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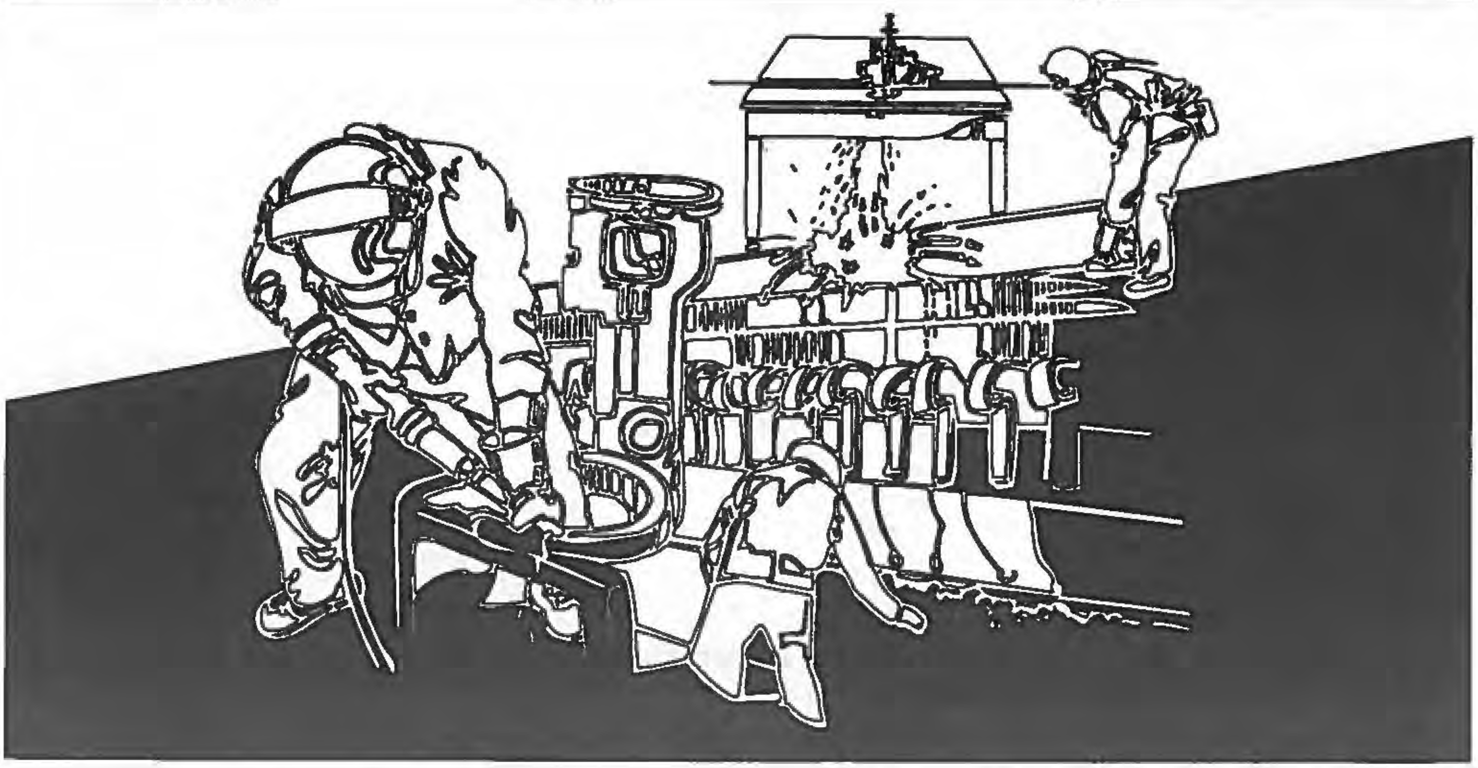
NIOSH HEALTH HAZARD EVALUATION REPORT

HETA 95-0192-2538
Schlegel Tennessee, Inc.
Maryville, Tennessee

Beth Donovan Reh, M.H.S.



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

PREFACE

The Hazard Evaluations and Technical Assistance Branch of the National Institute for Occupational Safety and Health conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from an employer or authorized representative of the employees, to determine whether any substance normally found in the place of employment has potential toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance to Federal, State, local agencies, labor, industry, and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 95-0192-2538
NOVEMBER 1995
SCHLEGEL TENNESSEE, INC.
MARYVILLE, TENNESSEE

NIOSH INVESTIGATOR:
Beth Donovan Reh, M.H.S.

SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) conducted a health hazard evaluation (HHE) at Schlegel Tennessee, Inc., a manufacturer of automotive vehicle sealing, in Maryville, Tennessee, on May 2-3, 1995. The company Regulatory Compliance and Safety Engineer requested the HHE because employees in the extrusion department had been experiencing symptoms of shortness of breath, dizziness, light-headedness, disorientation, headaches, and nausea. Overexposure to carbon disulfide had been documented in the early 1980's, but the exposures had been lowered through engineering controls. Similar symptom complaints occurred again in the late 1980's and were reduced by the addition of more engineering controls. During both of these episodes, a NIOSH HHE was conducted in response to management requests. Additionally, an outside consultant was hired by the company in 1989. The symptoms appeared to be improved until January 1995, when a new coating application process was added on line 8. NIOSH was requested to conduct another HHE to try to determine the cause of the complaints on line 8. When investigators arrived at the plant, they were informed that employees on lines 1 and 6 also appeared to be experiencing symptoms.

The HHE consisted of general area air sampling for nitrosamines and volatile organic compounds (VOCs) in the extrusion department and a symptoms survey questionnaire distributed among employees. The nitrosamine sampling revealed very low concentrations of nitrosodimethylamine (NDMA). The VOC sampling was done using thermal desorption tubes and at least one sample was collected on each extrusion line. Most of these samples detected relatively very small amounts of similar compounds. The symptoms survey was administered to any employee from the plant willing to participate, and on employees from one department in the adjacent finishing plant where the same coating was used as is used on extrusion line 8. The questionnaire data did not reveal any significant relationships; reported symptoms did not correspond with extrusion lines where more compounds were detected in relatively higher concentrations.

Neither the air sampling nor the symptoms survey revealed an identifiable exposure problem or complaint area in this plant. Recommendations were made to help the company deal with symptom complaints by implementing a system to monitor symptom reports. These records may help the safety officer target problem areas that might require industrial hygiene monitoring or additional engineering controls.

KEYWORDS: SIC 3061 (Molded, Extruded, and Lathe-Cut Mechanical Rubber Goods), rubber vehicle sealing, rubber automotive parts, extrusion, carbon disulfide, nitrosamines, hydrocarbons

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) conducted a health hazard evaluation (HHE) at Schlegel Tennessee, Inc. in Maryville, Tennessee, on May 2-3, 1995. The company Regulatory Compliance and Safety Engineer requested the HHE because employees in the extrusion department had been experiencing symptoms of shortness of breath, dizziness, light-headedness, disorientation, headaches, and nausea. Overexposure to carbon disulfide had been documented in the past (early 1980's), but the exposures had been lowered through engineering controls. Similar symptom complaints had occurred in the late 1980's and again were reduced by the addition of more engineering controls. The symptoms appeared to be improved until January 1995, when a new coating application process was added on line 8.

BACKGROUND

Schlegel Tennessee, Inc. produces automotive rubber vehicle sealing. The original building, constructed in 1974, still houses the mixing department and the extrusion department. This building will be referred to as the rubber plant throughout the report. The finishing processes are now done in two separate plants - one next door and one in Ohio - which will be referred to as the finishing plants. The HHE was focused on the extrusion department, which consists of 12 extrusion lines that operate 24 hours per day, 5 days a week. (Line 10 was down for redesign during the survey.) Approximately 90 employees work over three shifts in this department.

The extrusion process begins with wire mesh being formed into a channel while dense rubber is extruded on top of it. Sponge rubber is extruded with the dense rubber to form the bulb portion of the vehicle sealing material. Some of the rubber stocks are made at this facility in the mixing department and others are bought. Curing is done with heated glass beads on lines 1 through 9, with an electric oven (Gerlach system) on line 11, and with a microwave oven on line 12. The curing process is followed by a "brush-off" process, a wash tank, a drill, and then a cutting process. The cut rubber lengths are then either automatically or manually taken off the line and put into appropriate containers. Both lines 7 and 8 were unique in that they each contained a spray booth along the line which sprayed a coating - a different one for each line - onto the rubber strip. This coating process, relatively new to the extrusion lines, had always been done in the finishing department; but, the company has plans to add it to all the extrusion lines instead.

NIOSH Survey 1979-1981

The first NIOSH HHE at this facility was conducted in 1979 and 1981 (HETA 80-0013 and 81-0147-1644).[1] The HHE request was submitted by management in October 1979, stating that employees in the extruded rubber department had been experiencing eye irritation from an unknown source for the previous three years. NIOSH investigators concluded that certain employees were overexposed to carbon disulfide (CS_2), which could have been a risk factor for the keratitis/conjunctivitis symptoms. Low levels of nitrosodimethylamine (NDMA) and nitrosopiperdine (NPIP) were also detected during this survey. Thirty-seven other substances were sampled for, but none were detected above the relevant exposure criteria, and many were not detected at all. Several recommendations were offered, including the addition of local exhaust ventilation (LEV), to reduce worker exposures.

NIOSH Survey 1989

The second HHE was conducted at Schlegel Tennessee, Inc. in 1989 (HETA 89-0212-2020),[2] and was also in response to a management request. Employees had been experiencing symptoms of dizziness, nausea, tingling lips, headaches, and depression, and one employee had a positive urine iodine-azide test indicating possible over-exposure to CS_2. Union representatives from the Amalgamated Clothing and Textile Workers' Union (ACTWU), Local 1933, also expressed concerns about a possible high incidence of cancer among current and former employees and asked that NIOSH also sample for nitrosamines. During this survey, 2-thiothiazolidine-4-carboxylic acid (TTCA) was not detected in any pre- or post-shift urine samples, indicating that workers were not exposed to more than 0.5 parts per million (ppm) airborne CS_2 at the time of the survey. Similarly, personal breathing zone (PBZ) and general area (GA) air samples did not detect CS_2 concentrations above the NIOSH recommended exposure limit (REL). Also, a standardized morbidity ratio (SMR) analysis of reported cancers among employees did not show an overall excess of disease compared to the general United States population; and monitoring for nitrosamines did not reveal any detectable concentrations. NIOSH investigators recommended that the company follow the LEV recommendations of the consultant that had also done sampling in 1989.

Consultant Survey 1989

The outside consultant sampled for CS_2 in April and May 1989, at the request of Schlegel Tennessee, Inc. PBZ samples for employees at the ends of lines 2, 8, 9, and 10 were all less than 1 ppm; but levels inside finished vehicle sealing bubbles were as high as 2500 ppm and in the air around filled scrap receptacles, as high as 28 ppm. The consultant recommended extending and modifying the bubble evacuator, installing a LEV system for the scrap receptacles, and educating employees about work practices that could decrease their exposures. These recommendations were acted upon by the company.

Current Manufacturing Conditions

At the time of the current NIOSH survey, all the extrusion lines had LEV systems. The ovens and glass-bead beds were enclosed and ventilated; the drills are either partially or totally enclosed and ventilated; there are "bubble evacuators" (small enclosures that surround the rubber strip as it exits the drill press) which are ventilated to draw any volatiles out of the drilled bulb; there is LEV along the back side or bottom of the rubber strip as it moves along the line; and the product and scrap bins are ventilated by flexible ducts connected to exhaust fans in the ceiling.

Since symptom complaints had begun again and the exposures to hazards identified in the past still remained low or were no longer detectable, NIOSH was requested to conduct another HHE to try to determine what might be the cause of the complaints on line 8. When investigators arrived at the plant, they were informed that employees on lines 1 and 6 also appeared to be experiencing symptoms.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ evaluation criteria for the assessment of a number of chemical and physical agents. The primary sources of environmental evaluation criteria for the workplace are the following: (1) NIOSH Criteria Documents and RELs, (2) the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs), and (3) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).[3,4,5] The objective of these criteria is to establish levels of exposure to which the vast majority of workers may be exposed without experiencing adverse health effects.

Full–shift and shorter duration criteria are available depending on the specific physiologic properties of the agent. Full–shift limits for chemical agents are based on the time–weighted average (TWA) airborne concentration of a substance that workers may be repeatedly exposed to during an 8 or 10 hour work day, up to 40 hours a week for a working lifetime, without adverse health effects. Some substances have short–term exposure limits (STELs) or ceiling limits (CLs) which are intended to supplement the full–shift criteria where there are recognized irritative or toxic effects from brief exposures to high airborne concentrations. STELs are based on 15 minute TWA concentrations, whereas CL concentrations should not be exceeded even momentarily.

Occupational health criteria are established based on the available scientific information provided by industrial experience, animal or human experimental data, or epidemiologic studies. Differences between the NIOSH RELs, OSHA PELs, and ACGIH TLVs may exist because of different philosophies and interpretations of technical information. It should be noted that RELs and TLVs are guidelines, whereas PELs are standards which are legally enforceable. OSHA PELs are required to take into account the technical and economical feasibility of controlling exposures in various industries where the agents are present. The NIOSH RELs are primarily based upon the prevention of occupational disease without assessing the economic feasibility of the affected industries. The ACGIH is not a government agency; it is a professional organization whose members are industrial hygienists or other professionals in related disciplines and are employed in the public or academic sector. The TLVs are developed by consensus agreement of the ACGIH TLV committee and are published annually. The documentation supporting the TLVs (and proposed changes) is periodically reviewed and updated if believed necessary by the committee.

Not all workers will be protected from adverse health effects if their exposures are maintained below these occupational health exposure criteria. A small percentage may experience adverse effects due to individual susceptibility, a pre–existing medical condition, previous exposures, or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, or with medications or personal habits of the worker (such as smoking) to produce health effects even if the occupational exposures are controlled to the limit set by the evaluation criterion. These combined effects are often not considered by the chemical specific evaluation criteria. Furthermore, many substances are appreciably absorbed by direct contact with the skin and thus potentially increase the overall exposure and biologic response beyond that expected from inhalation alone. Finally, evaluation criteria may change over time as new information on the toxic effects of an agent become available. Because of these reasons, it is prudent for an employer to maintain worker exposures well below established occupational health criteria.

The evaluation criteria for the compound analyzed during this health hazard evaluation are discussed below.

N-nitrosamines

Nitrosamines are compounds characterized by the -N--N=O functional group. They result from the combination of primary, secondary, or tertiary amines with nitrite. These reactions can occur in the laboratory; in various food, household, or industrial products; in industrial processes; and in vivo. Because of the variety of amines and reaction conditions possible, there are hundreds of nitrosamines; and because of the large number of exposure sources, including formation in vivo, there is a complicated matrix of total nitrosamine exposure. Occupational exogenous exposures have been observed in rubber industries, leather tanning industries, metal working industries, chemical industries, mining, pesticide production, detergent production, and fish factories.

Most nitrosamines are suspected to be human carcinogens, but direct causal associations have not yet been proven. There is circumstantial evidence that nitrosamines could cause cancer in humans. In 1956, Magee and Barnes demonstrated the carcinogenic potential of NDMA in rats.[6] Since then, nitrosamines have been studied extensively in laboratory animals. Approximately 90% of the 300 tested nitrosamines have shown carcinogenic effects in bioassays and laboratory animals. The animals that have been studied include mammals, birds, fish, and amphibia. Of the approximately 40 animal species tested, none has been resistant. The tumor sites depend on the specific nitrosamine, the species tested, and the route of administration. Nitrosamine affects have been demonstrated in the bladder, bronchi, central nervous system, earduct, esophagus, eyelid, duodenum, forestomach, glandular stomach, hematopoietic system, intestine, jaw, kidney, larynx, nasal cavity, oral cavity, ovary, liver, mammary glands, pancreas, pelvis, peripheral nervous system, pharynx, respiratory tract, skin, testes, trachea, uterus, and vagina.[7] Dose-response studies with rats have shown "no effect levels" corresponding to dietary concentrations of 1 ppm NDMA, 1 ppm NDEA, and 1 ppm NPYR.[7] These n-nitrosamines and others appear to be very potent carcinogens.

