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FASHION TANNERY
JOHNSTOWN, NEW YORK

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I. SUMMARY

A Health Hazard Evaluation (HHE) was conducted at the Fashion Tannery following a request by the Amalgamated Clothing and Textile Workers Union. The request was made in response to a report published by Levin et al. in Lancet documenting a cluster of three men with testicular cancer who worked in another tannery, on the same shift, in the same department, and during the same time period. Area air samples were taken in the finishing department for dimethylformamide, glycol ethers, lead, trace metals, nitrosamines, benzidine, and formaldehyde/aldehyde. The major components in the air samples that were identified were butyl cellosolve, cyclohexanone, diisobutyl ketone, 2-ethylhexyl acetate, various C_9H_{12} and $C_{10}H_{14}$ aromatics, n-butanol, isoamyl acetate, 2-propoxyethanol, acetone,and isopropanol. The results were all well below the applicable exposure criteria.

Based on the environmental results, the NIOSH investigators conclude that there is limited exposure to airborne contaminants in the finishing department. However, there is the potential for dermal exposure due to poor work practices and personal hygiene. The personal protective equipment was not maintained and could result in an overexposure. Further details on the recommendations to further reduce potential exposure can be found in Section VIII.

Keywords: SIC 3111 (Leather Tanning and Finishing), dimethylformamide, testicular cancer, glycol ethers.

II. INTRODUCTION

In December 1987, NIOSH received a request from the Amalgamated Clothing and Textile Workers Union (ACTWU) to conduct an investigation of an outbreak of cancer in leather tannery workers in Gloversville, New York. This request came soon after a report published by Levin et al.[1] in Lancet documenting a cluster of three men with testicular cancer who worked at another tannery, on the same shift, in the same department, and during the same time period. In response to this request, NIOSH, in February 1988, conducted a walk-through industrial hygiene survey and a standardized incidence ratio (SIR) study of finishing department workers at the tannery, the site of the reported cluster. (A SIR is a ratio in which the rate of disease of interest in an exposed population is in the numerator, and the rate of a disease of interest in an unexposed population is in the denominator.) In January 1989, the ACTWU filed a formal Health Hazard Evaluation (HHE) request for six tanneries in Fulton County, New York. Fashion Tannery was one of the tanneries in the request. The request was for the evaluation of the potential for occupational exposure to hazardous chemicals in the finishing department of tanneries in Fulton County that had used dimethylformamide. The Health Hazard Evaluation was conducted at Fashion Tannery on April 20, 1989.

Soon after Levin et al.[1] reported the cluster of testicular cancer at the tannery, the New York Department of Health conducted a case-referent study to determine the risk of testicular cancer in Fulton County, New York.[2] Gloversville is located in Fulton County. Using New York State Cancer Registry Data, occupation was determined for all male residents aged 20-54 residing in Fulton County who developed testicular cancer between 1974 and March 1987. Occupation was also determined for a control group consisting of men of similar age living in Fulton County who developed any other type of cancer between 1977 and March 1987. Ten cases of testicular cancer were identified and matched with
115 controls. Five of the 10 cases and 17 of the 115 controls were found to have been employed in leather related occupations (full tannery or finish tannery.) This represents an odds ratio of 5.76 (95% CI 1.50-22.05). Three of the five cases employed in leather related occupations were the men who worked in the finishing department of the tannery with the cluster. One of the two remaining men with tannery-associated testicular cancer had testicular problems as a child, which can be a risk factor for developing testicular cancer. Although this individual never worked at the tannery in question, 11 years before his diagnosis he had worked for 1 year in the finishing department of another tannery. The other individual with tannery employment and testicular cancer never worked at the tannery; however, he worked for 21 years in other tanneries, although never in a finishing department.
This cluster of cases of testicular cancer is cause for concern because these workers were exposed to glycol ethers, which are known testicular toxins in animals, and to dimethylformamide (DMF), which has been cited in some studies as the possible agent responsible for the observed elevations in testicular cancer.

In a cross-sectional study by Ducatman et al., an elevation of testicular cancer among workers at two of three Navy aircraft maintenance sites was reported.[3] The authors proposed that dimethylformamide (DMF) may have been responsible for testicular cancer. This study was undertaken when investigators were informed that, at one Navy F-4 aircraft maintenance site, three workers had testicular cancer. The investigators next surveyed another Navy F-4 aircraft maintenance site with exposures similar to the first facility. Four cases of testicular cancer were detected. Finally, the investigators surveyed an F-15 aircraft maintenance facility having similar exposures as the first two facilities, except that DMF had never been used. No testicular cancer was detected at this facility. Although the investigators speculated that DMF may have

been responsible for the elevated risk of testicular cancer at the first two facilities, workers at all three facilities were exposed to numerous chemicals. It is possible that chemical exposures other than DMF may also have been unique to the first two facilities and that the true exposure responsible for the elevation in testicular cancer was not identified by the investigators.

Citing the study by Ducatman et al.[3], Levin et al.[1] proposed that DMF may have been responsible for the three cases of testicular cancer at the tannery in Fulton County. However, like the workers at the aircraft maintenance sites investigated by Ducatman, workers at the tannery were exposed to a large number of chemicals in addition to DMF.

One month before the study by Ducatman et al[3] was published, a standardized incidence ratio (SIR) study was completed by DuPont on 2430 current or pensioned DMF-exposed employees.[4,5] At this plant, DMF was used as a spinning solvent in the production of acrylic fiber. No elevation of testicular cancer was found. Limitations of the study included a poor exposure assessment, no reference was made to latency or length of exposure in their analysis of testicular cancer, and the use of the company's cancer registry has the limitation (for epidemiologic research) of not including former employees.

