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HETA 20010210
DynCorp Technical Services
Columbus Air Force Base
Columbus, Mississippi

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PREFACE

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) 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 (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to Federal, State, and 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 NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Max Kiefer and Allison Tepper of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Analytical support was provided by Ardith Grote of the NIOSH Division of Applied Research and Technology. Desktop publishing was performed by Pat Lovell. Review and preparation for printing were performed by Penny Arthur.

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Highlights of the NIOSH Health Hazard Evaluation

Evaluation of Building 218 at Columbus Air Force Base

On April 4, 2001, NIOSH evaluated a possible cancer cluster and DynCorp worker exposure to contaminants from two industrial ovens in Building 218 at Columbus Air Force Base in Columbus, Mississippi.

What NIOSH Did

- We took air samples of emissions from the two ovens.
- We talked to employees about their health concerns.
- We collected information about the cases of cancer.
- We inspected the shop and watched work practices.

What NIOSH Found

- The ovens are not a substantial source of contaminants in the shop.
- No unusual occurrence of cancers that could be associated with work was found.
- Workers are concerned about long-term effects of exposure to emissions from the ovens.

What DynCorp Technical Services Managers Can Do

- Install ventilation on the ovens in a timely fashion.
- Keep employees informed of progress on the ventilation.

What the DynCorp Technical Services Employees Can Do

- Inform management whenever there are health and safety concerns.

What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513/841-4252 and ask for HETA Report # 20010210

Health Hazard Evaluation Report 20010210
DynCorp Technical Services
Columbus Air Force Base, Columbus, Mississippi
July, 2001

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SUMMARY

On March 14, 2001, the National Institute for Occupational Safety and Health (NIOSH) received a request for assistance from the Occupational Safety and Health Administration (OSHA) regarding DynCorp Technical Services in Columbus, Mississippi. OSHA requested that NIOSH conduct a health hazard evaluation (HHE) regarding a potential cancer cluster and worker health complaints at a private contractor facility servicing military jet aircraft at Columbus Air Force Base. Specifically, employees were concerned about exposure to emissions from two industrial ovens used to heat treat engine components in Building 218.

On April 4, 2001, a NIOSH investigator conducted a site visit to the DynCorp Technical Services Building 218. The objectives of this site visit were to review the health complaints at the facility, obtain additional information regarding the occurrence of cancer among employees who worked in this building, and characterize the emissions from the two industrial ovens.

During the site visit, a walkthrough of Building 218 was conducted and material safety data sheets (MSDSs) for chemicals used in this building were reviewed. Subsequent activities included collecting air samples to characterize emissions from the ovens, holding informal discussions with employees regarding their health concerns, and reviewing work practices. The environmental monitoring was conducted using a qualitative broad spectrum technique which can identify a wide range of contaminants, as well as substance specific monitoring for carbon monoxide (CO) and oxides of nitrogen. For control purposes, samples were collected prior to operating the ovens and also from an adjacent administrative area. Information regarding the cases of cancer was obtained from the shop supervisor, individuals with cancer, and persons knowledgeable about those who had passed away with cancer.

The shop was clean, orderly, and no open chemical containers, or evidence of spills were found. Various solvents, lubricants, adhesives, and oils commonly found in engine repair facilities were present throughout the shop. Employee health concerns were primarily associated with exposure to contaminants from the bake ovens; other than occasional odors, no reports of irritation or discomfort were noted. An unrelated employee concern was noted regarding jet fuel remaining in engines and inadequate means for removing this fuel during maintenance.

During oven operation, visible emissions were observed from the seals and passive exhaust ports at the top of both ovens. A wide variety of compounds typical of those expected to be present in an engine maintenance facility were detected on all air samples collected. These included a number of aliphatic hydrocarbons, toluene, and other compounds normally associated with solvents, degreasers, and oils. Although quantitative data was not obtained, comparison of air samples collected prior to oven operation with those collected while the oven was in use did not identify any substantive differences in relative concentrations. Similarly, the process and control samples collected from the Administrative office were not substantially different and the results suggest that the Administrative office is isolated from the main work shop. Instantaneous air monitoring using direct-reading colorimetric tubes did not identify any detectable CO (less than one part per million) or oxides of nitrogen.