All of the biochemical, pathological, and experimental data provides little evidence that humans might be resistant to the carcinogenic potential of nitrosamines.[8] Human tissues from the trachea, bronchus (lung), esophagus, colon, pancreatic duct, bladder, and buccal mucosa have been shown to metabolize nitrosamines into DNA-binding compounds.[8] Human liver tissue appears to metabolize nitrosamines with a similar activity to rodent liver tissue, and rodents have similar acute symptoms of liver necrosis and cirrhosis similar to those that have been observed in humans.[8]

A few human DNA adduct studies have revealed higher levels of nitrosamine- related DNA adducts in cancer cases than in controls.[9,10] Studies in experimental animals have shown similar DNA adduct formation to those detected in the human studies.[11-13]

Only one nitrosamine, nitrosodimethylamine, is regulated in the United States. Both OSHA and NIOSH regulate NDMA as an occupational carcinogen, recommending that its exposure be reduced to the lowest feasible concentration. There are no established numerical exposure limits in this country.

In Germany, Der Ausschuβ für Gefahrstoffe (AGS) strictly regulates occupational exposures to nitrosamines. In general industry, the total exposure to all nitrosamines present may not exceed 1 microgram per cubic meter ($\mu g/m^3$). In special cases, such as the tire storage warehouses, exposures to all nitrosamines present may not exceed 2.5 $\mu g/m^3$. In addition to these regulations, eight nitrosamines are regulated individually—nitrosodimethylamine, nitrosomorpholine, nitrosopiperidine, phenyl–ethylnitrosamine, phenyl–methylnitrosamine, di–N–butylnitrosamine, di–iso–propylnitrosamine, and diethylnitrosamine.

EVALUATION METHODS

N–nitrosamines

Three GA air samples were collected on Thermosorb/N® media tubes using Gillian® high–flow pumps at a flow rate of 2.0 liter per minute (l/min), and analyzed for nitrosamines. The analysis was performed in a NIOSH laboratory using a capillary column gas chromatograph and a high–resolution mass spectrometer (MS) in the selected–ion–monitoring (SIM) mode.

Hydrocarbons

Fourteen GA air samples were collected on thermal desorption tubes using Gillian® low–flow pumps at a flow rate of 50 cubic centimeters per minute (cc/min), and analyzed qualitatively to identify relative amounts of hydrocarbons present. Samples were analyzed in a NIOSH laboratory using a Perkins–Elmer ATD 400 thermal desorption system interfaced to an HP5890A gas chromatograph and an HP5970 mass selective detector (TD–GC–MSD).

Symptoms Survey

To assess whether complaints were specific to a certain location or time, a symptoms survey was conducted. A questionnaire was designed that contained questions about prevalence of symptoms that had been experienced in the four weeks preceding the survey, and whether medical attention had been sought for those symptoms. Any employees in the rubber plant and from one specific area in the adjacent finishing plant who were willing to participate were asked to complete the questionnaire. All three shifts were sampled and questionnaires were filled out in the presence of a NIOSH investigator.

RESULTS

General Area Air Sampling

The GA nitrosamine samples revealed very low concentrations of NDMA, but did not detect any other nitrosamines. Samples were collected on line 6 after the water bath (0.12 $\mu g/m^3$ NDMA), on line 8 at the drill (0.59 $\mu g/m^3$ NDMA), and on line 1 after the drill (0.97 $\mu g/m^3$ NDMA). The minimal detectable concentration for these samples was 0.02 $\mu g/m^3$. These samples were collected directly on the lines and do not represent a personal exposure. Since no workers spend a full shift working at the drill or water bath areas, the personal exposures from these sources are most likely lower than the measured concentrations and below the German recommendations.

The thermal desorption tube results are presented in Appendix A. Line 1 and line 6 samples detected the highest number of compounds and many in relatively higher concentrations than detected on the other samples. The line 8 samples detected very little. It is important to note when looking at the data that the TD-GC-MSD method is 100 to 1000 times more sensitive than the standard carbon disulfide desorption-GC-MS method used with charcoal tube hydrocarbon sampling. Whereas the latter detects amounts in the microgram per sample range, the former detects amounts in the nanogram per sample range. Many of the detected compounds would probably not even be detected on a quantitative sample.

Symptoms Survey

The questionnaire results are presented in Tables 1 through 10. Table 1 presents the percent of surveyed employees from the rubber plant (n=118) who are experiencing symptoms, who got better when away from work, and who experienced the symptoms on the day of the survey. For those rubber plant employees who reported symptoms, 4.3% (4) visited the plant nurse for the symptoms, 38.7% (36) visited a personal medical doctor for the symptoms, and 5.4% (5) visited both. Table 2 presents the same information as Table 1 but for employees of coating area #1 in the finishing plant (n=18). This finishing area was chosen for participation because the process involved using the same coating mixture that was added to line 8 of the rubber plant extrusion department - the coating that many employees felt was the cause of the complaint symptoms. For those finishing plant employees who reported symptoms, 6.3% (1) visited the plant nurse for the symptoms, 37.5% (6) visited a personal medical doctor for the symptoms, and none visited both.

Tables 3 through 8 present the questionnaire results separated for sex, smoking status, duration of employment, hours worked per week, years worked at current job, and shift. These were stratified to determine whether one group was more likely to report symptoms than another. The only separation that consistently revealed a difference was that females appear more likely (at least two times as likely) to report symptoms (Table 3). Also, smokers were more likely to report sore or dry throat, cough, wheezing, chest tightness, and shortness of breath (Table 4). Employees who had worked more than five years at the plant were twice as likely to report a symptom for 8 of the 13 symptoms asked about (Table 5), but years at current job did not appear to make a difference in the percent who report symptoms (Table 7). Neither average hours per week nor shift appeared to make a difference (Table 6 and 8). Tables 9 and 10 present the reported symptoms for extrusion department employees separated by their line(s). Table 9 shows this for employees who reported experiencing symptoms at least one day per week during the four weeks preceding the survey, and Table 10 shows it for employees who reported experiencing symptoms every or almost every day during the four weeks preceding the survey. It appears that a higher percentage of employees who work on line 7, and also perhaps on line 8, reported symptoms. However, there were 10 female and 6 male line 7 employees, and 12 female and 9 male line 8 employees.

DISCUSSION

Neither the air sampling nor the symptoms survey revealed an identifiable exposure problem or complaint area in this plant. The hydrocarbon results did not detect any major or significantly different exposures on line 8 or in the finishing plant coating area #1. In fact, the exposures in these locations appeared to be much lower than in some of the other areas, such as lines 1 and 6. Even on lines 1 and 6 where more airborne compounds were detected, no compound(s) could be identified as unique or present at a relatively much higher concentration. The questionnaire data do suggest that possibly workers on line 7, and perhaps even line 8, report more symptoms, but the sampling data does not explain these higher rates. Both of these lines contained newer coating processes which could have introduced a new odor to the area. Although no specific compounds were identified in relatively high concentrations that were substantially different from the other lines, a new odor could result in more complaints based on the fact that there is a perceived new exposure.

CONCLUSIONS AND RECOMMENDATIONS

No health hazard was identified at this plant. In an effort to help the company deal with symptom complaints in the future, NIOSH investigators recommend that the plant nurse maintain a record of symptom complaints separate from the OSHA 200 Injury and Illness log. Any complaints should be recorded, whether or not they would have to be entered in the OSHA log, and each entry should detail the complaint along with the date, time, department, location, and employee sex, age, and job title. Employees should be encouraged to report any symptoms so that this record is accurate. With this record, the nurse or safety engineer should be able to determine if a certain area is experiencing more complaints and might be able to identify the source of the problem. It would also provide the company with some baseline data about the symptom prevalence in this worker population, and help the safety engineer target plant locations to conduct industrial hygiene sampling.

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1. Regulatory Compliance and Safety Engineer
2. Amalgamated Clothing and Textile Worker's, Local 1933 President
3. Safety Committee member

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table 1. Symptoms experienced by employees surveyed in the rubber plant on May 2, 1995. (n=118) (percent followed by actual number in parentheses)

Symptom	Frequency of experience in last 4 weeks				For only those who experienced symptom at least one day in last 4 weeks			Whether or not experienced symptom on day of survey	
	% Did not experience symptom in last 4 weeks	% Experienced 1-3 days in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Got worse	% Stayed same	% Got better	% Yes	% No
dry, itching, or irritated eyes	36.3(41)	15.0(17)	22.1(25)	26.5(30)	0	36.4(20)	63.6(35)	63.8(44)	36.2(25)
dizziness or lightheadedness	54.8(63)	15.7(18)	15.7(18)	13.9(16)	0	14.7(5)	85.3(29)	51.1(24)	48.9(23)
headache	32.2(38)	18.6(22)	28.8(34)	20.3(24)	1.7(1)	31.0(18)	67.2(39)	56.2(41)	43.8(32)
unusual tiredness or fatigue	35.0(41)	16.2(19)	19.7(23)	29.1(34)	3.8(2)	38.5(20)	57.7(30)	62.7(42)	37.3(25)
nausea	58.2(64)	13.6(15)	16.4(18)	11.8(13)	3.2(1)	25.8(8)	71.0(22)	52.5(21)	47.5(19)
sore or dry throat	40.4(46)	21.9(25)	19.3(22)	18.4(21)	0	23.8(10)	76.2(32)	61.9(39)	38.1(24)
stuffy or runny nose	31.3(36)	20.9(24)	22.6(26)	25.2(29)	0	55.8(29)	44.2(23)	62.9(44)	37.1(26)
cough	50.4(57)	17.7(20)	16.8(19)	15.0(17)	2.9(1)	41.2(14)	55.9(19)	57.1(28)	42.9(21)
sinus congestion	34.2(39)	17.5(20)	18.4(21)	29.8(34)	3.7(2)	57.4(31)	38.9(21)	65.7(46)	34.3(24)
wheezing	70.9(78)	11.8(13)	9.1(10)	8.2(9)	5.6(1)	22.2(4)	72.2(13)	33.3(10)	66.7(20)
chest tightness	61.1(69)	14.2(16)	10.6(12)	14.2(16)	3.7(1)	29.6(8)	66.7(18)	43.9(18)	56.1(23)
shortness of breath	56.5(65)	16.5(19)	13.0(15)	13.9(16)	0	44.8(13)	55.2(16)	55.6(25)	44.4(20)
dry, itchy, or irritated skin	40.0(46)	15.7(18)	16.5(19)	27.8(32)	4.3(2)	41.3(19)	54.3(25)	71.2(42)	28.8(17)

Table 2. Symptoms experienced by employees surveyed from the coating area in the finishing plant on May 2, 1995. (n=18) (percent followed by actual number in parentheses)

Symptom	Frequency of experience in last 4 weeks				For only those who experienced symptom at least one day in last 4 weeks		
	% Did not experience symptom in last 4 weeks	% Experienced 1-3 days in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Got worse	% Stayed same	% Got better
dry, itching, or irritated eyes	35.3(6)	23.5(4)	23.5(4)	17.6(3)	0	0	100.0(7)
dizziness or lightheadedness	38.9(7)	22.2(4)	22.2(4)	16.7(3)	28.6(2)	14.3(1)	57.1(4)
headache	22.2(4)	16.7(3)	27.8(5)	33.3(6)	18.2(2)	9.1(1)	72.7(8)
unusual tiredness or fatigue	41.2(7)	17.6(3)	23.5(4)	17.6(3)	0	85.7(6)	14.3(1)
nausea	47.1(8)	35.3(6)	11.8(2)	5.9(1)	0	66.7(2)	33.3(1)
sore or dry throat	33.3(6)	27.8(5)	0	38.9(7)	28.6(2)	0	71.4(5)
stuffy or runny nose	29.4(5)	11.8(2)	29.4(5)	29.4(5)	22.2(2)	11.1(1)	66.7(6)
cough	50.0(9)	22.2(4)	11.1(2)	16.7(3)	0	40.0(2)	60.0(3)
sinus congestion	17.6(3)	23.5(4)	5.9(1)	52.9(9)	20.0(2)	20.0(2)	60.0(6)
wheezing	82.4(14)	17.6(3)	0	0	0	0	
chest tightness	70.6(12)	11.8(2)	17.6(3)	0	0	66.7(2)	33.3(1)
shortness of breath	64.7(11)	29.4(5)	5.9(1)	0	0	100.0(1)	0
dry, itchy, or irritated skin	38.9(7)	16.7(3)	16.7(3)	27.8(5)	28.6(2)	14.3(1)	57.1(4)

Table 3. Percent of males versus females that reported symptoms in the rubber plant on May 2, 1995. (percent followed by actual number in parentheses)

Symptoms	Sex			
	Male (n=59)		Female (n=59)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	24.1(13)	14.8(8)	20.3(12)	37.3(22)
dizziness or lightheadedness	7.1(4)	10.7(6)	23.7(14)	16.9(10)
headache	22.0(13)	11.9(7)	35.6(21)	28.8(17)
unusual tiredness or fatigue	15.5(9)	19.0(11)	23.7(14)	39.0(23)
nausea	11.3(6)	3.8(2)	21.1(12)	19.3(11)
sore or dry throat	12.5(7)	8.9(5)	25.9(15)	27.6(16)
stuffy or runny nose	19.3(11)	15.8(9)	25.9(15)	34.5(20)
cough	12.5(7)	7.1(4)	21.1(12)	22.8(13)
sinus congestion	15.8(9)	21.1(12)	21.1(12)	38.6(22)
wheezing	1.9(1)	5.6(3)	16.1(9)	10.7(6)
chest tightness	3.6(2)	5.5(3)	17.2(10)	22.4(13)
shortness of breath	3.6(2)	7.1(4)	22.0(13)	20.3(12)
dry, itchy, or irritated skin	15.5(9)	13.8(8)	17.5(10)	42.1(24)

Table 4. Percent of smokers versus non-smokers that reported symptoms in the rubber plant on May 2, 1995. (percent followed by actual number in parentheses)

Symptoms	Smoking Status					
	Never Smoked (n=41)		Former Smoker (n=30)		Current Smoker (n=46)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	28.2(11)	30.8(12)	18.5(5)	14.8(4)	19.6(9)	30.4(14)
dizziness or lightheadedness	17.5(7)	17.5(7)	7.1(2)	10.7(3)	19.6(9)	13.0(6)
headache	26.8(11)	22.0(9)	36.7(11)	16.7(5)	26.1(12)	21.7(10)
unusual tiredness or fatigue	27.5(11)	30.0(12)	20.0(6)	30.0(9)	13.0(6)	28.3(13)
nausea	10.5(4)	10.5(4)	14.3(4)	14.3(4)	23.3(10)	11.6(5)
sore or dry throat	25.0(10)	15.0(6)	17.9(5)	14.3(4)	15.6(7)	24.4(11)
stuffy or runny nose	26.8(11)	26.8(11)	26.7(8)	20.0(6)	16.3(7)	27.9(12)
cough	35.9(14)	5.1(2)	6.9(2)	6.9(2)	6.8(3)	29.5(13)
sinus congestion	30.0(12)	30.0(12)	14.3(4)	21.4(6)	11.1(5)	35.6(16)
wheezing	8.1(3)	2.7(1)	7.1(2)	7.1(2)	15.9(7)	13.6(6)
chest tightness	12.5(5)	7.5(3)	10.3(3)	10.3(3)	9.3(4)	23.3(10)
shortness of breath	17.5(7)	7.5(3)	10.3(3)	10.3(3)	11.1(5)	22.2(10)
dry, itchy, or irritated skin	20.5(8)	25.6(10)	16.7(5)	26.7(8)	13.3(6)	31.1(14)