DuPont also conducted a case-control study for cancer among DMF-exposed workers at four plants.[6] Because of the study by Ducatman et al.,[3] testicular cancer was chosen as one of the outcomes to be investigated. Exposure estimates, based on DMF air measurements and monomethylformamide (MMF) urinary metabolite sampling were made for each job category. Sixty-four percent of the workers had no DMF exposure, 20% had DMF exposures below 10 ppm, the Occupational Safety and Health Administration's Permissible Exposure Limit (OSHA PEL), and 16% had exposures greater than 10 ppm. No worker had exposure greater than 50 ppm. Only 3 of the 11 individuals with testicular cancer had DMF exposure. Latency ranged from 3 to 16 years for these three cases. Odds ratios were calculated for all plants combined and for each individual plant. The summary odds ratio for all plants was 0.99 (90% CI 0.22,4.44). Workers with DMF exposures greater than 10 ppm had a statistically nonsignificant elevation in risk for testicular cancer (logistic adjusted O.R.=11.6, 90% CI= 0.47,286). In only one plant were DMF exposed workers found to have an elevated risk for testicular cancer, although the risk was not statistically significant (cases - 1 exposed, 3 unexposed; controls - 0 exposed, 8 unexposed; O.R. 15.0, 90% C.I. 0.37,608). The major limitations of the study are low DMF exposure among employees, a statistical power too low to detect a statistically significant excess of testicular cancer, and possible overmatching of cases and controls on DMF exposure.

NIOSH conducted a standardized incidence ratio study (SIR) of finishing department workers at the tannery in Gloversville, New York, with the testicular cancer cluster.[7] Eighty individuals identified from yearly seniority lists for 1975-1988 had worked in the finishing department of the tannery. No records exist to identify workers employed in the finishing department before 1975. Data on year of first employment in the finishing department and age were used to calculate person-years at risk. Expected numbers of cases of testicular cancer were determined by applying age specific incidence rates for all males from upstate New York to the person-years at risk. Although all cases at the tannery were white, race-specific incidence rates are not available for upstate New York. In addition to a crude SIR, separate SIR calculations were made by examining risk by years of latency and by years of exposure in the finishing department. A latency period of three years was chosen. This agrees with the latency period used in two other reports that examined the association between testicular cancer and occupation.[2,8]

Three cases of testicular cancer among the finishing department workers represent a crude SIR of 40.5 (95% CI 8.15, 118.45). A statistically significant SIR was found for those finishing department workers with one to five years of exposure (SIR=55.5, 95% CI 6.24, 200.6), with greater than five years of exposure (SIR=76.9, 95% CI 1.01, 427.99), and with greater than five years of latency (SIR=76.9, 95% CI 15.5, 224.76).

III. BACKGROUND

The Fashion Tannery began in Gloversville, New York, in 1973. The company is a finish tannery and is currently processing whole cow hides into upholstery leather. The plant has expanded over the years. Fashion Tannery began with three spray booths and a bolster and in 1974 added another spray booth. In 1978 the company eliminated the bolster and added a fifth spray booth. The company presently has two spray lines; one line has 4-eight gun spray booths and the other has 5-sixteen gun spray booths. The plant has had two fires, both in 1979, which destroyed the building. The plant has since been rebuilt and has been operating continuously since 1980.

A. Process Description

The finish process begins when the "feeders" place a whole hide on the conveyor line. The hide first passes through an automated airless rotary spray booth and a base coat is applied. The hide is then conveyed through a dryer. A series of base coats, an antiquing coat, and a top coat are applied by the automated airless rotary sprayers. Between each applied coat the hide passes through a dryer. The spray booths are enclosed and operate at their designed flow rate when the doors are shut. The hides are manually transferred by the "take off" employees to drying sticks.

B. Major Job Categories

The department has the following major job descriptions:

1) Feeder - Transfers the hide onto the conveyor belt. The worker is approximately 4 feet from the first ventilated spray booth. Two employees work this job on the 16 gun line and one employee on the 8 gun line.

2) Take Off - Transfers the hides from the finish line to a drying hook or from the hook to a pallet after the leather has gone through the dryer. This job requires two employees on the 16 gun line and one employee on the 8 gun line.

3) Put-up Color - Responsible for setting up the finish line and maintaining a proper supply of finish material. Does some mixing of the preformulated material. One employee is responsible for this job.

4) Color Matchers - Responsible for the amount and quality of the finish material being applied to the leather. Three employees and one trainee are responsible for this job.

5) Line Supervisor - Maintains the finish line. Two employees on the 16 gun line and one employee on the 8 gun line.

6) Wipers - Hand rubs the leather with vinylidene chloride, butyl cellosolve and 2-ethylhexyl acetate.

7) Tippers - Rub accent colors on the tip of a design by hand.

There is a total of 82 employees in the plant with the balance of the employees in quality control, maintenance, dry milling, shipping, warehouse, and the office.

The finishing department operates from 5:00 a.m.-1:30 p.m. five days per week.

IV. Materials and Methods

The industrial hygiene evaluation involved personal and area sampling for selected contaminants associated with substances present in the materials used in the process. All personal exposure samples were obtained in the workers' breathing zones. Sample duration approximated a full work shift. The analytical methods have limits of detection and limits of quantification.

At the lower range of an analytical method, it may not be possible to confidently attribute an instrument response to the substance in question. The point at which instrument response can confidently be attributed to the contaminant being measured is called the "limit of detection" (LOD). If an instrument response is attributed to the contaminant, it may be present at such low levels that the confidence interval for the results reported may be excessive. The point at which the range of possible values are within acceptable limits is called the "limit of quantitation" (LOQ).

A. Dimethylformamide (DMF)

Airborne concentrations of DMF were evaluated by drawing air at a rate of 100 cc/minute through a series of 2 silica gel tubes (150 mg/75 mg) using a Gillian low flow pump. Sections A (150 mg) and B (75 mg) were separated and analyzed by gas chromatography according to NIOSH Method 2004.[9] The calculated limit of detection for DMF was 0.01 mg/sample.

B. Glycol Ethers

Airborne concentrations of glycol ethers were evaluated by drawing air through a Gillian low flow pump at a rate of 50 cc/minute through SKC coconut shell charcoal (100mg/50 mg). The samples were analyzed according to NIOSH Method 1403.[9] They were extracted with 1 ml of 5% methanol/methylene chloride and analyzed by gas chromatography using an HP 5890A gas chromatograph (GC) equipped with a 30-meter DB-1 fused silica capillary column and flame ionization detector (FID). The calculated limit of detection was 0.1 mg/sample.