Information provided to NIOSH described several different types of cancer among DynCorp employees. These cancers do not appear to represent an unusual number of cancers. In addition, neither the distribution of types of cancers, exposures expected within the engine shop, or latency period suggest an occupational etiology.

Environmental monitoring indicates that the two industrial ovens are not substantial contributors to workplace airborne contaminants in Building 218. The characteristics of the cancer cases did not suggest an occupational etiology. To address worker concerns and resolve questions regarding the ovens, a prudent course of action would be to ventilate the ovens outdoors. Recommendations for oven ventilation and removal of jet fuel from the ovens is provided in the Recommendation section of this report.

Keywords:7699 (Repair Shops and Related Services, NOC). Cancer, Industrial Ovens, Qualitative Air Sampling, Aircraft Engine Maintenance, Carbon Monoxide, Oxides of Nitrogen, Respiratory Irritation.

TABLE OF CONTENTS

INTRODUCTION

On April 4, 2001, a NIOSH investigator conducted a site visit at the Columbus Air Force Base in Columbus, Mississippi, in response to a request for a health hazard evaluation (HHE) from the Occupational Safety and Health Administration (OSHA). OSHA asked NIOSH to investigate workplace hazards and a possible cluster of cancer cases in Building 218 at this Base. Building 218 is an engine maintenance facility operated by a private contractor, DynCorp Technical Services. Specific concerns included long-term effects associated with exposure to emissions from two industrial ovens used for heat treating engine parts.

During the site visit, information regarding the cases of cancer among current and former Building 218 employees was obtained. Environmental monitoring was conducted to characterize emissions from the ovens. A workplace review was conducted to evaluate materials used in the maintenance shop and observe work practices.

BACKGROUND

The mission of the Columbus Air Force Base is to train Air Force pilots. Student pilots will typically spend a year at the Base, where they receive flight instruction and training utilizing three types of jet aircraft: T-32, T-38, and the T-1. To support the training, the Air Force Base has numerous runways, aircraft hangers, maintenance facilities, and class rooms.

DynCorp Technical Services

DynCorp Technical Services, Columbus Support Division, is a civilian contractor that provides full service military jet maintenance and repair at the Columbus Air Force Base. DynCorp was the contractor from 1989-1993, when the contract was awarded to Raytheon Corporation; at this time many DynCorp employees continued to work at the facility. In October, 1998, DynCorp reacquired the contract. Approximately 550 workers are employed by DynCorp at the Columbus Base. Employees are represented by the International Organization of Electronic and Communication Workers of America (IOE/CWA), Local 77.

At the Columbus Base, Air Force personnel have overall responsibility for equipment, chemicals, parts, and building maintenance. DynCorp has responsibility for aircraft maintenance and service personnel, and project management. DynCorp personnel are also responsible for janitorial services, and occasionally may perform minor machine maintenance.

Building 218 Maintenance Floor

Building 218

Building 218, also known as the Engine Shop, operates on a 2-shift basis and employs 40 workers. Building 218 is a single-story facility encompassing approximately 25,000 square feet, with concrete flooring, block walls, an open maintenance floor with overhead doors at each end, and an adjacent administrative area. The administrative offices are air-conditioned and ventilated by a separate heating, ventilating, and air-conditioning system. Food and beverage consumption is allowed in work areas and there is a designated break area. Smoking is not permitted inside the building.

Full engine repair, maintenance, and assembly is conducted in this building. One aspect of engine maintenance entails heat treating selected engine components (bearings and compressor cases) two to three times a week. This is accomplished with two electric industrial ovens located approximately 75 feet apart in Building 218. Prior to heat treating, the engine bearings are conditioned with a corrosion inhibitor, a fingerprint remover, and then dipped in lubricating oil. After excess oil is drained, the bearings are placed in one of the ovens for twelve minutes at 240° C. The other bake oven is used for different engine components and is also used two or three times a week. The components are first treated with a solid film lubricant, that is either brushed or sprayed on the part. The component is then heat treated at 550° F for one hour or longer. Neither oven is equipped with a local exhaust ventilation system, and both passively vent into the shop area when in use. The ovens have been in operation since 1979.