Table 5. Percent that reported symptoms in the rubber plant on May 2, 1995, separated by duration of employment. (percent followed by actual number in parentheses)

Symptoms	Years at this plant			
	Less than or equal to 5 years (n=28)		More than 5 years (n=70)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	34.8(16)	15.2(7)	13.4(9)	34.3(23)
dizziness or lightheadedness	17.0(8)	8.5(4)	14.7(10)	17.6(12)
headache	25.0(12)	14.6(7)	31.4(22)	24.3(17)
unusual tiredness or fatigue	21.3(10)	19.1(9)	18.6(13)	35.7(25)
nausea	17.8(8)	11.1(5)	15.4(10)	12.3(8)
sore or dry throat	12.8(6)	10.6(5)	23.9(16)	23.9(16)
stuffy or runny nose	21.3(10)	21.3(10)	23.5(16)	27.9(19)
cough	17.8(8)	8.9(4)	16.2(11)	19.1(13)
sinus congestion	14.9(7)	31.9(15)	20.9(14)	28.4(19)
wheezing	8.9(4)	2.2(1)	9.2(6)	12.3(8)
chest tightness	10.9(5)	8.7(4)	10.4(7)	17.9(12)
shortness of breath	8.7(4)	8.7(4)	15.9(11)	17.4(12)
dry, itchy, or irritated skin	21.3(10)	21.3(10)	13.2(9)	32.4(22)

Table 6. Percent that reported symptoms in the rubber plant on May 2, 1995, separated by hours worked per week. (percent followed by actual number in parentheses)

Symptoms	Average hours per week			
	40 hours or less (n=30)		over 40 hours (n=88)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	26.7(8)	30.0(9)	20.5(17)	25.3(21)
dizziness or lightheadedness	16.7(5)	16.7(5)	15.3(13)	12.9(11)
headache	20.0(6)	26.7(8)	31.8(28)	18.2(16)
unusual tiredness or fatigue	10.0(3)	30.0(9)	23.0(20)	28.7(25)
nausea	24.1(7)	10.3(3)	13.6(11)	12.3(10)
sore or dry throat	16.7(5)	13.3(4)	20.2(17)	20.2(17)
stuffy or runny nose	23.3(7)	26.7(8)	22.4(19)	24.7(21)
cough	20.7(6)	10.3(3)	15.5(13)	16.7(14)
sinus congestion	20.7(6)	34.5(10)	17.6(15)	28.2(24)
wheezing	11.1(3)	3.7(1)	8.4(7)	9.6(8)
chest tightness	13.3(4)	13.3(4)	9.6(8)	14.5(12)
shortness of breath	20.0(6)	13.3(4)	10.6(9)	14.1(12)
dry, itchy, or irritated skin	16.7(5)	40.0(12)	16.5(14)	23.5(20)

Table 7. Percent that reported symptoms in the rubber plant on May 2, 1995, separated by years at current job. (percent followed by actual number in parentheses)

Symptoms	Years at current job			
	less than or equal to 5 years (n=98)		more than 5 years (n=20)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	25.8(24)	24.7(23)	5.0(1)	35.0(7)
dizziness or lightheadedness	16.8(16)	13.7(13)	10.0(2)	15.0(3)
headache	28.6(28)	17.3(17)	30.0(6)	35.0(7)
unusual tiredness or fatigue	22.7(22)	24.7(24)	5.0(1)	50.0(10)
nausea	16.7(15)	11.1(10)	15.0(3)	15.0(3)
sore or dry throat	19.1(18)	16.0(15)	20.0(4)	30.0(6)
stuffy or runny nose	26.3(25)	24.2(23)	5.0(1)	30.0(6)
cough	16.1(15)	15.1(14)	20.0(4)	15.0(3)
sinus congestion	17.9(17)	28.4(27)	21.1(4)	36.8(7)
wheezing	8.8(8)	6.6(6)	10.5(2)	15.8(3)
chest tightness	11.7(11)	13.8(13)	5.3(1)	15.8(3)
shortness of breath	11.6(11)	13.7(13)	20.0(4)	15.0(3)
dry, itchy, or irritated skin	18.9(18)	27.4(26)	5.0(1)	30.0(6)

Table 8. Percent that reported symptoms in the rubber plant on May 2, 1995, separated by shift. (percent followed by actual number in parentheses)

Symptoms	Shift					
	First (n=34)		Second (n=46)		Third (n=34)	
	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks	% Experienced 1-3 days per week in last 4 weeks	% Experienced every or almost every work day in last 4 weeks
dry, itching, or irritated eyes	21.2(7)	27.3(9)	25.6(11)	23.3(10)	18.2(6)	33.3(11)
dizziness or lightheadedness	18.2(6)	15.2(5)	13.6(6)	9.1(4)	17.6(6)	20.6(7)
headache	35.3(12)	17.6(6)	23.9(11)	26.1(12)	26.5(9)	17.6(6)
unusual tiredness or fatigue	23.5(8)	32.4(11)	8.9(4)	31.1(14)	29.4(10)	26.5(9)
nausea	25.0(8)	12.5(4)	12.2(5)	9.8(4)	12.1(4)	15.2(5)
sore or dry throat	24.2(8)	21.2(7)	18.6(8)	14.0(6)	17.6(6)	23.5(8)
stuffy or runny nose	32.4(11)	20.6(7)	13.6(6)	27.3(12)	21.2(7)	30.3(10)
cough	15.6(5)	15.6(5)	16.3(7)	16.3(7)	20.6(7)	14.7(5)
sinus congestion	28.1(9)	21.9(7)	11.1(5)	33.3(15)	21.2(7)	33.3(11)
wheezing	9.7(3)	12.9(4)	12.2(5)	2.4(1)	5.9(2)	11.8(4)
chest tightness	15.2(5)	18.2(6)	4.8(2)	11.9(5)	11.8(4)	14.7(5)
shortness of breath	21.2(7)	21.2(7)	9.1(4)	9.1(4)	8.8(3)	14.7(5)
dry, itchy, or irritated skin	20.6(7)	26.5(9)	11.1(5)	33.3(15)	21.9(7)	21.9(7)

Table 9. Percent of employees surveyed in the rubber plant on May 2, 1995, who experienced symptoms <u>at least 1 day per week</u> for the 4 weeks previous to the survey, separated by the line on which they work.*

Symptom		Percent that reported symptom per line (number that reported symptom)										
	(n)	(11)	(8)	(10)	(15)	(13)	(16)	(16)	(21)	(18)	(21)	(15)
	Line	1	2	3	4	5	6	7	8	9	11	12
dry, itching, or irritated eyes		30.0(3)	25.0(2)	40.0(4)	53.9(7)	50.0(6)	53.9(7)	64.2(9)	50.0(10)	50.0(9)	42.8(9)	40.0(6)
dizziness or lightheadedness		20.0(2)	12.5(1)	30.0(3)	23.1(3)	25.0(3)	35.7(5)	60.0(9)	47.6(10)	27.8(5)	28.6(6)	33.4(5)
headache		63.7(7)	37.5(3)	50.0(5)	53.4(8)	46.2(6)	50.0(8)	62.6(10)	66.7(14)	61.1(11)	38.0(8)	46.6(7)
unusual tiredness or fatigue		63.7(7)	50.0(4)	50.0(5)	57.1(8)	50.0(6)	40.0(6)	66.6(10)	52.4(11)	61.1(11)	42.8(9)	53.4(8)
nausea		30.0(3)	25.0(2)	44.4(4)	38.5(5)	36.4(4)	71.4(10)	46.2(6)	66.7(14)	22.3(4)	19.1(4)	26.7(4)
sore or dry throat		30.0(3)	37.5(3)	60.0(6)	38.5(5)	58.4(7)	50.0(7)	73.4(11)	55.0(11)	38.9(7)	38.1(8)	46.7(7)
stuffy or runny nose		54.6(6)	50.0(4)	55.5(5)	46.6(7)	46.2(6)	37.6(6)	75.0(12)	57.2(12)	50.0(9)	35.0(7)	28.6(4)
cough		20.0(2)	12.5(1)	30.0(3)	28.6(4)	41.7(5)	42.8(6)	46.6(7)	45.0(9)	23.6(4)	26.3(5)	28.5(4)
sinus congestion		40.0(4)	37.5(3)	55.5(5)	57.1(8)	66.7(8)	40.0(6)	73.4(11)	52.4(11)	61.1(11)	42.8(9)	46.7(7)
wheezing		40.0(4)	12.5(1)	33.3(3)	14.2(2)	20.0(2)	26.7(4)	33.4(4)	28.6(6)	16.7(3)	23.8(5)	20.0(3)
chest tightness		33.3(3)	0	22.2(2)	23.1(3)	18.2(2)	21.4(3)	46.2(6)	30.0(6)	17.7(3)	21.0(4)	23.1(3)
shortness of breath		50.0(5)	0	30.0(3)	28.5(4)	16.6(2)	20.0(3)	35.7(5)	31.3(7)	16.7(3)	20.0(4)	26.6(4)
dry, itchy, or irritated skin		45.5(5)	50.0(4)	44.4(4)	69.3(9)	41.6(5)	40.0(6)	60.0(9)	47.6(10)	55.5(10)	57.2(12)	53.3(8)
average		40.1	27.0	42.0	40.9	40.0	40.7	57.2	48.5	38.7	33.5	36.4
mucous membrane irritation†		30.0	31.3	50.0	46.2	54.2	52.0	68.8	52.5	44.5	40.5	43.4
respiratory irritation‡		35.8	6.3	28.9	23.6	24.1	27.8	40.5	33.7	18.7	22.8	24.6

* Many employees work on more than one line routinely and are counted for each line on which they reported working.
† Mucous membrane irritation includes symptoms of dry, itching, or irritated eyes and sore or dry throat.
‡ Respiratory irritation includes symptoms of cough, wheezing, chest tightness, and shortness of breath

Table 10. Percent of employees surveyed in the rubber plant on May 2, 1995, who experienced symptoms <u>every or almost every day</u> for the 4 weeks previous to the survey, separated by the line on which they work.*

Symptom	Percent that reported symptom per line (number that reported symptom)										
(n)	(11)	(8)	(10)	(15)	(13)	(16)	(16)	(21)	(18)	(21)	(15)
Line	1	2	3	4	5	6	7	8	9	11	12
dry, itching, or irritated eyes	10.0(1)	25.0(2)	30.0(3)	38.5(5)	41.7(5)	23.1(3)	57.1(8)	25.0(5)	16.7(3)	19.0(4)	33.3(5)
dizziness or lightheadedness	10.0(1)	0	20.0(2)	7.7(1)	16.7(2)	7.1(10	33.3(5)	14.3(3)	11.1(2)	4.8(1)	6.7(1)
headache	27.3(3)	25.0(2)	40.0(4)	26.7(4)	30.8(4)	37.5(60	31.3(5)	42.9(9)	22.2(4)	19.0(4)	33.3(5)
unusual tiredness or fatigue	36.4(4)	25.0(2)	40.0(4)	35.7(5)	41.7(5)	26.7(4)	53.3(8)	38.1(8)	38.9(7)	33.3(7)	46.7(7)
nausea	10.0(1)	12.5(1)	22.2(2)	15.4(2)	18.2(2)	21.4(3)	23.1(3)	28.6(6)	5.6(1)	4.8(1)	6.7(1)
sore or dry throat	20.0(2)	25.0(2)	50.0(5)	30.8(4)	41.7(5)	21.4(3)	46.7(7)	30.0(6)	11.1(2)	14.3(3)	26.7(4)
stuffy or runny nose	27.3(3)	25.0(2)	44.4(4)	33.3(5)	38.5(5)	31.3(5)	50.0(8)	42.9(9)	33.3(6)	20.0(4)	28.6(4)
cough	10.0(1)	12.5(1)	30.0(3)	14.3(2)	25.0(3)	21.4(3)	33.3(5)	20.0(4)	11.8(2)	15.8(3)	21.4(3)
sinus congestion	20.0(2)	25.0(2)	44.4(4)	50.0(7)	50.0(6)	33.3(5)	46.7(7)	42.9(9)	44.4(8)	23.8(5)	26.7(4)
wheezing	20.0(2)	0	11.1(1)	7.1(1)	10.0(1)	6.7(1)	16.7(2)	4.8(1)	5.6(1)	9.5(2)	6.7(1)
chest tightness	22.2(2)	0	22.2(2)	7.7(1)	9.1(1)	7.1(1)	38.5(5)	15.0(3)	5.9(1)	10.5(2)	7.7(1)
shortness of breath	20.0(2)	0	20.0(2)	7.1(1)	8.3(1)	6.7(1)	28.6(4)	19.0(4)	5.6(1)	9.5(2)	13.3(2)
dry, itchy, or irritated skin	27.3(3)	37.5(3)	33.3(3)	46.2(6)	33.3(4)	26.7(4)	40.0(6)	38.1(8)	33.3(6)	28.6(6)	40.0(6)
average	19.4	16.3	31.1	24.7	28.1	20.8	38.4	27.9	18.9	16.4	23.0
mucous membrane irritation†	10.0	25.0	40.0	34.7	41.7	22.3	51.9	27.5	13.9	16.7	30.0
respiratory irritation‡	18.1	3.1	20.8	9.1	13.1	10.5	29.3	14.7	7.2	11.3	12.3

* Many employees work on more than one line routinely and are counted for each line on which they reported working.
† Mucous membrane irritation includes symptoms of dry, itching, or irritated eyes and sore or dry throat.
‡ Respiratory irritation includes symptoms of cough, wheezing, chest tightness, and shortness of breath

Appendix A

Hydrocarbon Sampling Results

DEPARTMENT OF HEALTH & HUMAN SERVICES

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Memorandum

MAY 23 1995

INDUSTRIAL HYG. SECTION

Date May 19, 1995

From Chemist, MDS, MRSB

Subject Sequence 8252A; HETA 95-0192: Qualitative Analysis of Thermal Desorption Tubes for Volatile Organic Compounds.

To D. Tharr, HETAB Lab Coordinator
Attn: B. Reh
Through: Acting Director, DPSE_____
Chief, MRSB, DPSE______

INTRODUCTION:

Sixteen thermal desorption tubes collected at Schlegel Tennessee, Inc. were submitted for qualitative analysis of volatile organic compounds by GC-MS.

EXPERIMENTAL:

Since the types of contaminants were expected to be widely varied, thermal desorption tubes were used for sampling. Stainless steel tubes configured for the Perkin-Elmer ATD 400 thermal desorption system were used. Each thermal desorption tube contained three beds of sorbent materials--a front layer of Carbopack Y (~90 mg), a middle layer of Carbopack B (~115 mg), and a back section of Carboxen 1003 (~150 mg). Prior to field use, each tube was cleaned by conditioning at 375°C for 2 hours.