C. Lead

Airborne concentrations of lead were evaluated by drawing air at a rate of 3 liters per minute through a 37 millimeter diameter, 0.8 um pore size cellulose ester membrane filter using a SKC Universal Constant Flow air sampling pump. The filters were analyzed by atomic absorption spectrophotometer according to NIOSH Method 7082.[9] The calculated limit of detection was
1.3 ug/sample.

D. N-nitroso Compounds

Airborne concentrations of N-nitroso compounds were evaluated by drawing air at a rate of 1 liter per minute through a Thermosorb/N-sorbent tube using an SKC Universal Constant Flow air sampling pump. Four Thermosorb/N-sorbent tubes were collected in the finishing department. The tubes were eluted with a mixture of 25% methanol and 75% dichloromethane. The samples were analyzed according to NIOSH Method 2522 using a gas chromatograph with a Thermal Energy Analyzer in the nitrosamine mode, equiped with a 10 foot stainless steel Carbowax 20M + 2% KOH packed column. The calculated limit of detection was 1 ug/sample.

E. Minerals and Metals

Airborne concentrations of minerals and metals were evaluated by drawing air through a 37 mm diameter, 0.8 um pore size cellulose ester membrane filter at a rate of 1 Lpm using a SKC Universal Constant Flow air sample pump. The filters were analyzed by inductively coupled argon plasma, atomic emission spectroscopy according to NIOSH Method 7300.

F. Qualitative Analyses of Organic Compounds

Charcoal tubes and ORBO-24 tubes were submitted for qualitative analysis of volatile organic compounds. The ORBO-24 tubes were also submitted for qualitative aldehyde screening.

The charcoal samples were desorbed with 1 ml of carbon disulfide. The samples were screened by gas chromatography using a 30-meter DB-1 fused silica capillary column (splitless mode) and a flame ionization detector. Since the chromatograms from all the charcoal samples were similar, one representative sample (charcoal tube numbered CT-3) was chosen for further analysis by gas chromatography-mass spectroscopy (GC-MS) to identify specific contaminants. Appendix 1 is the reconstructed total ion chromatograms from the GC-MS analysis of the charcoal tube.

The ORBO-24 tubes were desorbed with 1 ml toluene in an ultrasonic bath for 6 minutes, then screened for aldehydes by GC-FID using a 15-meter, DB-1301, fused silica capillary column (splitless mode). Formaldehyde spikes of 1-2 ug were prepared and analyzed with the samples for comparison.

G. Organic Solvents

Airborne concentrations of methylamyl alcohol, methyl isoamyl ketone, isoamyl acetate, methyl amyl ketone, diisobutyl ketone, 2-ethyl hexyl acetate, and acetone were evaluated by drawing air at a rate of 100 cc/min through an SKC coconut shell charcoal tube (100 mg/50 mg) using a Gillian low flow pump. The A and B sections of the charcoal tubes were separated and analyzed by gas chromatography according to NIOSH Methods 1300, 1301, 1401, 1402, and 1450.[9] The calculated limit of detection for all analytes ranged from 0.04 - 0.08 mg/sample.

V. EXPOSURE EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employed several environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week, for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of any agent become available. The primary sources of environmental evaluation criteria for the workplace are 1) NIOSH Criteria Documents and recommendations, 2) The American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) The U.S. Department of Labor's Permissible Exposure Limits (PEL's). Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In reviewing the exposure levels and the recommendations for reducing those levels found in this report, it should be noted that industry is required by the Occupational Safety and Health Administration (OSHA) Act of 1970 to meet those levels specified by OSHA standards.

Evaluation Criteria used in this report are presented in Table 1. The following is a discussion of the toxicity of the compounds that were specified in the Health Hazard Evaluation request or for which there is a potential for exposure at the plant. Not all of the compounds sampled for are discussed in this section because they were non-detectable in the workplace air at the time of this evaluation.

A. Dimethylformamide

DMF as a liquid is readily absorbed after dermal contact, ingestion, and inhalation.[10] It is rapidly metabolized and excreted in the urine, as N-hydroxymethyl-N-methylformamide and, to a small extent, N-methylformamide, N-hydroxymethylformamide, and unmetabolized dimethylformamide.[11]

Liver toxicity has been observed in persons occupationally exposed to DMF.[12,13] DMF is not a mutagen in animals.[14] Only one animal species (rat) has developed cancer after exposure to DMF. This finding was made in a study undertaken to assess the carcinogenic effects of aflatoxins.[18] DMF was used as the solvent vehicle for the aflatoxin. Eighteen male rats were given 0.1 ml intraperitoneal injections of gas chromatoghraphy grade DMF weekly for 10 weeks. One rat developed a testicular tumor (embrynal cell carcinoma).

Two of the remaining 17 rats developed malignant tumors (one developed stomach cancer and one developed a sarcoma of the colon). Occupational exposure to DMF followed by consumption of alcohol has resulted in dermal flushing (especially of the face), nausea, headache, and dizziness, indicating alcohol intolerance. [15,16]

Overexposure to DMF (>10 ppm) is known to cause abdominal pain.[17] One study found that 67% of workers with overexposure to DMF complained of either anorexia, abdominal pain, or nausea.[12] The proportion that complained of only abdominal pain was not reported. Industrial hygiene measurements were not reported, however, large quantities of DMF (approximately 15 to
20 fifty-five gallon drums per week) were used in poorly ventilated areas without appropriate skin protection. There is no evidence that DMF exposures under 10 ppm cause abdominal pain or hepatic damage.[17,18]

Using different methods of administration and different doses, other investigators have not found DMF to be tumorogenic. No increase in tumors was observed in rats fed daily oral doses of 75 or 150 mg/kg of DMF for
250 to 500 days and observed for 750 days.[19] Another study found no tumors in rats fed a single dose of 0.1 ml of DMF and observed for 13 to 34 months.[20] No tumors were observed in rats, with or without partial hepatectomy, given a single intraperitoneal dose of 0.5 mg/kg/DMF.[15] No tumors were detected in hamsters given weekly intraperitoneal injections of 0.1 ml of a 50% solution of DMF.[21]

