 262-6277 or write for application.
WHEN TO APPLY	Applications may be picked up at the Personnel Department Application Counter from April 6, until selection has been made. Subject to closing without notice.
REFERENCE	6241 - Criminalist I LC - P.D. #4705

BOTH MEN AND WOMEN ARE ENCOURAGED TO APPLY
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CITY OF PHOENIX

EMPLOYMENT

O·P·P·O·R·T·U·N·I·T·Y

PERSONNEL DEPARTMENT 300 W. WASHINGTON Phoenix AZ 85003

CRIMINALIST II

SALARY	$29,370 - $39,728 annualized.
DUTIES	Performs skilled tests and analyses in connection with identification and evaluation of physical evidence.
EXPERIENCE	Requires three years of experience in a criminalistics laboratory and a Bachelor's degree in Chemistry, Criminalistics or a related field. Also requires journeyman level experience in Forensic Serology and at least one other of the following areas: toxicology, arson investigation, polarized microscopy, firearms and tool marks identification, hair and fiber identification, general comparative analysis, technical macrophotography and x-ray techniques. Any other combination of experience and education which provides the knowledge, skills and abilities to perform the work may be substituted.
ALSO REQUIRED	Must have a good driving record and be able to obtain an Arizona Operator's license. Use of personal vehicle must be authorized by the City and requires personal insurance coverage. Must meet polygraph and background standards appropriate to non-sworn employees of the Police Department. Working irregular hours, shifts, weekends, holidays and evenings may be required.
RESIDENCE	Waived. Anyone hired has twenty-four months after date of hire to move into Maricopa County.
EVALUATION	Based on training and experience. Only the highest qualified applicants will be certified to the eligible list. THIS ELIGIBLE LIST WILL EXPIRE TWELVE (12) MONTHS FROM THE DATE OF CERTIFICATION. Residents of Maricopa County apply Personnel Department Office. Residents outside Maricopa County call (602) 262-6277 or write for application.
WHEN TO APPLY	Applications may be picked up at the Personnel Department Application Counter from April 6, until selection has been made. Subject to closing without notice.
REFERENCE	6242 - Criminalist II LC - P.D. #4706

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CITY OF PHOENIX

CITY OF PHOENIX
POLICE DEPARTMENT
620 WEST WASHINGTON STREET
PHOENIX, ARIZONA 85003-2187

EMPLOYMENT OPPORTUNITY - LATENT PRINT EXAMINER II

The City of Phoenix Police Department is planning to open recruitment for the position of Latent Print Examiner II for approximately four weeks beginning, May 11, 1987, and subject to close without notice. Five known vacancies now exist.

This position is responsible for performing skilled technical level work in the latent fingerprint science for criminal identification, evidence classification, and police photography. The duties of the position involve investigating major crime scenes for physical evidence, performing scientific and comparative analysis, chemical sequencing of evidence, and forensic photography.

The Latent Print Examiner II operates a variety of laboratory equipment, lasers, computers, and microscopes. The incumbent of this position must be qualified to appear in court as an expert witness.

Requirements for this position include three years of experience in work involving both inked and latent fingerprint classification work in a law enforcement environment supplemented by formal training in latent fingerprint, photography, and other police identification techniques plus an Associate's degree or 60 accredited college semester hours in Criminalistics or related field.

Salary range for Latent Print Examiner II is $25,296 - $34,176 annualized. The City of Phoenix offers a comprehensive and attractive benefit package. If you need further information, please contact Robert Richardson at 262-6277. Applications and questionnaires from which qualifications will be evaluated, will be available during the open recruitment period.