Samples were analyzed using the ATD 400 automatic thermal desorption system containing an internal focusing trap packed with Carbopack B/Carboxen 1000 sorbents. The thermal unit was interfaced directly to a HP5890A gas chromatograph and HP5970 mass selective detector (TD-GC-MSD). The mass spectrometer was operated under EI conditions in full scan mode (20-300 amu). A thirty meter DB-1 fused silica capillary column was used for analyses. Sorbent tubes were desorbed in the ATD at 300°C for 10 minutes prior to analyses.

RESULTS:

Copies of the reconstructed total ion chromatograms from the TD-GC-MSD analyses of samples are enclosed. Chromatograms are all scaled the same for comparison (same time and abundance axes) and spread out into two sections to improve the visual separation among peaks. A separate table is enclosed listing each peak number with its corresponding identification. Samples A04163, A03941, and A04801 contained very high concentrations and may have exceeded the capacities of the ATD-GC-MS system. Some carryover into the next sample analysis may have occurred for these. Carbon disulfide was the major peak on all samples. Other major compounds detected included numerous nitrogen and nitrogen-sulfur containing compounds. These included various alkyl amines (methyl-, dimethyl-, trimethyl-, diethyl-), ureas, amides, isothiocyanates, thioureas, and carbamodithioic acid esters. Hydrogen sulfide and carbonyl sulfide were also detected. An aromatic solvent was detected on several samples. This solvent contained mostly $C_{10}H_{14}$ alkyl benzenes (tetramethyl-, dimethylethyl-, diethyl-, methylpropyl-, etc.) plus some C_9, C_{11}, and C_{12} alkyl benzenes (trimethyl-, pentamethyl-, hexamethyl-, etc.) and naphthalene. Butyl cellosolve, propylene glycol monomethyl ether acetate, propylene glycol methyl ether, and 1-methyl-2-pyrrolidinone were identified on a few samples.

Ardith A. Grote

John L. Holtz
Chief, MDS, MRSB, DPSE

Attachments

DPSE:MRSB:MDS:AAGROTE:rfs:wptxt:AG8252A:5/19/95

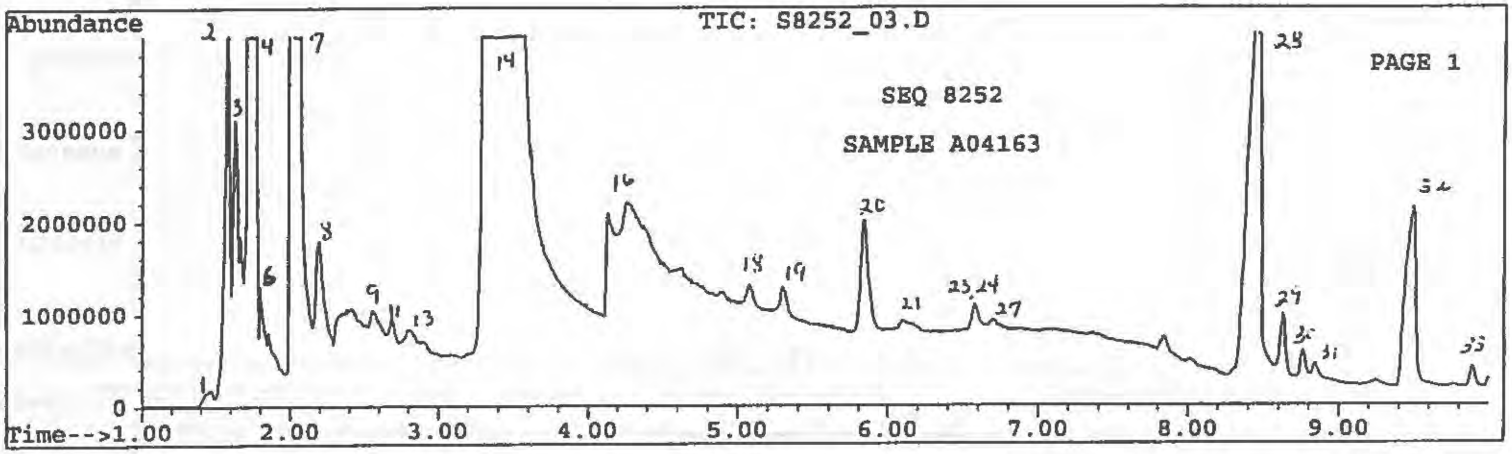
SEQ 8252
THERMAL DESORPTION TUBES
PEAK IDENTIFICATION

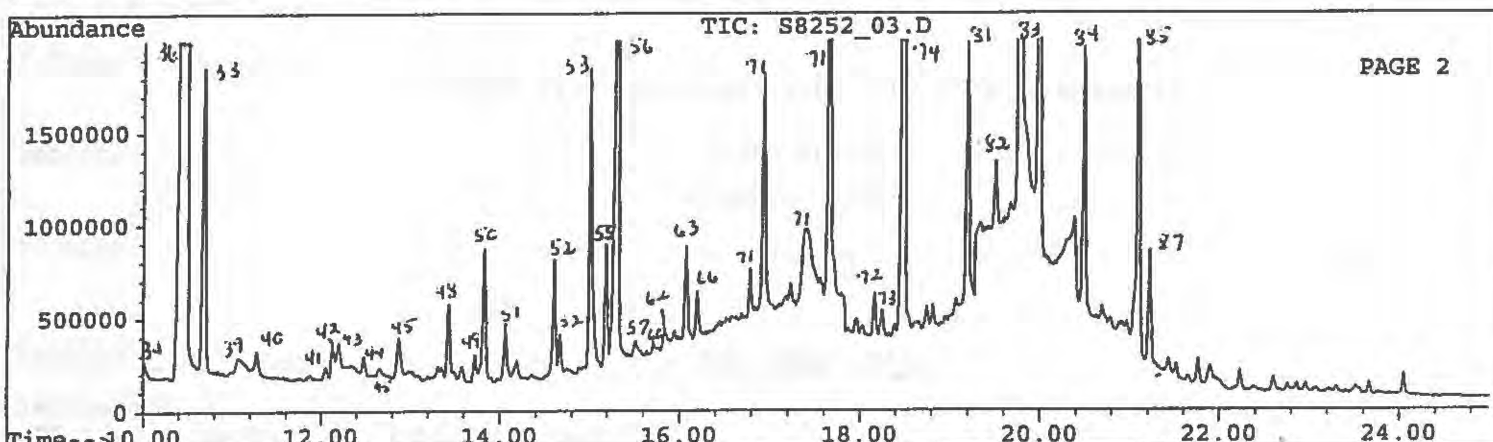
1) Air*
2) CO_2*
3) Hydrogen sulfide (H_2S)
4) Carbonyl sulfide (COS)**
4A) Propane
5) Acetaldehyde
5A) Methanol/isobutane
6) Methyl amine
6A) Butane
7) Dimethylamine
8) Trimethylamine
9) Acetone
10) Isopentane
11) Isopropanol
12) Pentane
13) Ethanethiol
14) Carbon disulfide (CS_2)
15) Methyl ethyl ketone (MEK)
16) Diethylamine
17) Ethyl acetate
18) Hexane
19) Diethylmethylamine
20) 1,2-Dichloroethylene
21) 1,1,1-Trichloroethane
22) 1-Methoxy-2-propanol (propylene glycol methyl ether)
22A) Triethylamine
23) Butanol
24) Benzene
25) C_7 alkanes
26) Propylene glycol
27) Thiophene
28) Methyl isothiocyanate
29) (Dimethylamino)acetonitrile
30) Pyridine
31) Dimethylcyanamide?
32) N,N-Dimethylformamdide
33) Toluene
34) 1-Methylpiperidine
35) Hexamethylcyclotrisiloxane
36) Ethyl isothiocyanate
37) 2-Butanone oxime
38) 2-Methyl thiazole?
39) Methyl pyridine
40) Dimethylaminopropanol?
41) 4-Vinylcyclohexene
42) N,N-Dimethylacetamide?
43) 2-Furanmethanol
44) Propylene glycol monomethyl ether acetate
45) Xylene/ethyl benzene isomers
46) Styrene
47) Butyl cellosolve
48) $C_6H_{12}N_2$, trimethyldihydropyrazole?
49) Cyclooctadiene
50) N,N-Diethylformamide
51) C_9H_{12} isomer, ethylidene norbornene?
52) C_9H_{14}, nonen-yne isomers?
53) Tetramethylurea
54) Methyl dibutyl amine
55) Butyl isothiocyanate
56) C_3H_7NS, N,N-dimethylmethanethioamide?
57) C_9H_{12} alkyl benzenes (trimethyl-, dimethylethyl-, propyl-, etc.)
58) Octamethylcyclotetrasiloxane
59) 1-Methyl-2-pyrrolidinone
60) n-Decane
61) Methyl styrene/indan isomer
62) Benzenamine
63) Trimethylurea
64) $C_{10}H_{14}$ alkyl benzenes (tetramethyl-, diethyl-, dimethylethyl-, etc.)
65) Dimethylstyrene/methyl indan isomers
66) Limonene
67) C_{11} aliphatics
68) $C_6H_{11}NO$, methyl piperidinone?
69) n-Undecane
70) Decamethylcyclopentasiloxane
71) Nitrogen containing compounds (amines, amides, ureas, etc.)
72) $C_8H_{13}NS$, alkyl thiazole?
73) Triethylurea
74) Tetramethylthiourea
75) $C_{11}H_{16}$ alkyl benzenes (pentamethyl-, etc.)
76) Naphthalene
77) n-Dodecane
78) $C_{12}H_{18}$ alkyl benzenes
79) Benzothiazole
80) Methyl naphthalenes
81) Dimethyl carbamodithioic acid, methyl ester
82) N,N-Dibutylformamide
83) Nitrogen, sulfur compounds (carbamodithioic acid esters?)
84) Diethyl carbamodithioic acid, methyl ester
85) Diethyl carbamodithioic acid, ethyl ester?
86) Diphenyl ether
87) Nitrogen, sulfur compounds

*Also present on some media/field blanks.
**COS may be formed from CS_2 and heat.

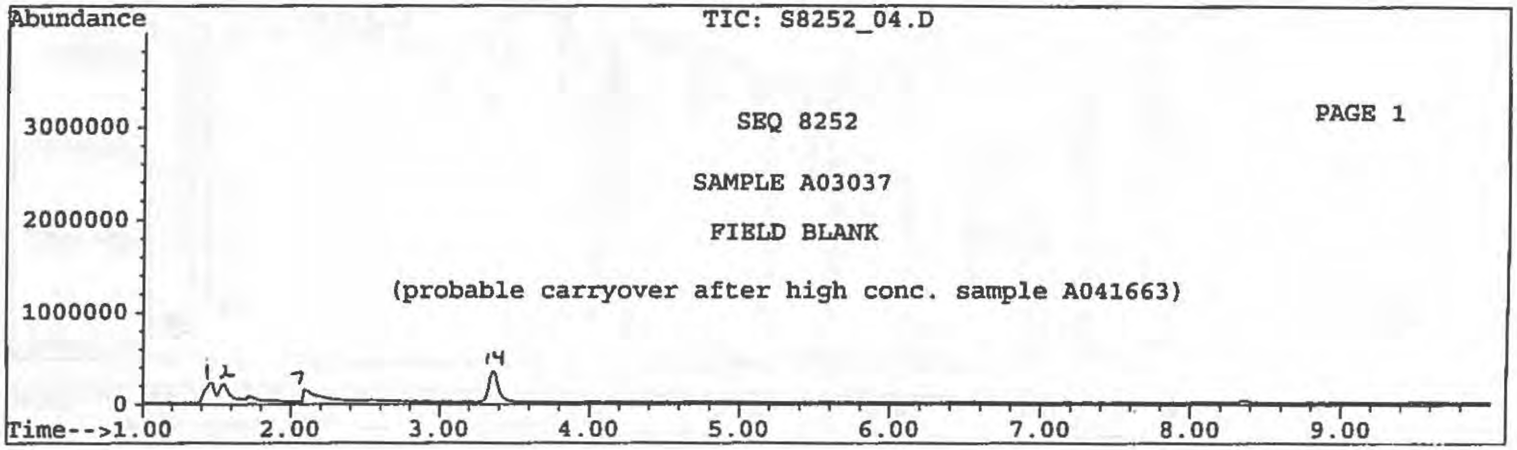
File : C:\HPCHEM\1\DATA\S8252\S8252_03.D
Operator : AAG
Acquired : 4 May 95 2:11 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04163
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 3

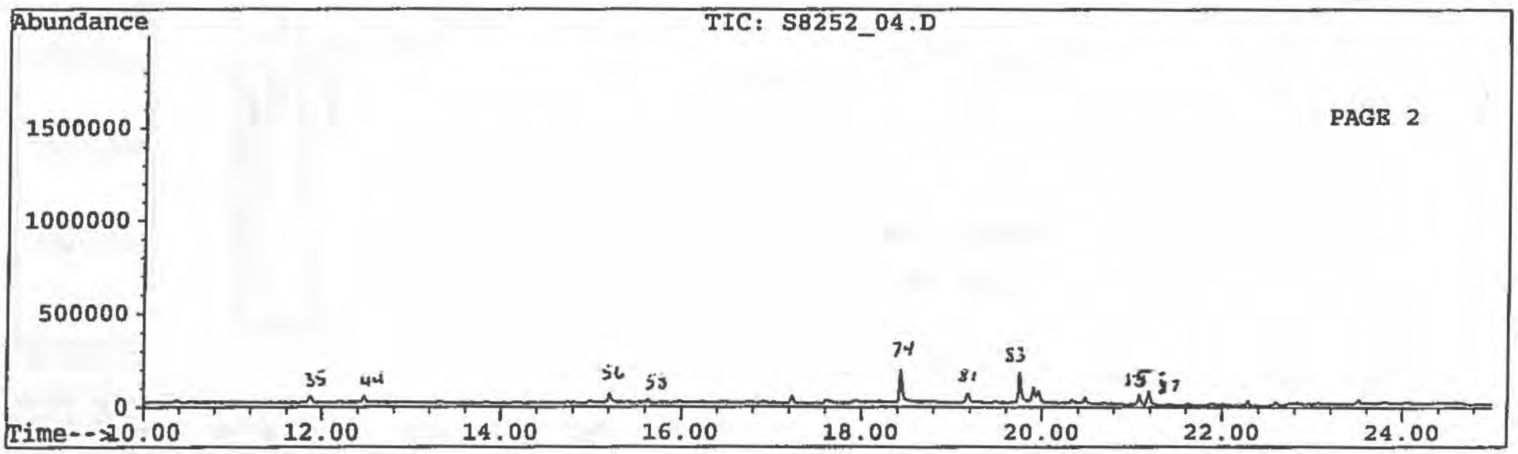
Line 6 - after cut





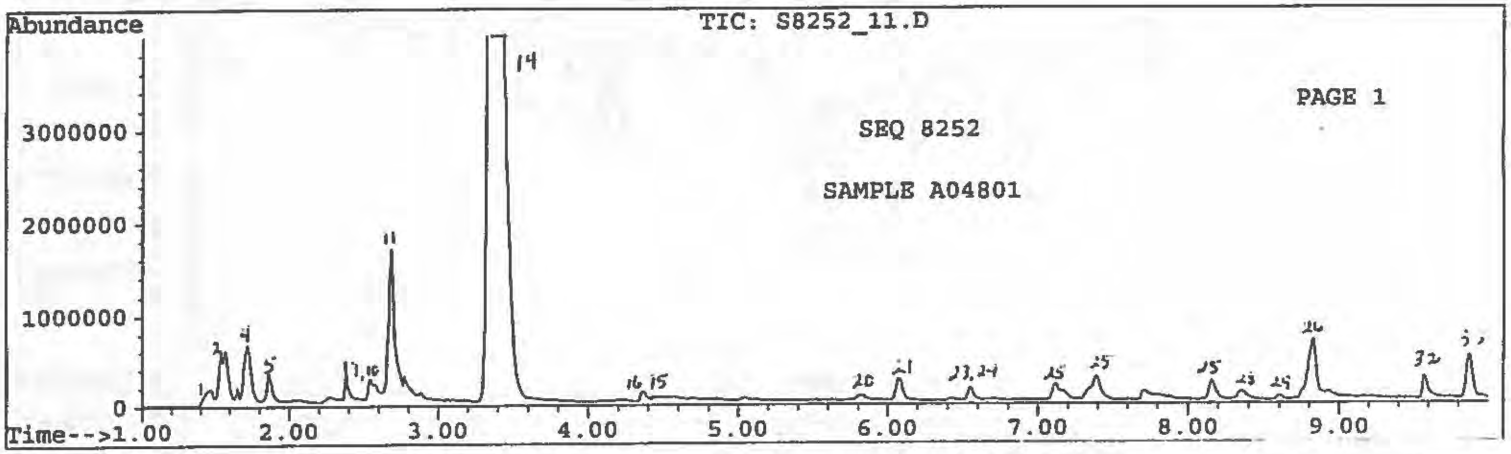
File : C:\HPCHEM\1\DATA\S8252\S8252_04.D
Operator : AAG
Acquired : 4 May 95 3:06 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A03037 FIELD BLANK
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 4