B. Glycol Ethers

The most toxicologically important glycol ethers are ethoxyethanol and its acetate, methoxyethanol and its acetate, and butoxyethanol. Absorption can occur after dermal contact, ingestion, and inhalation.[22] Animal studies have shown that ethoxyethanol can cause hemolytic anemia, and liver, kidney, and lung damage.[22] 2-Ethoxyethanol (2EE) caused a significant increase in diverse reproductive effects in experimental animals of both sexes. In females, 2EE was teratogenic and embryotoxic when administered to pregnant rats and rabbits.[23,24] In non-pregnant female rats, exposure to 2EE did not affect fertility.[24] In males, 2EE produced testicular atrophy in mice and microscopic testicular changes in mice, rats, and dogs.[25] In animals, 2EE has caused liver, kidney, and lung damage and anemia as well as eye irritation Limited information indicates that the toxic effects of the

individual compounds that are structurally related to 2EE (e.g. 2-ethyoxyethylacetate, methoxyethanol, and 2-butoxyethanol) are consistent with the reproductive effects caused by 2EE.[26]

VI. MEDICAL, SAFETY, AND INDUSTRIAL HYGIENE PROGRAMS

A. Medical

Fashion Tannery does not offer a pre-employment or annual physical. Arrangements have been made with the local hospital for acute medical care.

B. Safety

Fashion Tannery, at the time of the survey did not have an organized safety program. However, at the time of the survey the company was training individuals in Health and Safety and was in the process of developing a safety program. The company stated that they show tapes on hazard communications, chemical safety, material handling, and Material Safety Data Sheets. The company does not have anyone trained in CPR.

Because of the history of fires at the plant the company has conducted fire drills.

C. Industrial Hygiene

The company does not have an industrial hygiene program, but does rely on the State Department of Health for any technical assistance involving industrial hygiene.

VII. RESULTS

On April 18, 1989, NIOSH conducted an industrial hygiene survey of the finishing department at Fashion Tannery, Incorporated. Personal breathing zone and area air samples were obtained for DMF, glycol ethers, lead, formaldehyde/aldehydes, trace metals, and nitrosamines. The area air samples were qualitatively analyzed by GC/MS to identify the major components of the plant air.

DMF, no longer used at Fashion Tannery, was non-detectable in the two air samples (LOD = 0.01 mg/sample). The company consumed an average of 132 pounds of DMF per week for seven years and nine months, but discontinued the use of DMF in 1987 because of the possible association with adverse health effects.
Air levels of glycol ethers (see Table 2) ranged from 0.9-1.7 mg/m^3 with an average of 1.2 mg/m^3 for cellosolve, levels ranged from non-detectable (0.1 mg/sample) to 0.4 mg/m^3 with an average of 0.24 mg/m^3 for butyl cellosolve acetate, 9.7-45.6 mg/m^3 with an average of 21.8 mg/m^3 for butyl cellosolve, and 0.8-17.1 mg/m^3 with an average of 7.5 mg/m^3 for propyl cellosolve.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a Threshold Limit Value (TLV) of 19 mg/m^3 and 121 mg/m^3, respectively for cellosolve and butyl cellosolve. The OSHA PEL for butyl cellosolve is

240 mg/m^3. The OSHA PEL and the NIOSH REL for cellosolve are 740 mg/m^3 and the "lowest feasible limit" respectively. There currently are no exposure standards for propyl cellosolve and butyl cellosolve acetate.

No detectable air levels were found in the three lead air samples (LOD = 1.3 ug/sample), two nitrosamines air samples (LOD = 1 ug/sample), and the three samples for formaldehydes/aldehydes.

Three filter samples were taken (Table 3) for metals (LOD = 10 ug/filter). Chromium was non-detectable (LOD = 0.7 ug/m^3). Levels of iron ranged from 1.4-11.5 ug/m^3. Magnesium was found in the color matcher sample at 1.4 ug/m^3. Zinc was just above the limit of detection (0.6 ug/m^3) in two of the area samples.

A copy of the reconstructed total ion chromatogram from GC-MS analysis of charcoal tube sample numbers 52 and CT-53 and their back sections can be found in Appendix 1. Major components found in the samples were butyl cellosolve, cyclohexanone, diisobutyl ketone, 2-ethylhexyl acetate, various C_9H_{12} and $C_{10}H_{14}$ aromatics, n-butanol, isoamyl acetate, 2-propoxyethanol, acetone, and isopropanol. Other compounds include MEK, tert-butanol, triethylamine, ethyl acetate, 1-methoxy-2-propanol, cellosolve, methyl butanol, pentanol, ethoxypropanol, toluene, xylenes, methyl cellosolve acetate, diacetone alcohol, methoxyacetoxy propane, 2-ethyl-1-hexanol, butyl cellosolve acetate, ethyl acrylate, N-methyl-2-pyrrolidone, various C_{10}-C_{16} alkanes, ethanol, butyl acetate, and 1,1,1-trichloroethane.

The results of the GC-MS defined the strategy for the quantitative analysis of the charcoal tube air samples. Table 4 identifies the organic compounds that were detectable. The n-butanol levels ranged from non-detectable (0.08 mg/m^3) to 0.5 mg/m^3 with an average of 0.33 mg/m^3. The 2-ethylhexyl acetate levels ranged from 2.5 to 10.0 mg/m^3 with an average of 7.0 mg/m^3 and diisobutylketone levels ranged from 0.5 mg/m^3 to 2.2 mg/m^3 with an average of 2.8 mg/m^3. The methyl amyl ketone levels ranged from 0.1 to 0.7 mg/m^3 with an average of 0.5 mg/m^3. Isoamyl acetate ranged from 0.1 to 1.1 mg/m^3 with an average of 0.73 mg/m^3. Methylamyl alcohol ranged from non-detectable (0.04 mg/m^3) to 0.4 mg/m^3 with an average of 0.17 mg/m^3.

VIII. DISCUSSION AND CONCLUSIONS

Due to the fires which destroyed the buildings in 1979, the company has had the opportunity to rebuild the plant with more modern equipment and engineering controls. The ventilation system is adequate when the doors of the spray machines are kept closed. Over the past few years Fashion Tannery has made several changes within the finishing department which might explain the low environmental air concentrations. For one, the use of airless sprayers help reduce the overspray of the finish material. However, the plant should improve the housekeeping. Several of the employees complained of the odor in the finishing department when the antiquing coat was being run. The problem cound be attributed to the doors on the ventilated spray hoods. If the doors to the hoods are not kept shut throughout the process, overspray will result. The personal protective equipment should be properly maintained and fit tested to insure maximum protection. The respirators that were being used were worn out and not providing the protection they were designed for.