Health Complaints

Employee concerns with exposure to emissions from the bake ovens in Building 218 began approximately one year ago. Prior to filing the OSHA complaint, the operation was reviewed by Air Force Safety and Health personnel and a work order was initiated to ventilate the ovens to the outside. However, Air Force personnel indicated that it would take approximately six months to complete this renovation.

OSHA received a formal complaint from DynCorp workers in Building 218 on February 5, 2001. The complaint was prompted by concerns about odors emitted from the two industrial ovens, and that exposure to contaminants from these ovens may have contributed to an increase in cancers among current and former workers in building 218. In response to the complaint, an inspection was conducted by OSHA on February 8, 2001. During the inspection, the operation of the ovens used to heat jet engine components was reviewed, and material safety data sheets (MSDSs) for compounds used to treat the engine components prior to heat treating were obtained. No citations were issued as a result of the inspection. Because of employee concerns regarding the number of cancer cases and the lack of OSHA violations, NIOSH was asked to conduct an evaluation of the facility.

METHODS

Prior to conducting the April 4, 2001, site visit, background information was obtained about the process and health concerns in Building 218 from OSHA, employee representatives, and management. Based on this information, an evaluation strategy that entailed a process review, environmental monitoring, and obtaining information about the cases of cancer was developed.

During the site visit, a walkthrough of Building 218 was conducted and material safety data sheets (MSDSs) for chemicals used in this building were reviewed. Subsequent activities on April 4 and 5 included collecting air samples to characterize emissions from the ovens, holding informal discussions with employees on both day and evening shifts regarding their health concerns, and reviewing work practices.

Cancer

Information regarding the cases of cancer was obtained from the shop supervisor, and a form requesting additional information about the cancers was provided. This data collection form was intended to be completed by individuals with cancer, or persons knowledgeable about those who had passed away with cancer, and returned to the NIOSH Medical Officer.

Qualitative Air Sampling

Qualitative air monitoring was conducted to characterize volatile compounds that may be present in emissions from the two industrial bake ovens in Building 218. Monitoring was also conducted prior to oven operation to determine background levels, as well as in an adjacent administrative area. These area air samples were obtained utilizing reusable multibed thermal desorption (TD) tubes as the collection media. These stainless steel tubes contain 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 sampling the tubes were conditioned by heating at 375°C for 2 hours. This technique is designed to trap a wide range of organic compounds for subsequent qualitative analysis via thermal desorption and gas chromatography/mass spectrometry (GC/MS).

Low-flow air sampling pumps (SKC Pocket Pump™) were used to collect the air samples. The SKC pumps are constant-flow sampling devices and were pre- and post-calibrated using a primary standard (BIOS® Dry Cell) to verify the flow rate. Flow rates of 50 cubic centimeter per minute (cc/min) were used for the area monitoring and the sample time was approximately two hours.

After collection, the samples and blanks were shipped via overnight delivery to the NIOSH laboratory for analysis. At the NIOSH laboratory, each sample was analyzed by directly inserting the tube into a thermal desorber unit (Perkin Elmer ATD 400 thermal desorption system) with no other sample preparation. Samples were dry purged with helium for 30 minutes at 100 cc/min to remove water. A desorption time of 10 minutes at 300°C was used and the thermal desorber was directly connected to a HP6890A GC and HP5973 MS detector. Reconstructed total ion chromatograms were obtained for each sample, and all were scaled the same for comparison. Each peak in the chromatogram was identified.

Carbon Monoxide

A Metrosonics PM-7700 toxic gas monitor with a CO sensor was used to measure CO at various areas in Building 218, including directly from the exhaust ports of the ovens during operation. The instrument was zeroed and then calibrated prior to use with a known concentration of CO. According to the manufacturer, instrument sensor repeatability is ± 2% at an operating temperature of -5 to 40° C.