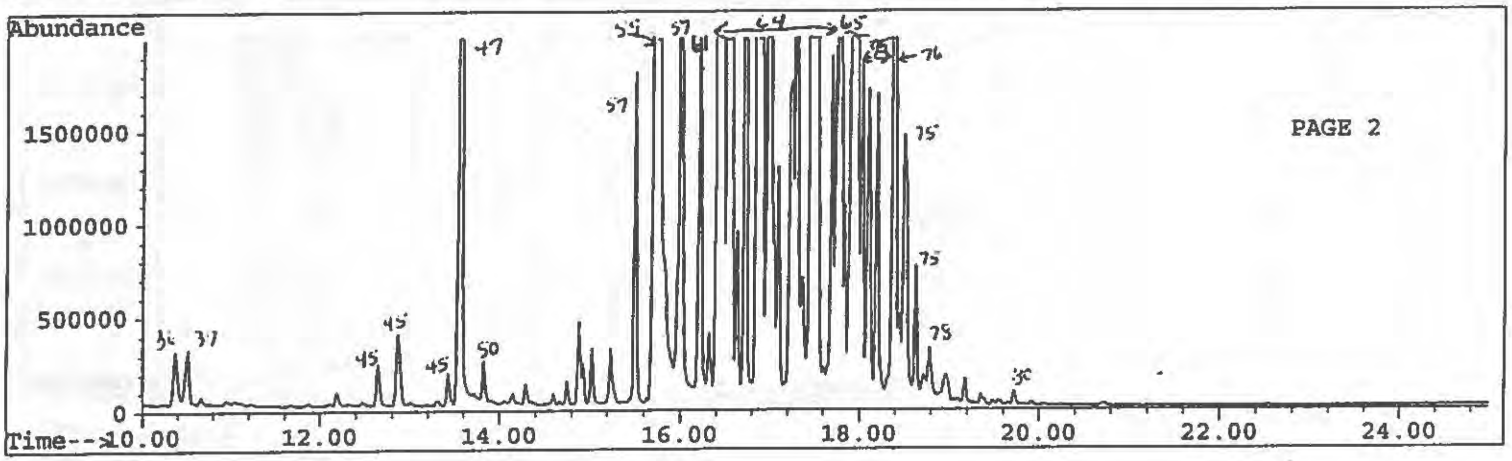




File : C:\HPCHEM\1\DATA\S8252\S8252_11.D
Operator : AAG
Acquired : 4 May 95 8:56 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04801
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 11

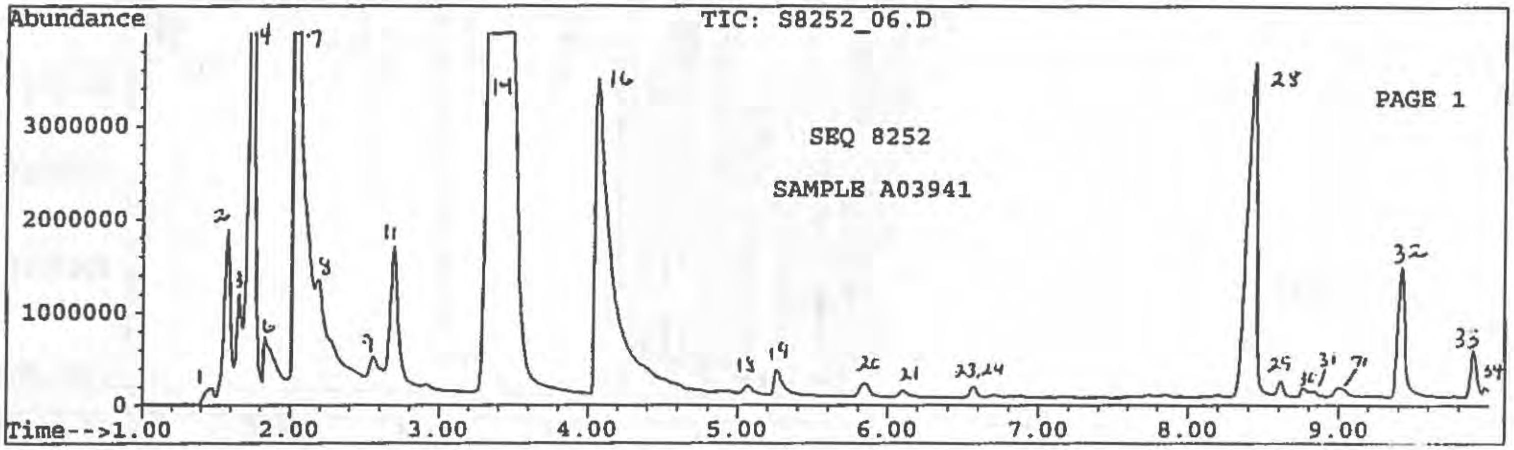
Line 7- before cut

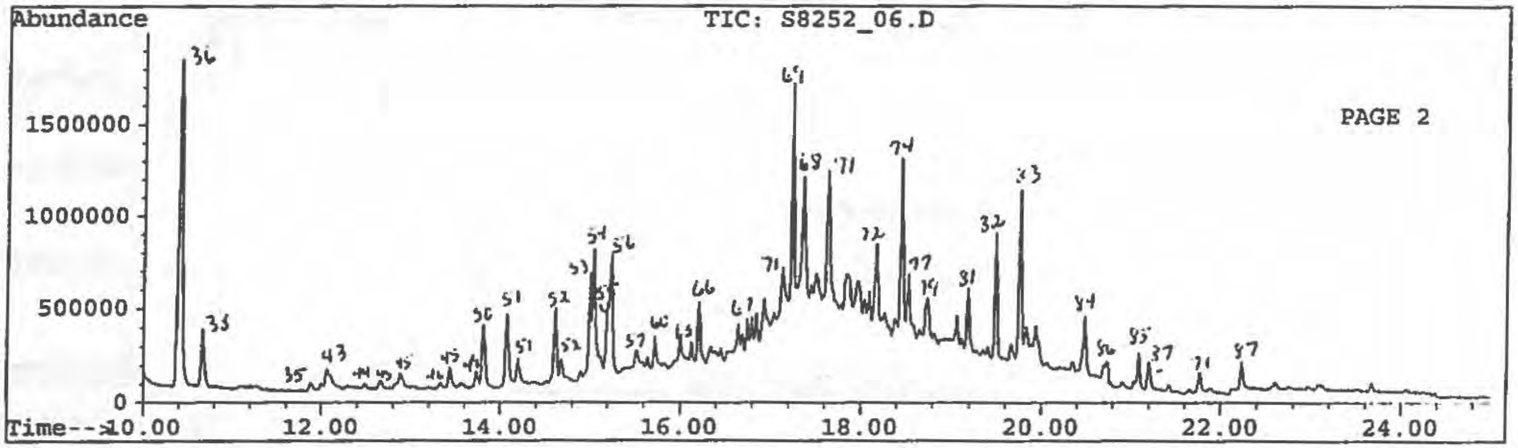




File : C:\HPCHEM\1\DATA\S8252\S8252_06.D
Operator : AAG
Acquired : 4 May 95 4:45 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A03941
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 6

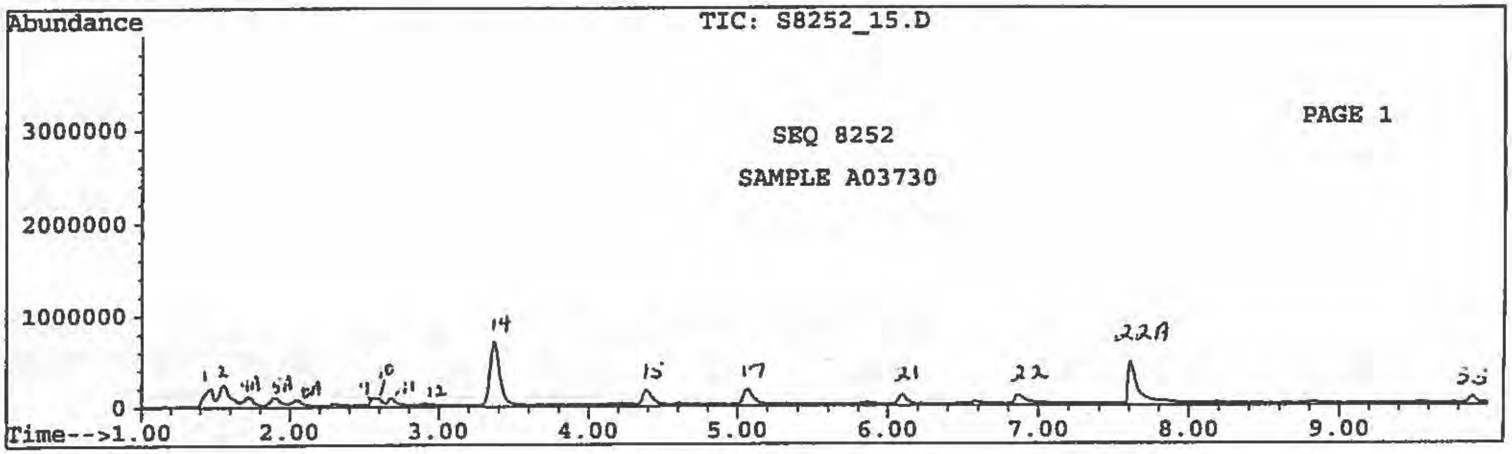
Line 1 - afterdrill

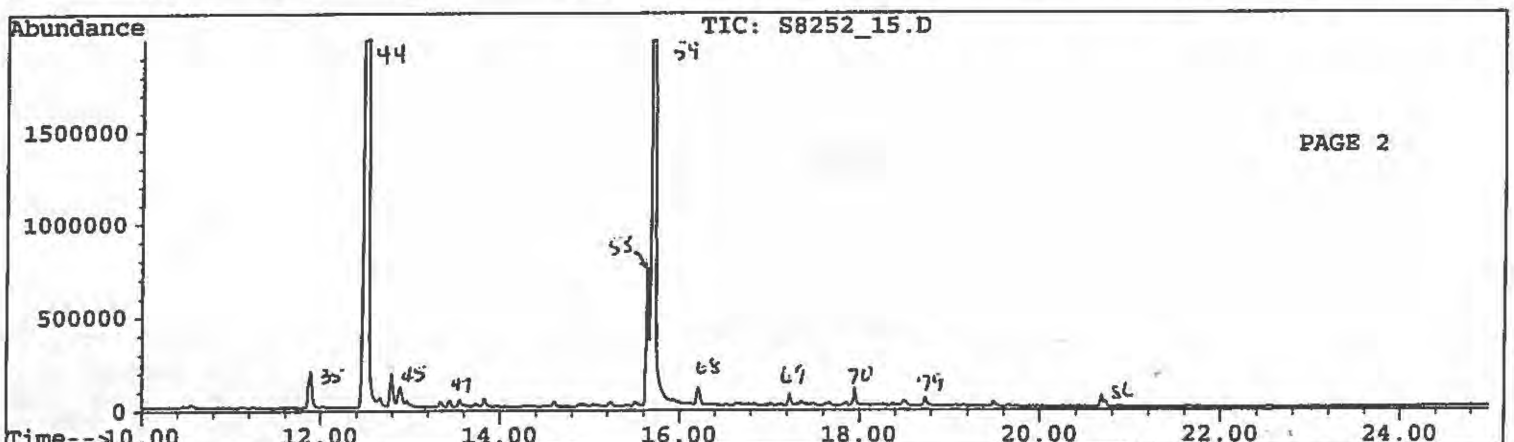




File : C:\HPCHEM\1\DATA\S8252\S8252_15.D
Operator : AAG
Acquired : 5 May 95 12:20 am using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A03730
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 15