Fashion Tannery used DMF for seven years and nine months and consumed an average of 132 pounds per week. The DMF was sprayed on by the rotary sprayers and the process did not

involve any hand swabbing. At the time of the survey a health hazard did not exist. The evaluation was submitted by the union becuase the company had used DMF in the past.

IX. RECOMMENDATIONS

Even though the current environmental air levels were low, there are a number of conditions within the plant that need to be improved.

1. Establish an active medical surveillance program to monitor the health of employees at the Fashion Tannery. The program should include an annual examination of the testicles. Also, the employees in the finishing department should receive instructions in testicular self-examination and be advised to perform this exam monthly. Employees should be encouraged to seek medical advice if they notice a swelling or lump in the scrotum.

2. Ground drums that contain flammable materials.

3. Encourage the employees to change their work clothes more frequently. More frequent changing of their clothes would reduce potential for dermatologic problems resulting from repeated contact with the materials being used.
4. Provide the appropriate personal protective equipment (gloves, respirator, safety glasses, etc.) Also, the company should conduct the appropriate training in the proper selection, use, and maintenance of this equipment.

5. Prohibit smoking and eating in the work areas.

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XII. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virgina 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Fashion Tannery, Johnstown, New York
2. Amalgamated Clothing and Textile Workers Union, Local Gloversville, New York
3. The Occupational Safety and Health Administration (OSHA) Region I.

Table 1

Evaluation Criteria and Health Effects Summary

Fashion Tannery
Johnstown, New York

Contaminant	Exposure Limit[1]	Source	Health Effects	
			Symptom or Specific Effects	Target Organ
Dimethylformamide	30 mg/m^3 10 ppm	NIOSH[2]	Nausea, vomiting, liver damage, hepatomegaly; high blood pressure, face flush, dermatitis	Liver, Kidneys cardiovascular system, skin
	10 ppm (skin)	ACGIH[3]		
Lead	<0.1 mg/m^3 10-hr TWA	NIOSH	Lassitude, insomnia; pallor, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia, gingival lead line; tremors, paresis	Gastrointestinal tract, Central nervous system, kidneys, blood, gingival tissue, reproductive system
	0.15 mg/m^3	ACGIH		
Glycol Ethers (cellosolve)	Lowest feasible limit	NIOSH	In animals: Hematologic effects; liver damage, kidney damage, liver damage, eye irritant	In animals: lungs, eyes, blood, liver, kidneys
	18 mg/m^3 5 ppm	ACGIH		
	200 ppm 740 mg/m^3	OSHA		

Table 1 (cont.)

Evaluation Criteria and Health Effects Summary

Fashion Tannery
Johnstown, New York

Contaminant	Exposure Limit[1]	Source	Health Effects: Symptom or Specific Effects	Health Effects: Target Organ
Cellosolve acetate	540 mg/m^3 100 ppm	OSHA	Eye & nose irritant, vomiting, kidney damage, paralysis	Respiratory system, eyes, gastrointestinal tract
	27 mg/m^3 5 ppm	ACGIH		
Butyl Cellosolve (skin)	240 mg/m^3 50 ppm	OSHA	Eyes, nose, throat irritant; hemolysis, hemoglobinuria	Liver, kidneys, lymphoid system, skin, blood, eyes,
	120 mg/m^3	ACGIH		respiratory system
Diisobutylketone	50 ppm 290 mg/m^3	OSHA	Eyes, nose, throat irritant, dizziness, dermatitis, loss of consciousness	Respiratory system, skin, and eyes
	25 ppm 10 hr TWA	NIOSH		
	25 ppm 145 mg/m^3	ACGIH		

1. Exposure limits are given in milligrams per cubic meter (mg/m^3) and parts per million (ppm) where applicable
2. National Institute for Occupational Safety and Health
3. American Conference of Governmental Industrial Hygienists
4. Occupational Safety and Health Administration

Table 2

Glycol Ethers

Fashion Tannery
Johnstown, New York
April 19, 1989

Sample # /Job	Min.	Flow L/min.	Volume m^3	Airborne Concentration mg/m^3 Cellosolve	Butyl Cellosolve	Butyl Cellosolve Acetate	Propyl Cellosolve
GE-51 (Feeder)	351	0.2	0.070	0.9	20.0	0.3	17.1
GE-54 Supervisor	460	0.2	0.092	1.4	9.7	ND	0.8
GE-55 (Feeder)	339	0.2	0.068	0.9	45.6	0.4	9.1
GE-56 (Line Checker)	459	0.2	0.092	1.7	12.0	0.2	2.8
Limit of Detection (LOD)				0.1	0.1	0.1	0.1
Limit of Quantitation (LOQ)				0.3	0.3	0.3	0.3

ND = non-detectable

Table 3

Metals

Fashion Tannery
Johnstown, New York

April 19, 1989

Sample # /Job	Min.	Flow L/min.	Volume m^3	Airborne Concentration ug/m^3				
				Chromium	Iron	Magnesium	Lead	Zinc
E-41-Area 1st Line	472	3	1.416	ND	2.1	ND	ND	0.7
E-42-Area 2nd Line	466	3	1.398	ND	1.4	ND	ND	ND
E-43 Color Matcher	491	3	1.473	ND	11.5	1.4	ND	1.4
Limit of Detection (LOD)				0.7	0.7	1.3	1.3	0.6