Bake Oven #1 and Sampling Media Location

Oxides of Nitrogen

Sampling for NOx was conducted using Dräger® Nitrous Fumes 0.5/a (NO + NOx) direct reading colorimetric indicator tubes and a bellows pump. With this sampling technique, a known volume of air is drawn through the tube and the media inside the indicator tube will change color in proportion to the concentration of contaminant. According to the manufacturer, the relative standard deviation for this sampling methods is 10-15%.[1] Background samples were collected prior to oven operation and directly from the exhaust ports of the ovens during operation.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the 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 even though 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 criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increases the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[2] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[3] and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).[4] Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criterion.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 95–596, sec. 5.(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8-to-10-hour workday. Some substances have recommended STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Cancer

Cancer is a group of different diseases that is common in the United States and may occur among people at any workplace. One in two men and one in three women will develop some type of cancer in their lifetime. One of every four deaths in the United States is from cancer. Among adults, the rate of occurrence grows with increasing age. These figures show the unfortunate reality that cancer occurs more often than many people realize.

Cancers can also occur in clusters. Cases that are close together in time or space may have a common cause or may be the coincidental occurrence of unrelated causes. The number of cases may seem high, particularly among the small group of people who have something in common with the cases, such as working in the same facility. Several elements are needed to establish that cancers occurring among employees are work-related. These elements, in the form of questions, are as follows:

- Is there an excess number of cancer cases than would be expected of a similar population with regard to age, gender, and race?
- Is there an unusual distribution of types of cancer given the age and gender of the workforce?

- Is there an exposure in the workplace known to be associated with this type of cancer? For example, exposure to asbestos fibers can cause lung cancer and a specific type of cancer known as mesothelioma.
- Has a sufficient length of time elapsed for the development of cancer? An important concept in cancer epidemiology is the **latency** period. The **latency** period is the time between onset of exposure to a carcinogen and the clinical detection of resulting cancers. **Latency** periods vary by cancer type. Usually, the latency period for most solid tumors is 15 to 20 years.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless gas that is a product of incomplete combustion. Engine exhaust, tobacco smoking, and inadequately ventilated combustion products from heaters that use hydrocarbon fuel are sources of CO. Overexposure to CO may cause initial symptoms such as weakness, confusion, headache, dizziness, drowsiness, and nausea. More serious effects such as loss of consciousness, or collapse can occur if high exposures are encountered.[5] The NIOSH REL for CO is 35 ppm as a time-weighted average for up to 10 hours per day. NIOSH also recommends a ceiling level of 200 ppm for CO.[2] The ACGIH TLV for CO is 25 ppm.[3]

Oxides of Nitrogen

Sampling was conducted for oxides of nitrogen (nitrogen dioxide [NO_2], nitric oxide [NO]) because it is associated with combustion processes and because of its acute irritant effects. NO_2 is a reddish/dark-brown gas with a pungent, acrid odor. NO_2 is a respiratory irritant and can cause pulmonary edema.[6] The NIOSH REL for NO_2 is 1 ppm as a 15 minute short-term exposure limit (STEL).[2] Most reported cases of severe illness due to NO_2 have been from accidental exposures to explosion or combustion of nitroexplosives or nitric acid, from arc or gas welding (particularly in confined spaces), or from entry into unvented agricultural silos.[7]

RESULTS

Workplace Observations

The shop was clean, orderly, and no open chemical containers, or evidence of spills were found. Comfort fans are commonly used in the summer, and the roof is equipped with ventilator fans that operate during the hotter times of the year. In addition to the heat treating operation, other activities conducted in this shop include spray washing, welding (Heliarc, tungsten inert gas), wet and dry abrasive blasting using aluminum oxide and plastic media within an enclosed booth, ultrasonic cleaning of parts, and sodium hydroxide cleaning in dip tanks located in a separate room. There is also a parts cleaning station using a commercially available non-chlorinated hydrocarbon solvent (under a ventilated hood), and various lubricants, adhesives, and oils commonly found in engine repair facilities are also present throughout the shop. Chemical inventories are maintained by the Air Force, and MSDSs were available in the work area for the materials used in the shop.

Employees typically wear disposable nitrile gloves when there is potential contact with lubricants, oils, and other shop materials. All workers wear a company provided uniform (pants and shirt). Extra uniforms are provided and a laundry service is available. Respiratory protection is not routinely used by workers in Building 218 and no jobs where respiratory protection is necessary were identified during the NIOSH site visit.