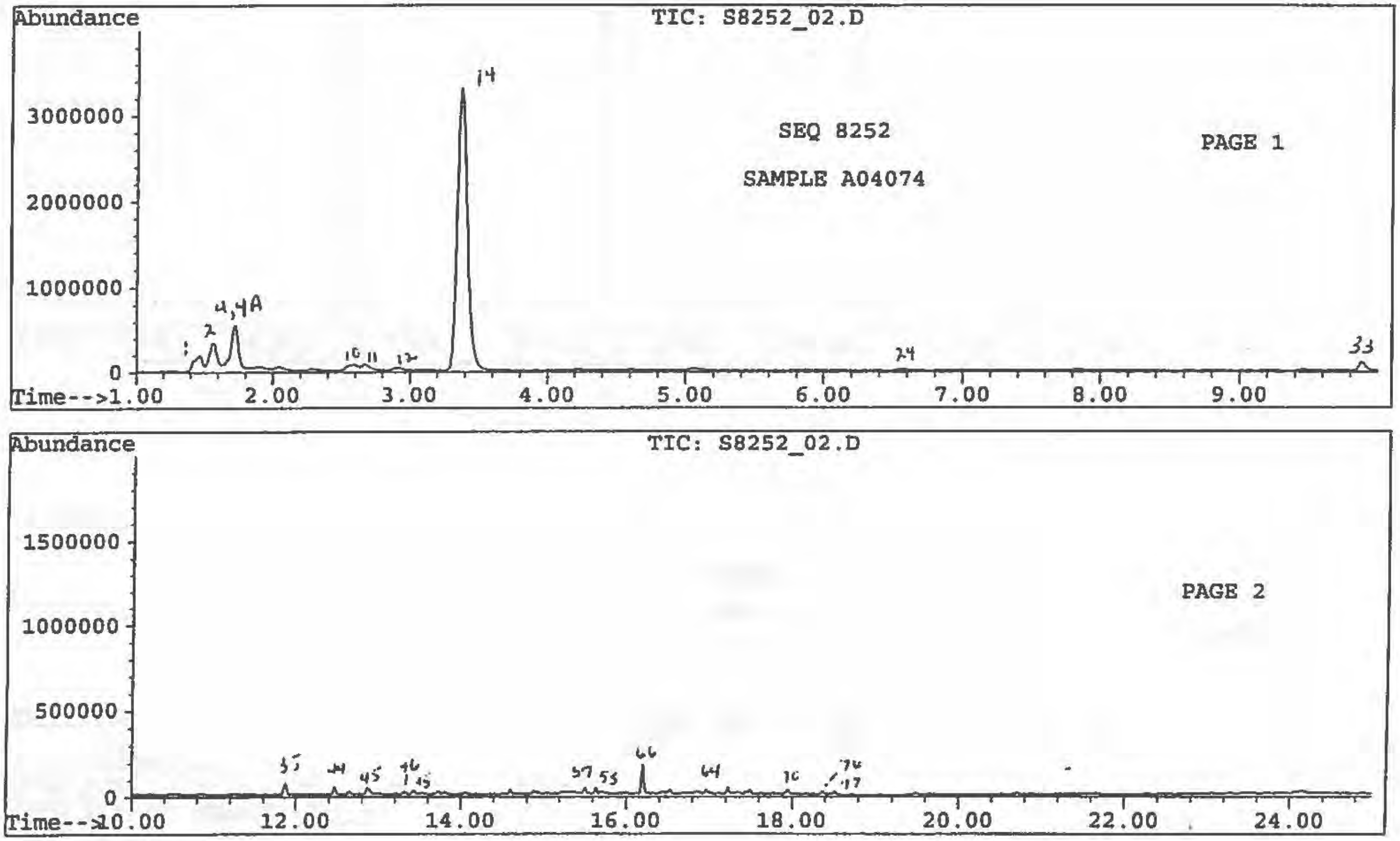
Finishing Plant
coating area # 1





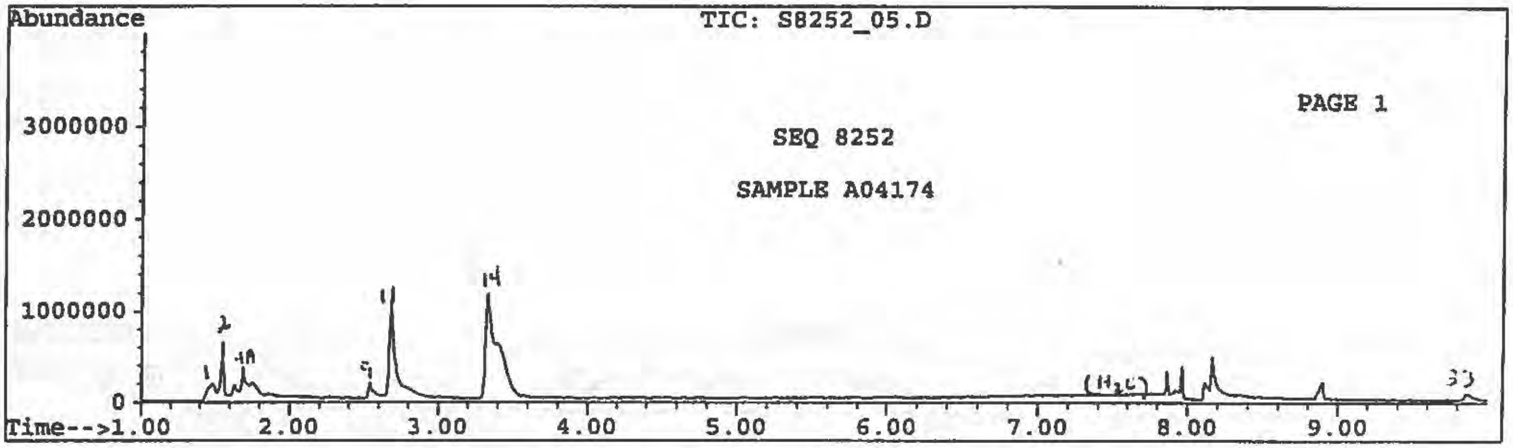
File : C:\HPCHEM\1\DATA\S8252\S8252_02.D
Operator : AAG
Acquired : 4 May 95 1:21 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04074
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 2

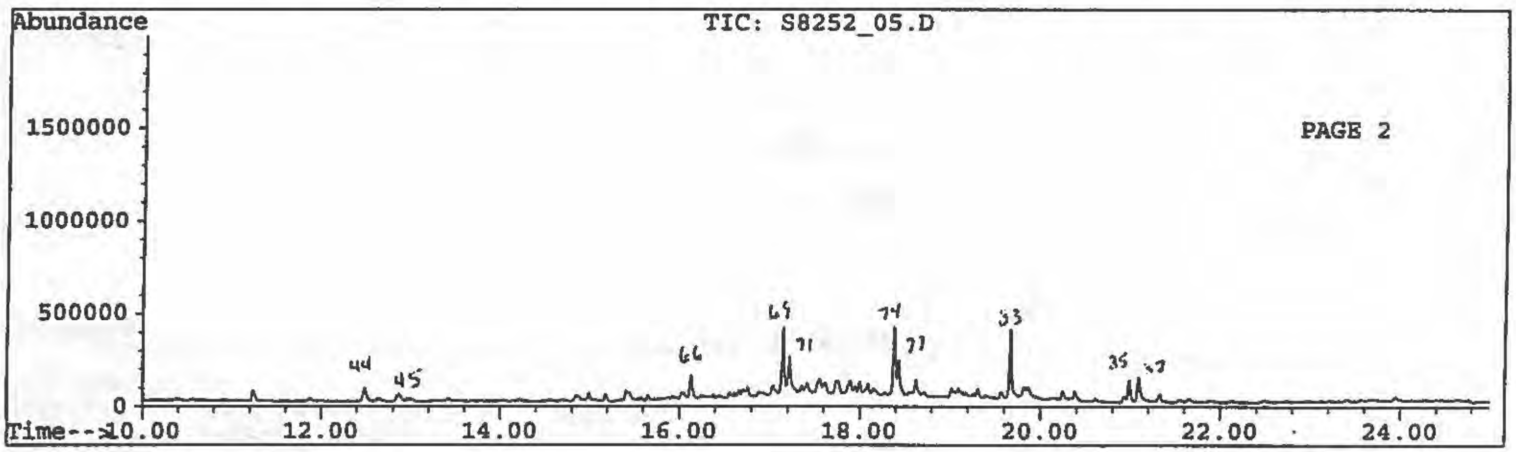
Line 5 - at end, near tub



File   : C:\HPCHEM\1\DATA\S8252\S8252_05.D
Operator   : AAG
Acquired   : 4 May 95   3:56 pm using AcqMethod ATD
Instrument :   5970 - In
Sample Name: SAMPLE A04174
Misc Info   : 30 M DB-1   SC20-300   TP35-300
Vial Number: 5

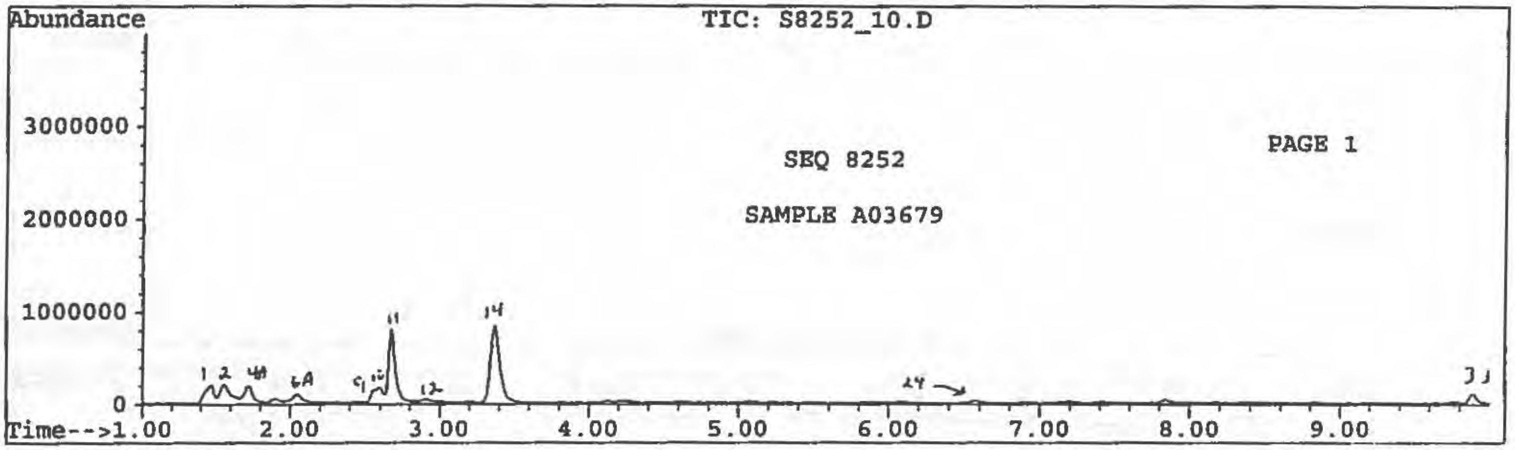
Line 2 after drill

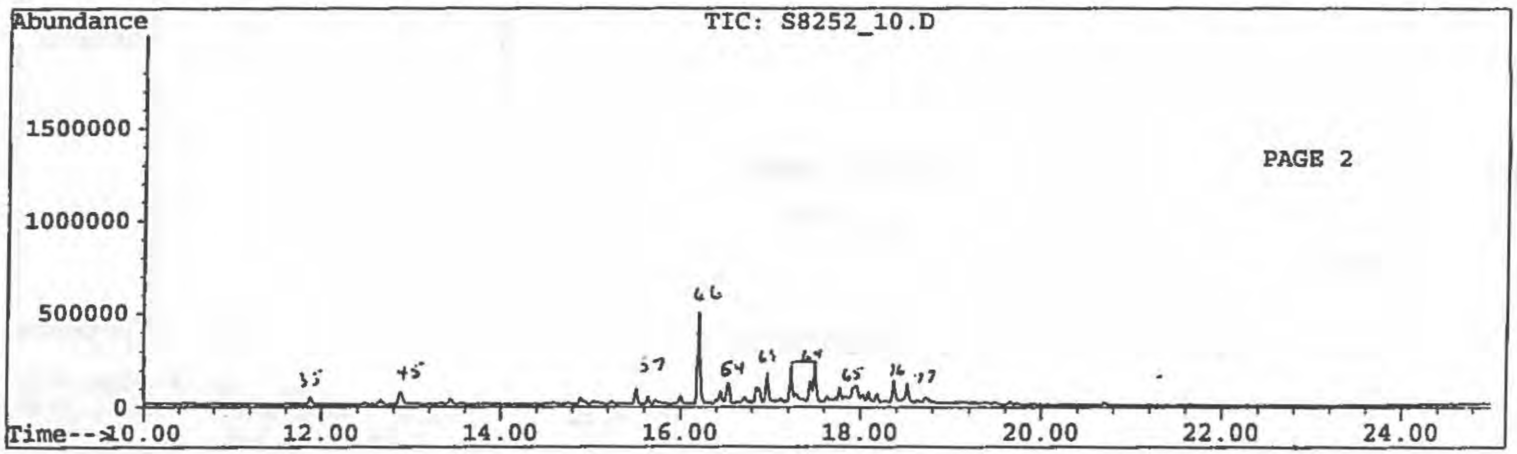




File   : C:\HPCHEM\1\DATA\S8252\S8252_10.D
Operator   : AAG
Acquired   : 4 May 95   8:06 pm using AcqMethod ATD
Instrument :   5970 - In
Sample Name: SAMPLE A03679
Misc Info   : 30 M DB-1   SC20-300   TP35-300
Vial Number: 10

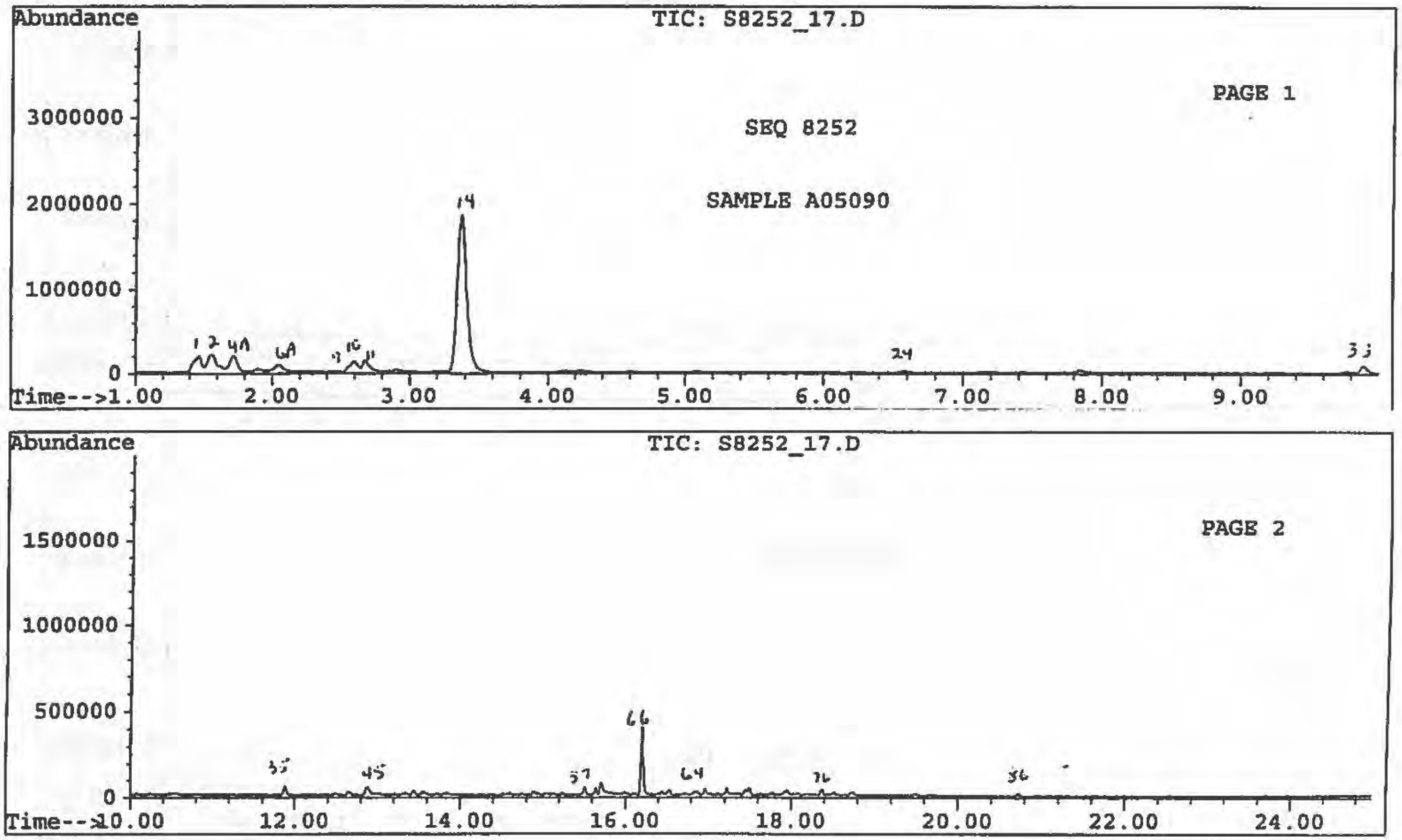
Line 8 coating





File : C:\HPCHEM\1\DATA\S8252\S8252_17.D
Operator : AAG
Acquired : 5 May 95 2:01 am using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A05090
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 17