ND = Nondetectable

Table 4

Organic Solvents

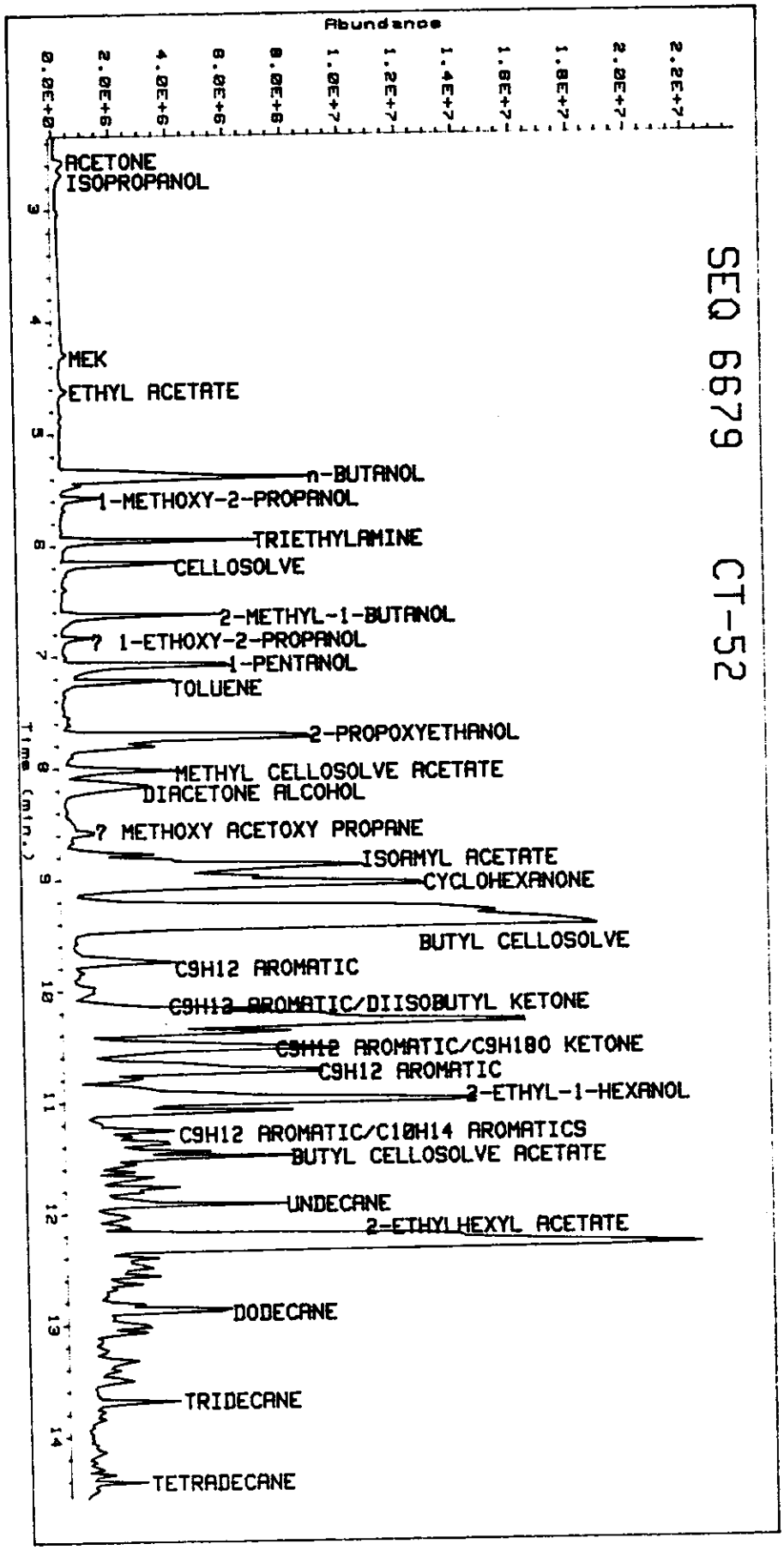
Fashion Tannery
Johnstown, New York
April 19, 1989

Sample # /Job	Min.	Flow L/min.	Volume m^3	Airborne Concentration mg/m^3 n-Butanol	Methylamyl Alcohol	Methyl Isoamyl Ketone	Isoamyl Acetate	Methyl Amyl Ketone	Diisobutyl Ketone	2-Ethylhexyl Acetate	Acetone
OS-52 Waste Room	370	0.5	0.185	0.2	ND	ND	0.1	0.1	0.5	2.5	ND
OS-53 Take-off	443	0.5	0.221	0.5	0.1	ND	1.0	0.6	2.2	10.0	0.1
OS-54 Top Coat Maker	494	0.5	0.247	0.4	0.4	ND	1.1	0.7	2.1	8.5	ND
Limit of Detection (LOD)				0.08	0.04	0.04	0.04	0.04	0.04	0.08	0.08
Limit of Quantitation (LOQ)				0.2	0.12	0.12	0.12	0.12	0.12	0.17	0.2