Informal discussions with workers indicated that employee health concerns with exposure to contaminants from the bake ovens appear to be primarily on the day shift. Although the bake ovens also operate at night, discussions with night-shift employees did not identify significant health complaints or concerns. The concerns appeared to be primarily associated with long-term effects from exposure to emissions; other than an occasional odor, no reports of irritation of discomfort were noted.

An unrelated employee concern was noted regarding jet fuel remaining in engines and inadequate means for removing this fuel during maintenance. During certain engine tasks, remaining jet fuel is drained into an open bucket on the shop floor. Although this task was not observed during the NIOSH site visit, workers reported there are times when the bucket is not removed in a timely manner, resulting in vapors from the fuel volatilizing into the work area, and occasional spills.

Oven Operation

Both ovens are floor mounted against a wall and are vented to atmosphere at the top of the oven. Prior to heat treating in Oven #1 (Bearing Oven), the bearings are cleaned with a commercial non-chlorinated hydrocarbon solvent, soaked overnight in a carbon remover, again rinsed in the commercial solvent, drained and inspected. After inspection, the bearing is lubricated with aircraft oil, and the bearing race is wrapped in aluminum foil prior to heat treating. The bake cycle for bearings is 12 minutes at 240° C. Gearboxes are also heat treated in this oven approximately 2-3 times a week. The gearboxes are wiped off with a cloth prior to treating, but traces of the aircraft lubricating oil may still remain. The Gearboxes are left in the oven for 15 minutes, and appear to generate the most visible emission and noticeable odor. Gearbox baking is perceived by employees as the "worst-case" heat treating operation.

The Aircraft Mount Oven (Oven # 2) is located adjacent a welding area at the front of Building 218. Engine mounts, bleed valves, and VEN housing leaves are baked in the oven. Prior to baking, the ovens are treated with a solid film spray lubricant or brushed with a lubricant oil. The parts are then heated for 60 minutes at 550 °F. During oven operation, visible emissions were observed from the seals and passive exhaust ports at the top of both ovens.

Bake Oven #2

Air Monitoring

Qualitative Air Sampling

Prior to operating the ovens on April 5, area air sampling using qualitative thermal desorption sampling media was conducted from 7 AM to 9 AM in Building 218. Samples were collected adjacent each oven, in an adjacent office area, and at the Age Desk located in the South (opposite) end of the shop. At approximately 9 AM, the control samples were removed and replaced with new sampling media. Sampling was begun immediately after a gearbox was placed in Bake Oven #1 and a basket of VEN leaves was placed in Bake Oven #2. The gearbox was heat treated in Bake Oven # 1 for 15 minutes and then removed; no other use of the oven occurred that day. After the VEN leaves were heat treated for one hour, they were removed and two bleed air valves were placed in the oven for heat treating for the remainder of the sampling period. At approximately 11 AM, the process samples were removed, packaged, and shipped to the analytical laboratory. During the collection of both the control and process samples, the overhead doors were closed, and the doors to the cleaning shop were open. All comfort fans and roof ventilators were off during the monitoring, and shop activities were considered normal.

Copies of the reconstructed total ion chromatograms and a table identifying each numbered peak are shown in Appendix A. The chromatograms are scaled the same for comparison purposes. Although true concentrations are not available from these data, because the sample volumes were the same, the signal strength of each identified peak allows for relative comparison. Major compounds detected on the thermal desorption tubes were various C_9-C_{12} aliphatic hydrocarbons and alkyl benzenes, dichlorobenzene, toluene, butyl acetate and butyl cellosolve, which are typical of materials used in machine shops and engine repair facilities. Fifty eight different compounds were identified.

Comparison of the sample chromatograms did not identify any substantive differences between the control and process samples taken on the shop floor at both ovens and the Age Desk. Similarly, the process and control samples collected from the Administrative office were similar and the results suggest that the Administrative office is isolated from the main work shop.

Carbon Monoxide and Oxides of Nitrogen

Instantaneous air monitoring using direct-reading colorimetric tubes did not identify any detectable CO (less than one part per million) or oxides of nitrogen. Samples were collected prior to oven operation and then directly from the emission port of the oven during heat treating.