Line 11 after drill



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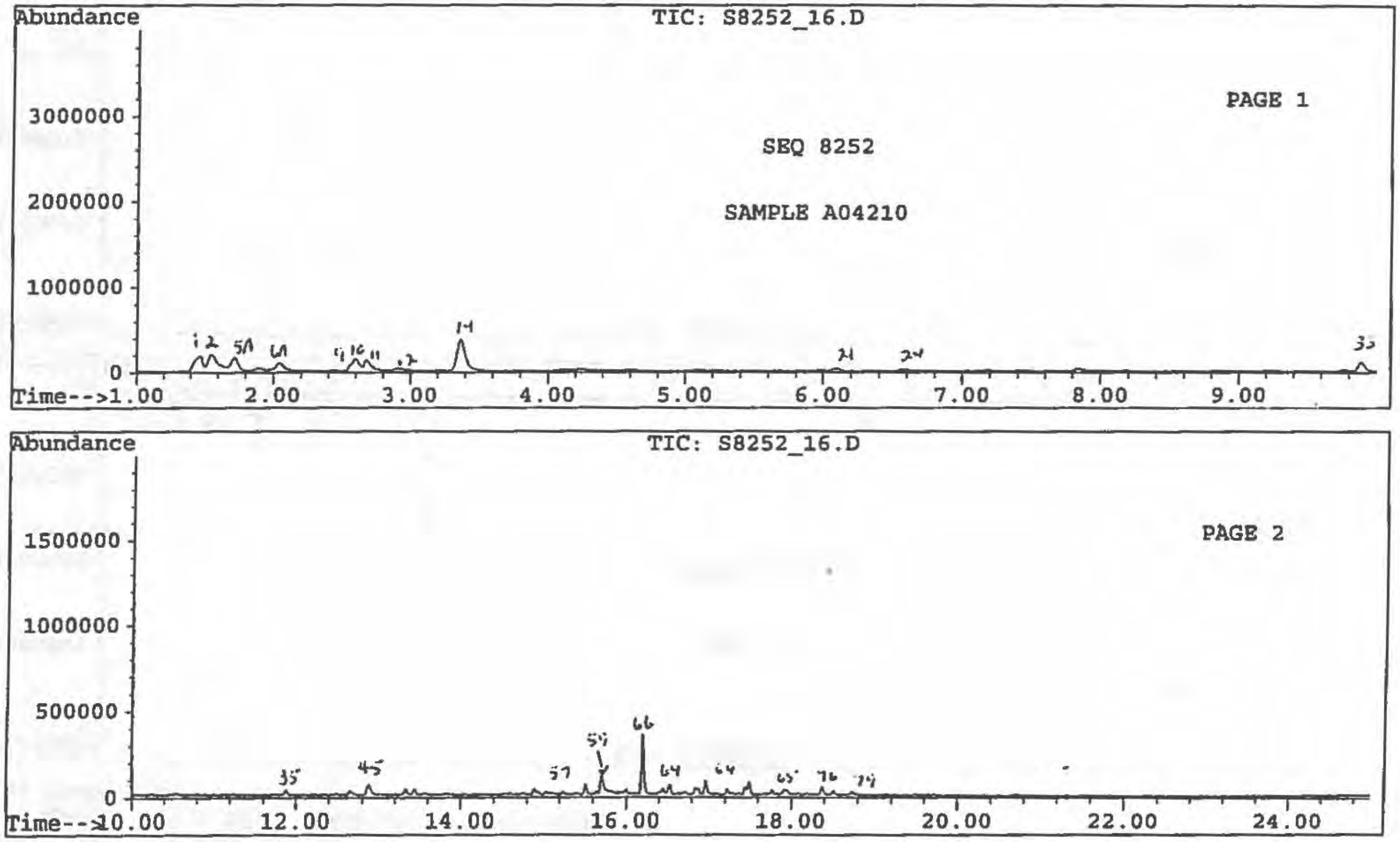
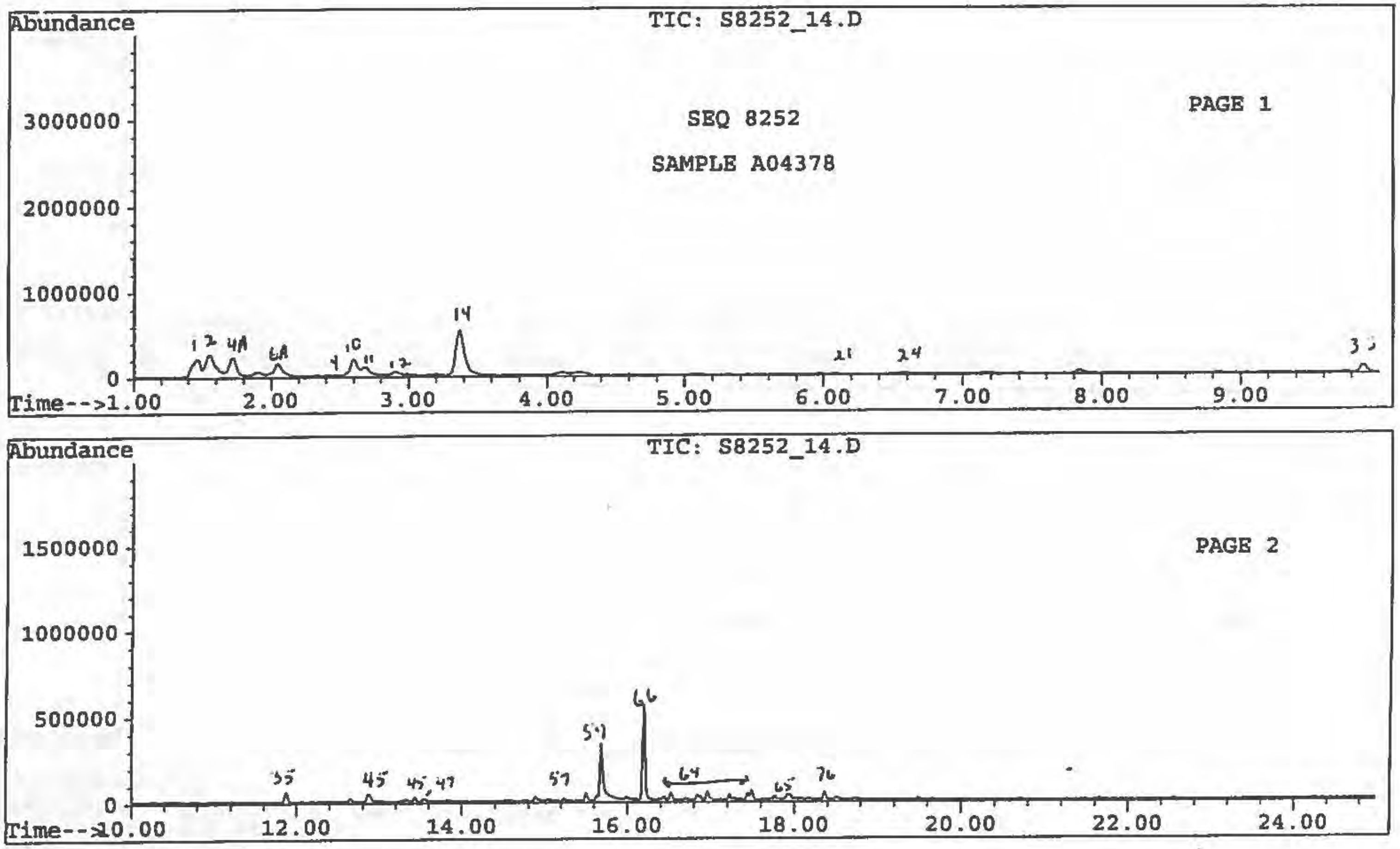
File        : C:\HPCHEM\1\DATA\S8252\S8252_16.D
Operator    : AAG
Acquired    :  5 May 95   1:11 am using AcqMethod ATD
Instrument  :    5970 - In
Sample Name: SAMPLE  A04210
Misc Info   : 30 M DB-1   SC20-300   TP35-300
Vial Number: 16
```

Line 9 before cut



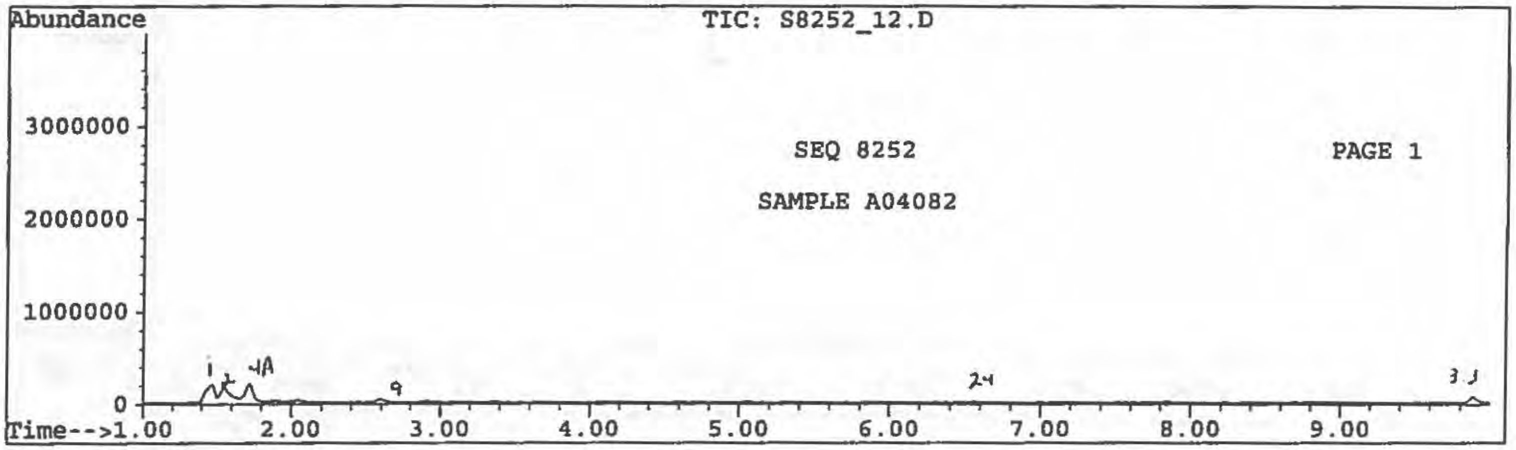
File : C:\HPCHEM\1\DATA\S8252\S8252_14.D
Operator : AAG
Acquired : 4 May 95 11:29 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04378
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 14

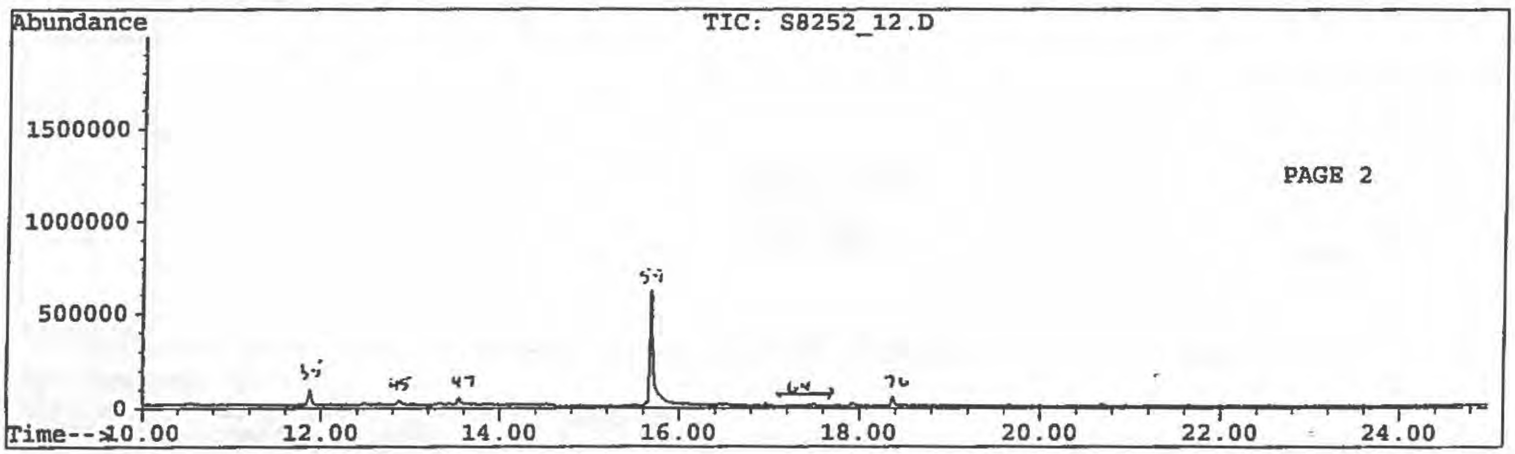
Line 12 after drill



File : C:\HPCHEM\1\DATA\S8252\S8252_12.D
Operator : AAG
Acquired : 4 May 95 9:47 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04082
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 12

outside plant





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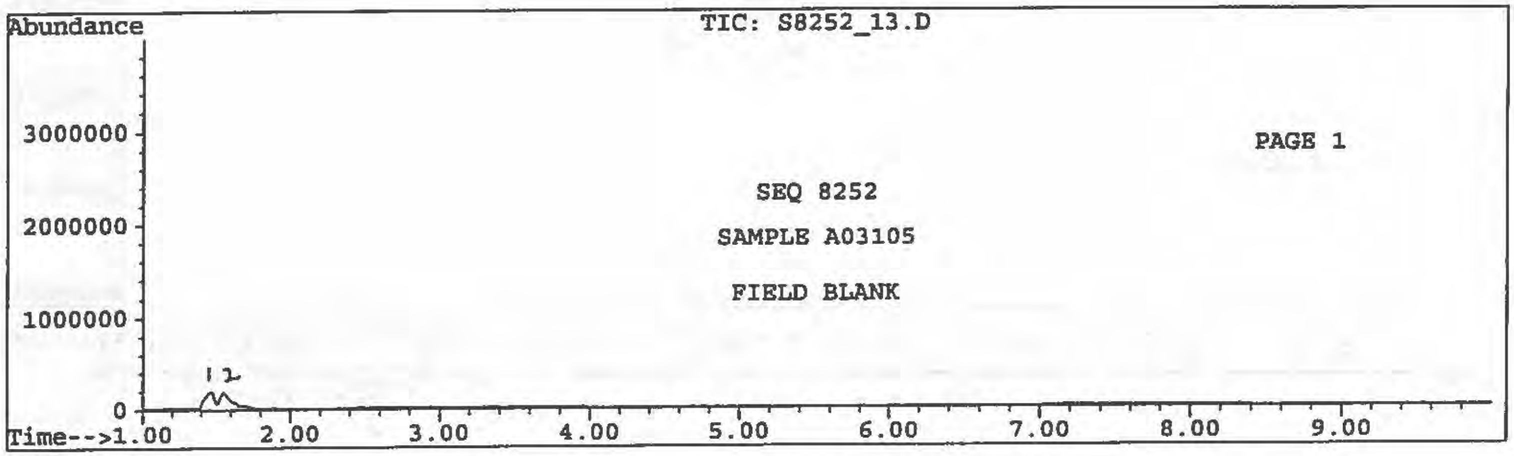
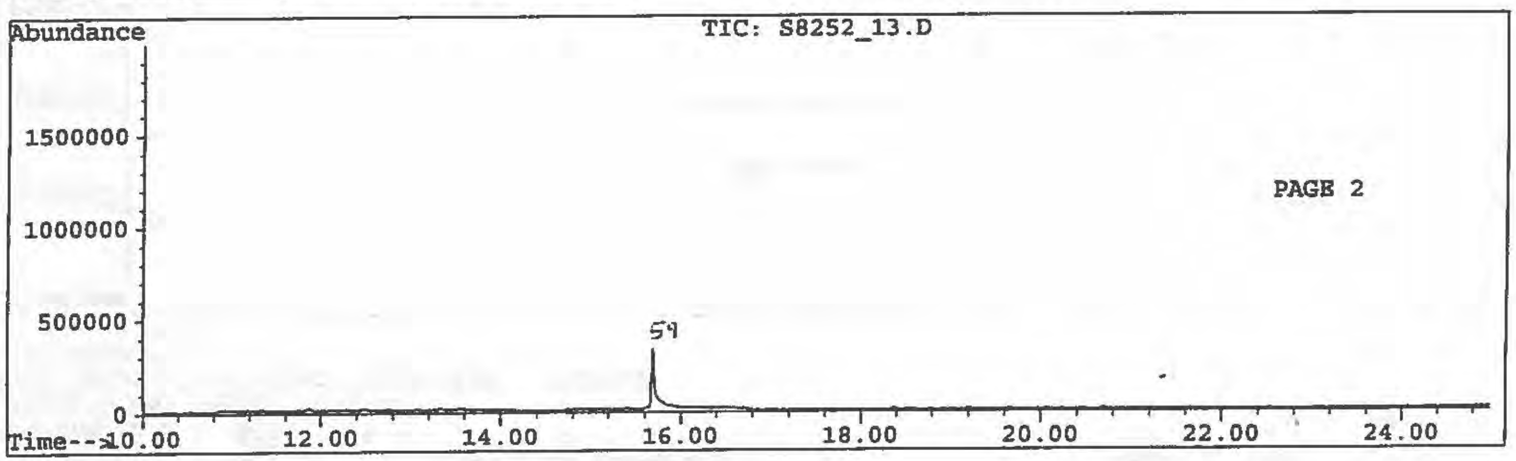
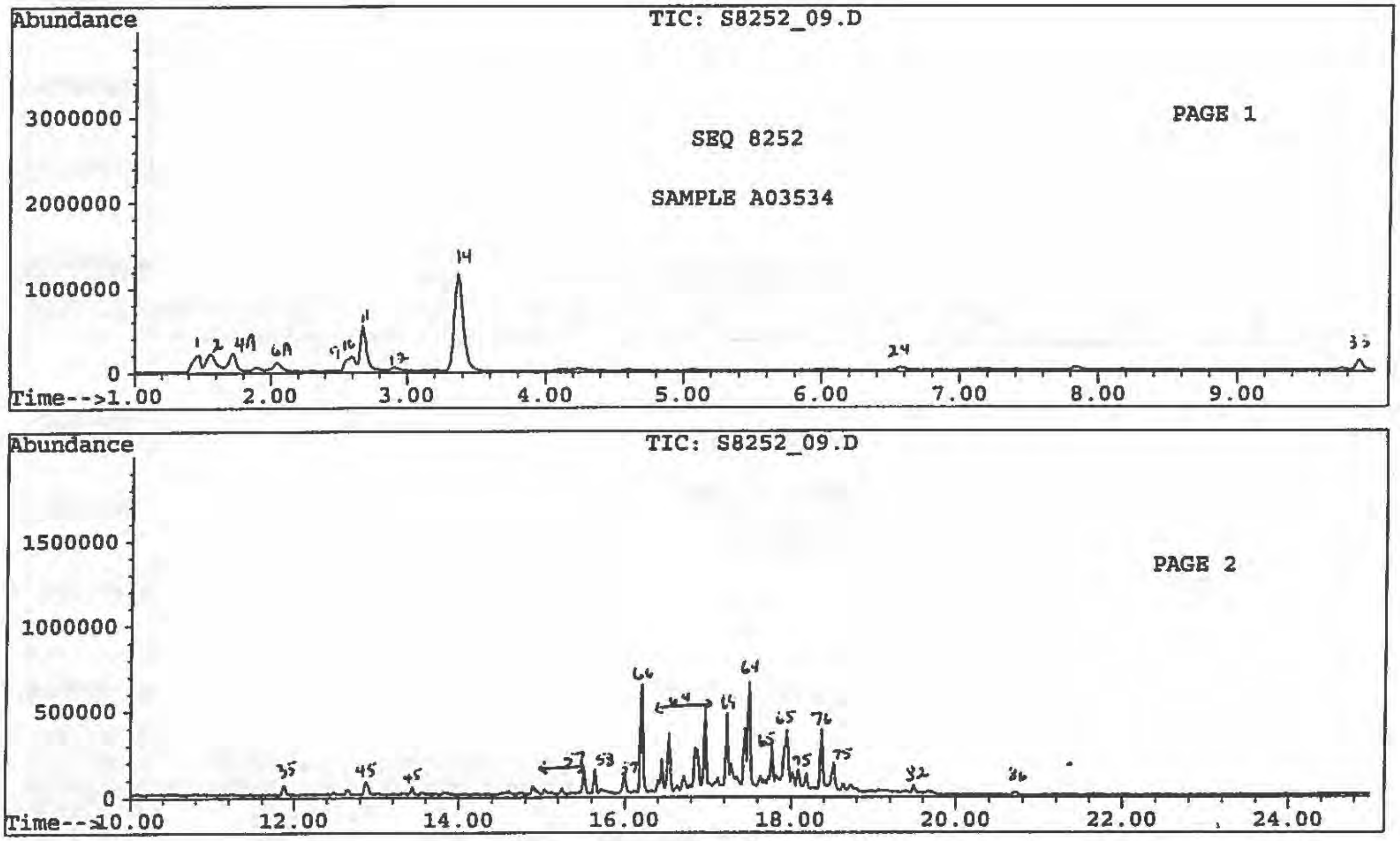
File : C:\HPCHEM\1\DATA\S8252\S8252_13.D
Operator : AAG