ND = non-detectable

Appendix I

Qualitative Analysis
by GC - MS of Charcoal Tubes



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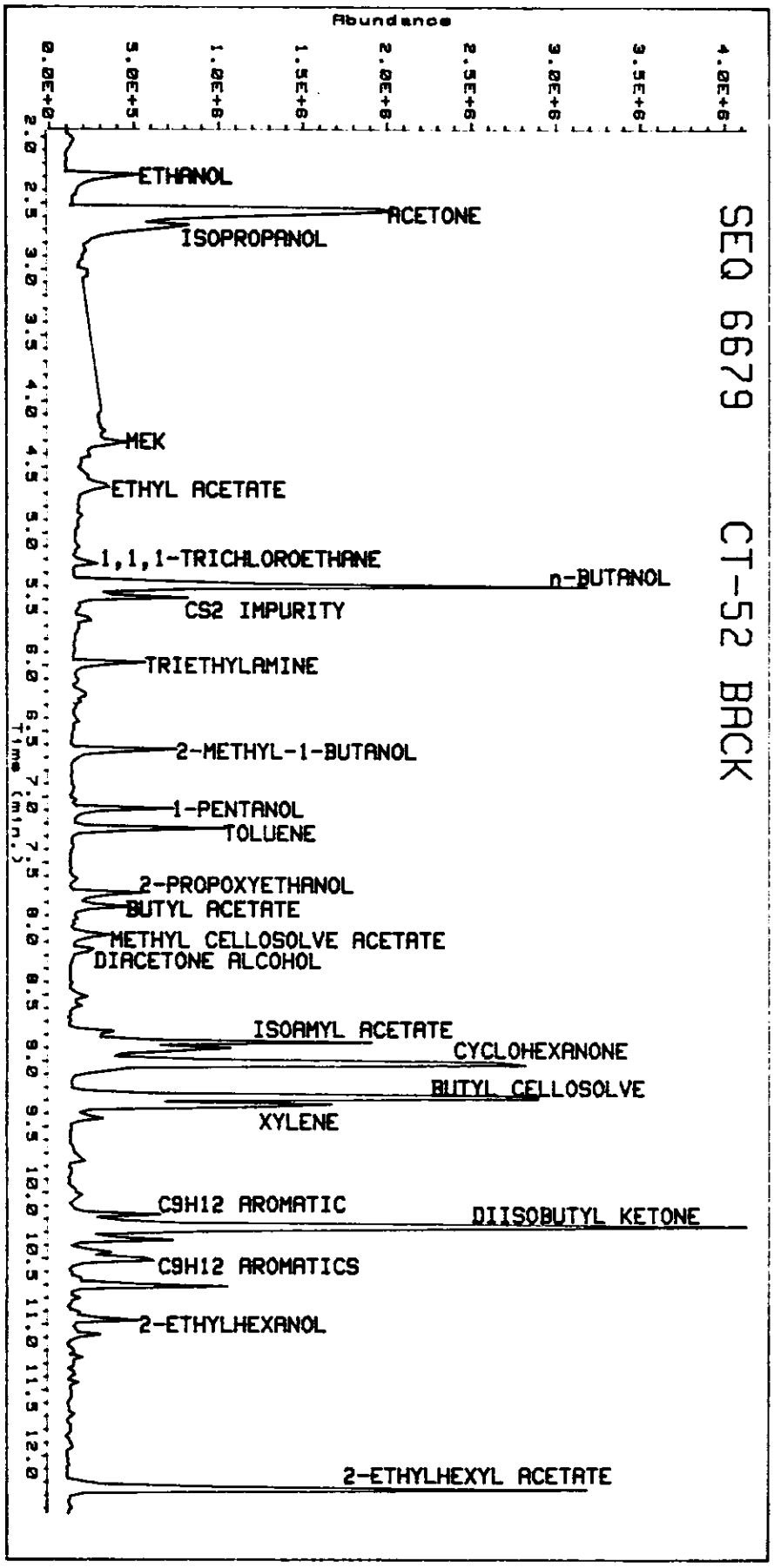
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2.5E+6
3.0E+6
3.5E+6
4.0E+6
Time (min.)
2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0
ETHANOL
ACETONE
ISOPROPANOL
MEK
ETHYL ACETATE
1,1,1-TRICHLOROETHANE
n-BUTANOL
CS2 IMPURITY
TRIETHYLAMINE
2-METHYL-1-BUTANOL
1-PENTANOL
TOLUENE
2-PROPOXYETHANOL
BUTYL ACETATE
METHYL CELLOSOLVE ACETATE
DIACETONE ALCOHOL
ISOAMYL ACETATE
CYCLOHEXANONE
BUTYL CELLOSOLVE
XYLENE
C9H12 AROMATIC
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C9H12 AROMATICS
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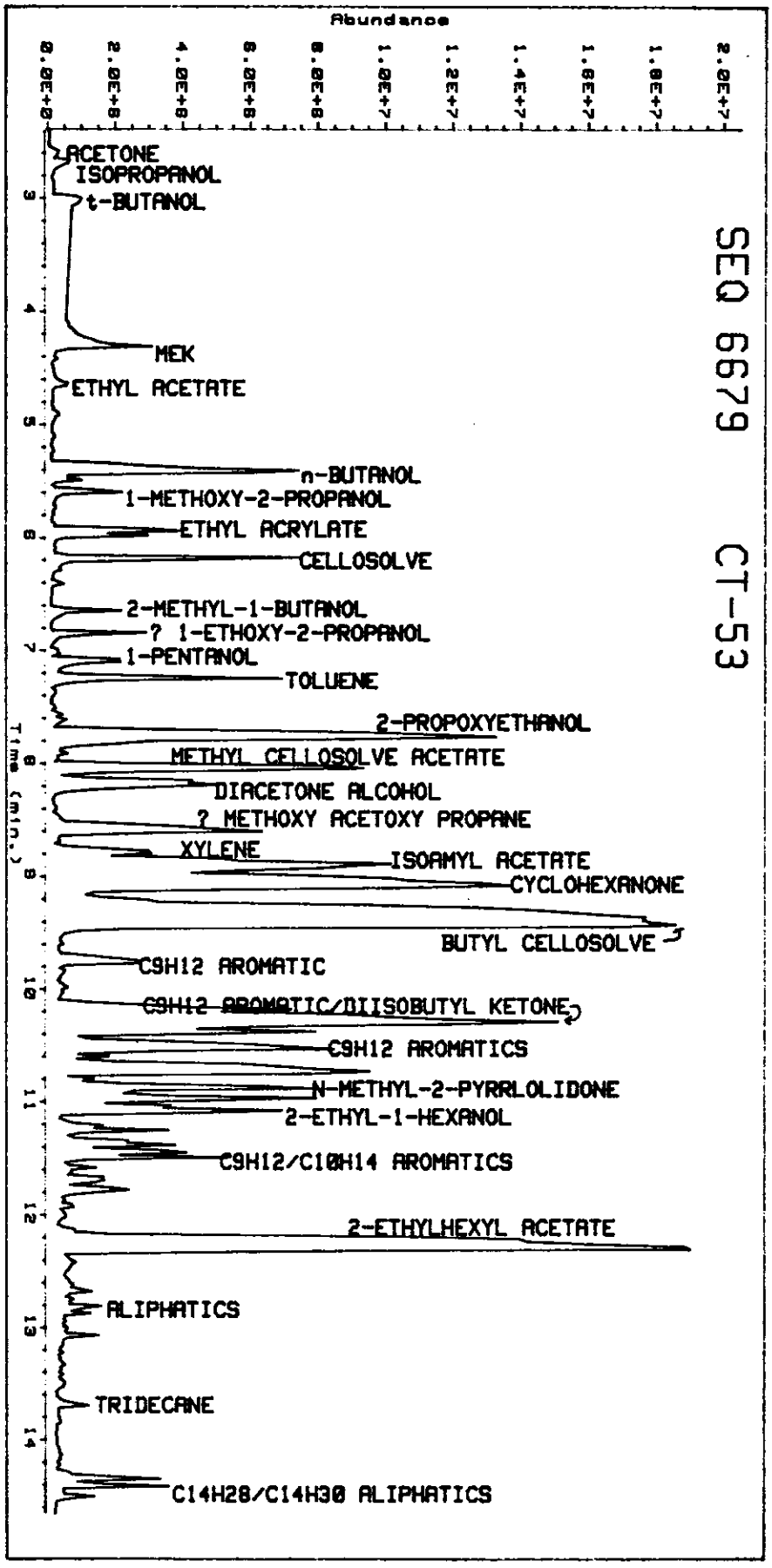
2-ETHYLHEXYL ACETATE
SEQ 6679
CT-52 BACK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Time (min.)
3
4
5
6
7
8
9
10
11
12
13
14
ACETONE
ISOPROPANOL
t-BUTANOL
MEK
ETHYL ACETATE
n-BUTANOL
1-METHOXY-2-PROPANOL
ETHYL ACRYLATE