Cancer

During the site visit, DynCorp representatives indicated that five cases of cancer had occurred among current and former Building 218 workers, including one person each with lymphoma, prostate, bladder, leukemia, and esophageal cancer. The case of leukemia occurred in a recently hired worker who was training to be an engine mechanic but had not actually started work in Building 218. Additional information regarding three of the five cases of cancer was subsequently provided to the NIOSH Medical Officer. This information indicated that two cases of bladder cancer and 1 case of esophageal cancer had occurred. One of the bladder cases was hired only 5 years before the cancer diagnosis.

DISCUSSION

The results of the air monitoring and workplace review did not indicate that pervasive exposures to contaminants from the bake ovens is occurring in Building 218. Comparison of control and process samples indicated that oven emissions had only a small influence on the type and quantity of air contaminants in the shop. The bake ovens are only used for a portion of the day, and other chemicals present were common shop materials used in relatively small quantities, or were contained. Carbon monoxide and oxides of nitrogen were not detected in any of the samples. This was not unexpected as the ovens are not operated at a temperature where combustion is occurring, there is sufficient oxygen present in the ovens (parts are heated in a standard atmosphere with no attempt to provide an inert environment), and there is typically only a small quantity of residue present on the parts. No unusual work practices involving hazardous materials were identified during the NIOSH review.

There is considerable day shift worker concern regarding exposure to emissions from the ovens. The presence of visible emissions, particularly from the gearbox, odors, lack of information about the composition of the emissions, and the cases of cancer among co-workers has understandably led to this concern. Plans had been developed to ventilate the ovens, however, delays in implementing these modifications heightened worker concerns. Although environmental monitoring did not identify the ovens as a significant source of contaminant emissions, providing exhaust ventilation (e.g., canopy hood over the oven, direct venting outdoors) for these ovens appears to be a reasonable and prudent precaution. Properly ventilating the oven will address worker concerns regarding the odor and possible adverse health outcomes associated with exposure to oven emissions. Strategies to ventilate the ovens should consider emissions from seals and gaskets on the ovens, and routine maintenance to ensure that the seals are functioning properly is necessary.

The occurrence of cancer is common in the U.S. population, and cancer is a term for a number of different diseases with different (when known) causes and outcomes. Information provided to NIOSH described four to five different types of cancer and the distribution of cases did not appear unusual among DynCorp employees given the age and gender of the workforce. All but one of the reported cancers occurred in male workers greater than 50 years old. At least two of the cancer cases mentioned in the HHE request did not meet sufficient latency criteria, that is, there did not appear to be sufficient time between working in Building 218 and the occurrence of cancer for the disease to develop as the result of an occupational exposure. Upon review, these cancers do not appear to represent an unusual number or types of cancers that followed a consistent pattern, and it is unlikely that further evaluation by NIOSH concerning these cancers would be useful.

CONCLUSIONS

Environmental monitoring indicates that the two industrial ovens are not substantial contributors to workplace airborne contaminants. Comparison of sampling results from control (before oven operation) and process air monitoring suggests very little change in the composition of airborne chemicals for the compounds monitored. Carbon monoxide and oxides of nitrogen were not detected in any sample. Unpleasant odors and visible emissions from the ovens, the occurrence of cancer among some Building 218 employees, lack of data regarding the composition of the oven emissions, and delays in providing ventilation controls, have created employee concern that the ovens present a health threat. A prudent course of action would be to ventilate the ovens outdoors. Data regarding the cases of cancer that have occurred among current and former Building 218 employees did not indicate any common elements that would suggest a work-place explanation.

RECOMMENDATIONS

1. Design and implement a ventilation system for the ovens to scavenge and exhaust emissions outside Building 218. Design options include a canopy design or direct exhaust from the oven port. It may be advantageous to place the ovens next to each other on an outside wall to allow for a more efficient ventilation installation. Ensure ovens are maintained and that any leaking seals or gaskets are replaced.

2. Develop a procedure and obtain the necessary equipment for removing fuel from engines prior to work in a manner that contains the removed fuel. Input on any procedural changes or equipment should be obtained from employees who work on these engines.