Acquired : 4 May 95 10:38 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A03105 FIELD BLANK
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 13





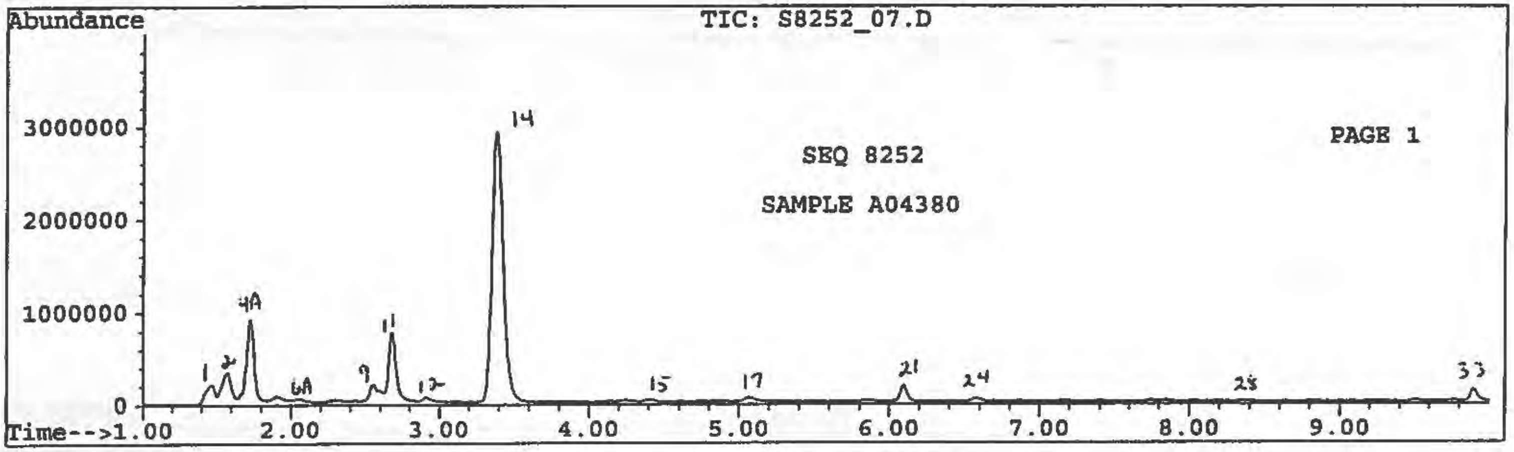
File : C:\HPCHEM\1\DATA\S8252\S8252_09.D
Operator : AAG
Acquired : 4 May 95 7:15 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A03534
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 9

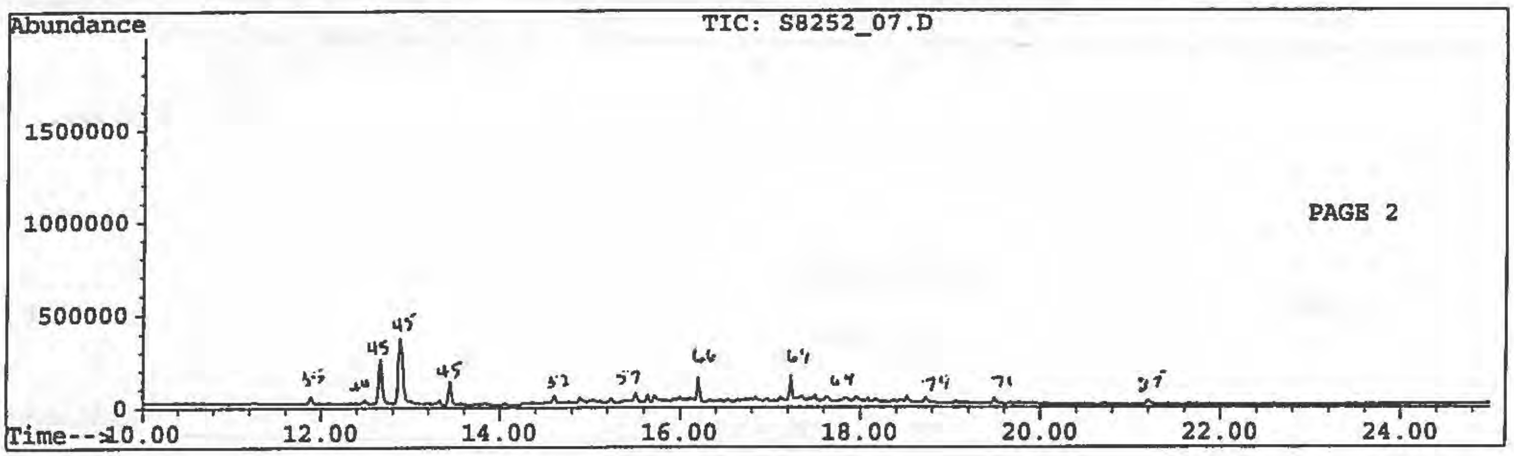
Line 8 - after coating & heating



File : C:\HPCHEM\1\DATA\S8252\S8252_07.D
Operator : AAG
Acquired : 4 May 95 5:35 pm using AcqMethod ATD
Instrument : 5970 - In
Sample Name: SAMPLE A04380
Misc Info : 30 M DB-1 SC20-300 TP35-300
Vial Number: 7

Line 3 before cut





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File         : C:\HPCHEM\1\DATA\S8252\S8252_08.D
Operator     : AAG
Acquired     :  4 May 95   6:25 pm using AcqMethod ATD
Instrument   :    5970 - In
Sample Name: SAMPLE  A04286
Misc Info    : 30 M DB-1    SC20-300    TP35-300
Vial Number: 8
```
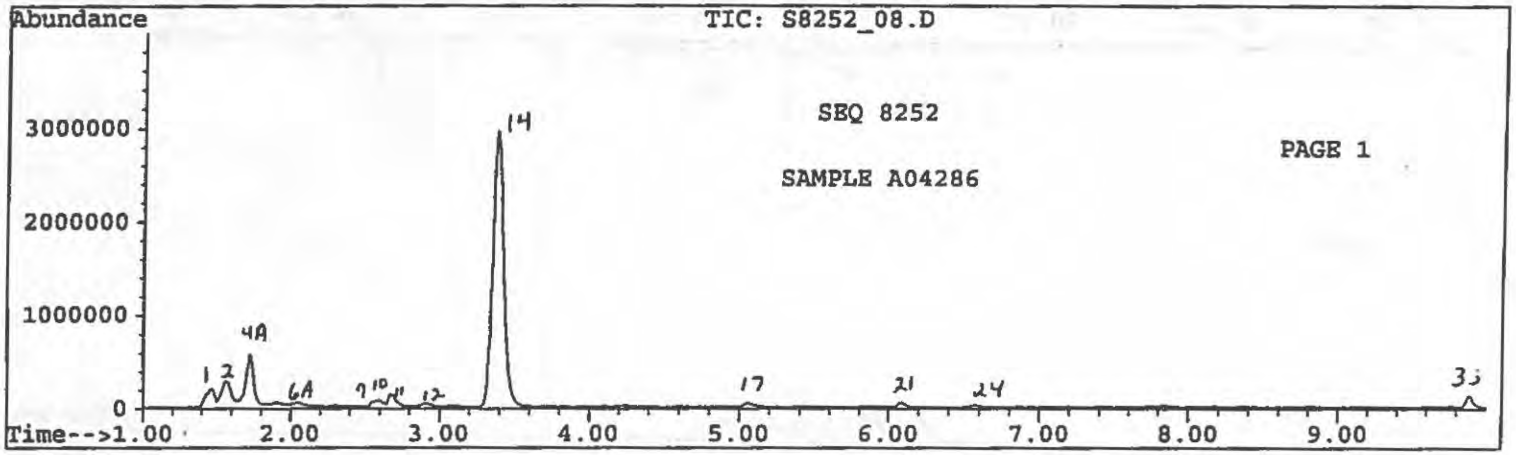
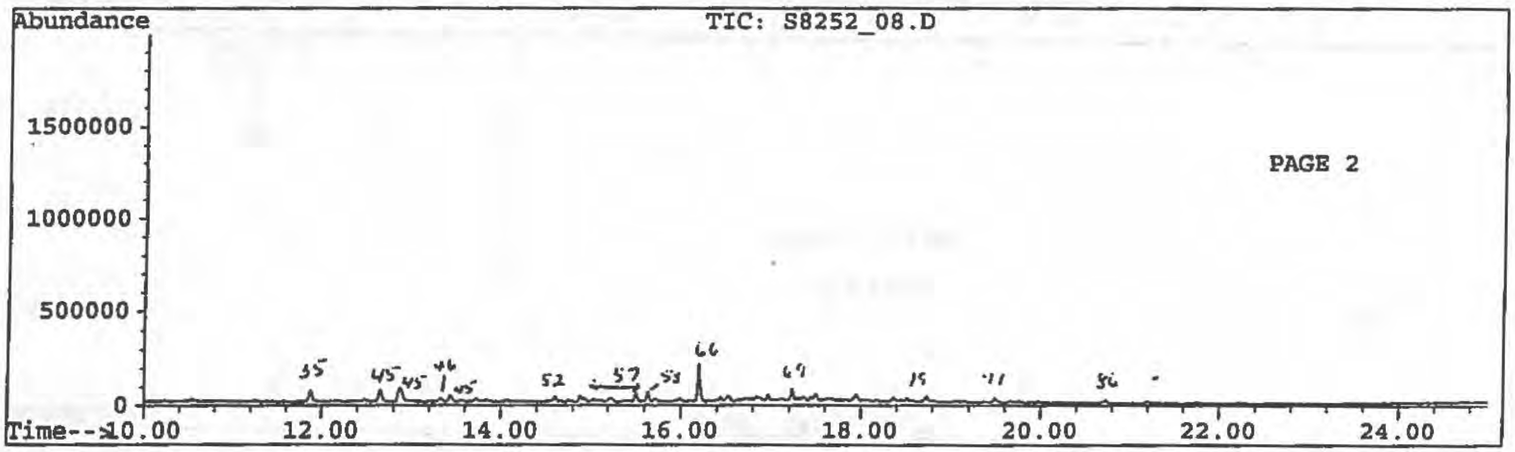

Line 4 before cut





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