CELLOSOLVE
2-METHYL-1-BUTANOL
? 1-ETHOXY-2-PROPANOL
1-PENTANOL
TOLUENE
2-PROPOXYETHANOL
METHYL CELLOSOLVE ACETATE
DIACETONE ALCOHOL
? METHOXY ACETOXY PROPANE
XYLENE
ISOAMYL ACETATE
CYCLOHEXANONE
BUTYL CELLOSOLVE
C9H12 AROMATIC
C9H12 AROMATIC/DIISOBUTYL KETONE
C9H12 AROMATICS
N-METHYL-2-PYRROLIDONE
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C9H12/C10H14 AROMATICS
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ALIPHATICS
TRIDECANE
C14H28/C14H30 ALIPHATICS
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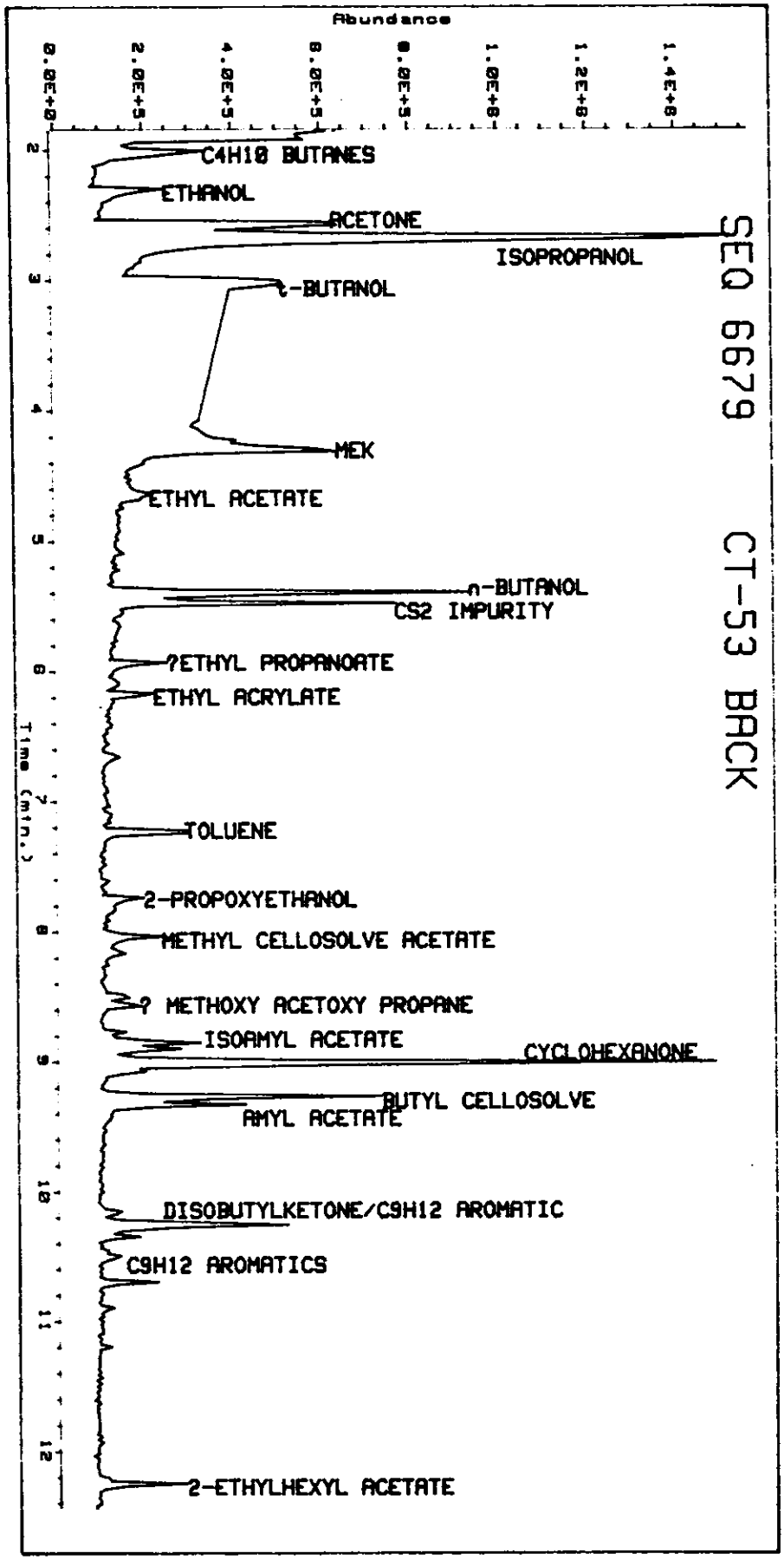
CT-53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1.2E+6
1.4E+6
Time (min.)
C4H10 BUTANES
ETHANOL
ACETONE
ISOPROPANOL
t-BUTANOL
MEK
ETHYL ACETATE
n-BUTANOL
CS2 IMPURITY
?ETHYL PROPANOATE
ETHYL ACRYLATE
TOLUENE
2-PROPOXYETHANOL
METHYL CELLOSOLVE ACETATE
? METHOXY ACETOXY PROPANE
ISOAMYL ACETATE
CYCLOHEXANONE
BUTYL CELLOSOLVE
AMYL ACETATE
DISOBUTYLKETONE/C9H12 AROMATIC
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SEQ 6679
CT-53 BACK