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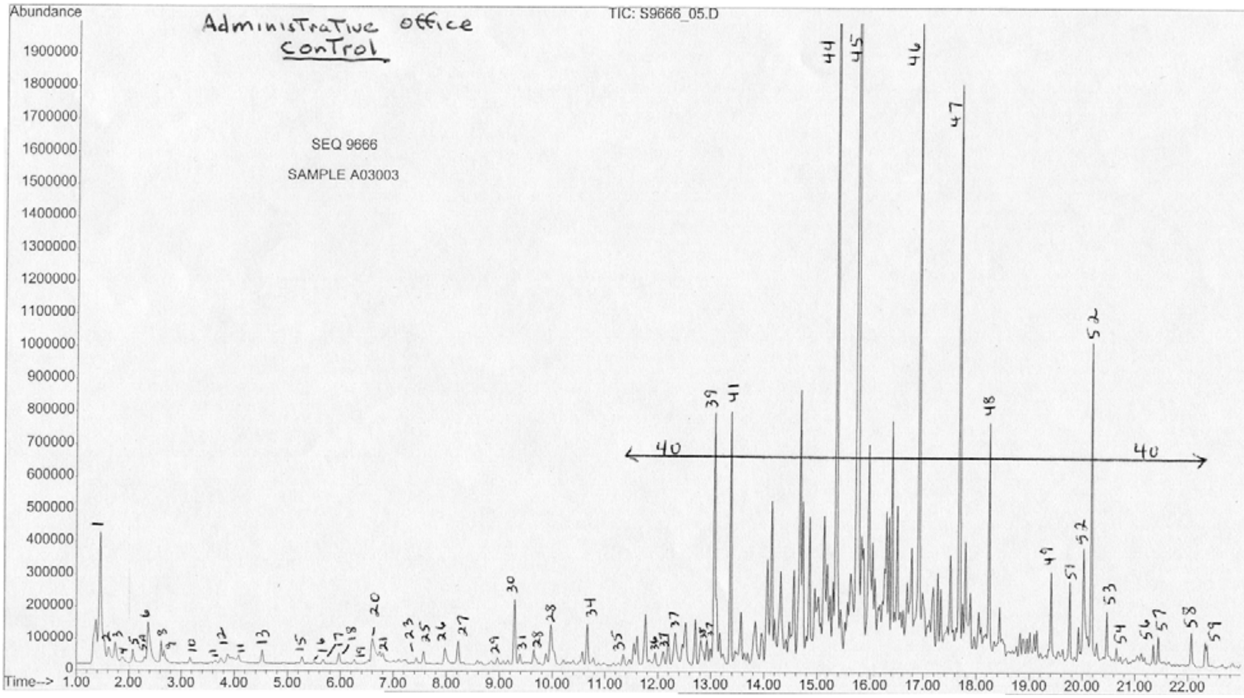
APPENDIX A: THERMAL DESORPTION TUBE RESULTS

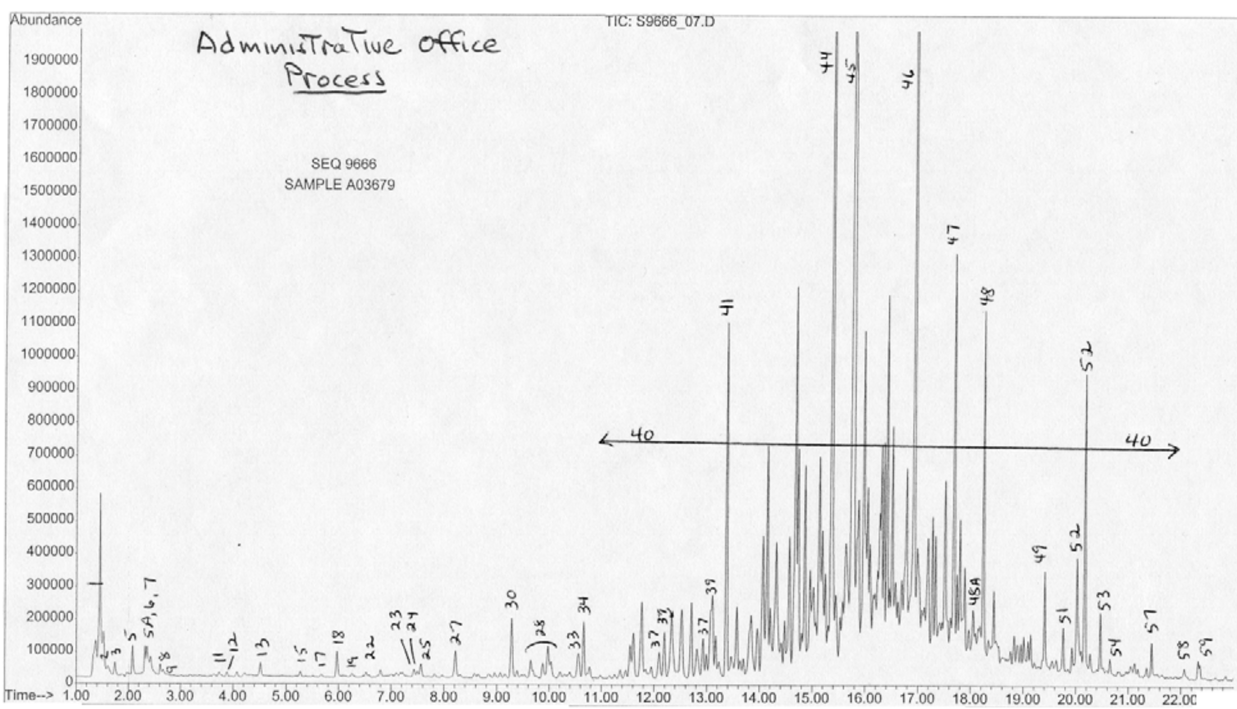
SEQ 9666
THERMAL DESORPTION TUBES
PEAK IDENTIFICATION

1) Air*/CO_2*
2) Dichlorodifluoromethane*
3) Methanol*/isobutane
4) Butane*
5) Ethanol
5A) Acetone
6) Isopentane*
7) Isopropanol
8) Pentane*
9) C_5H_8 isomer (isoprene)
10) Isobutyraldehyde?
11) C_6 aliphatic hydrocarbons
12) Methyl ethyl ketone (MEK)
13) Hexane
13A) Ethyl acetate
14) Tetrahydrofuran
15) Methyl cyclopentane
16) 1,1,1-Trichloroethane
17) Methyl isopropyl ketone
18) Benzene*/butanol
19) Cyclohexane
20) Ethylene glycol
21) Pentanal*
22) C_7 aliphatic hydrocarbons
23) Methyl methacrylate (MMA)
24) Propyl acetate
25) Heptane
26) Propylene glycol
27) Methyl cyclohexane/methyl isobutyl ketone (MIBK)
28) C_8 aliphatic hydrocarbons
29) Hexanol
30) Toluene
31) Cyclopentanone
32) Hexanal*
33) Butyl acetate
34) Octane
35) Hexamethylcyclotrisiloxane*
36) Propylene glycol methyl ether acetate
37) Xylene/ethyl benzene isomers
38) Styrene
39) Butyl cellosolve
40) C_9-C_{16} aliphatic hydrocarbons including alkyl cyclohexanes, alkyl decahydronaphthalenes, plus some C_9-C_{10} alkyl benzenes
41) Nonane
42) C_8-C_{10} aliphatic aldehydes*
43) Octamethylcyclotetrasiloxane*
44) Decane
45) Dichlorobenzene isomer(o- or m-)
45A) Limonene
46) Undecane
47) Decamethylcyclopentasiloxane*
48A) Naphthalene
48) Dodecane
49) Tridecane
50) Methyl naphthalenes
51) Siloxane compound*
52) $C_{12}H_{24}O_3$, methyl propanoic acid esters such as:
    a) 2,2-dimethyl-1-(2-hydroxy-1-methylethyl)propyl ester
    b) 3-hydroxy-2,4,4-trimethyl-pentyl ester
53) Tetradecane
54) Diisopropyl adipate
55) Dimethyl phthalate*
56) Methyl ionone, $C_{14}H_{26}O$ isomer?
57) Pentadecane
58) Diethyl phthalate*
59) Hexadecane

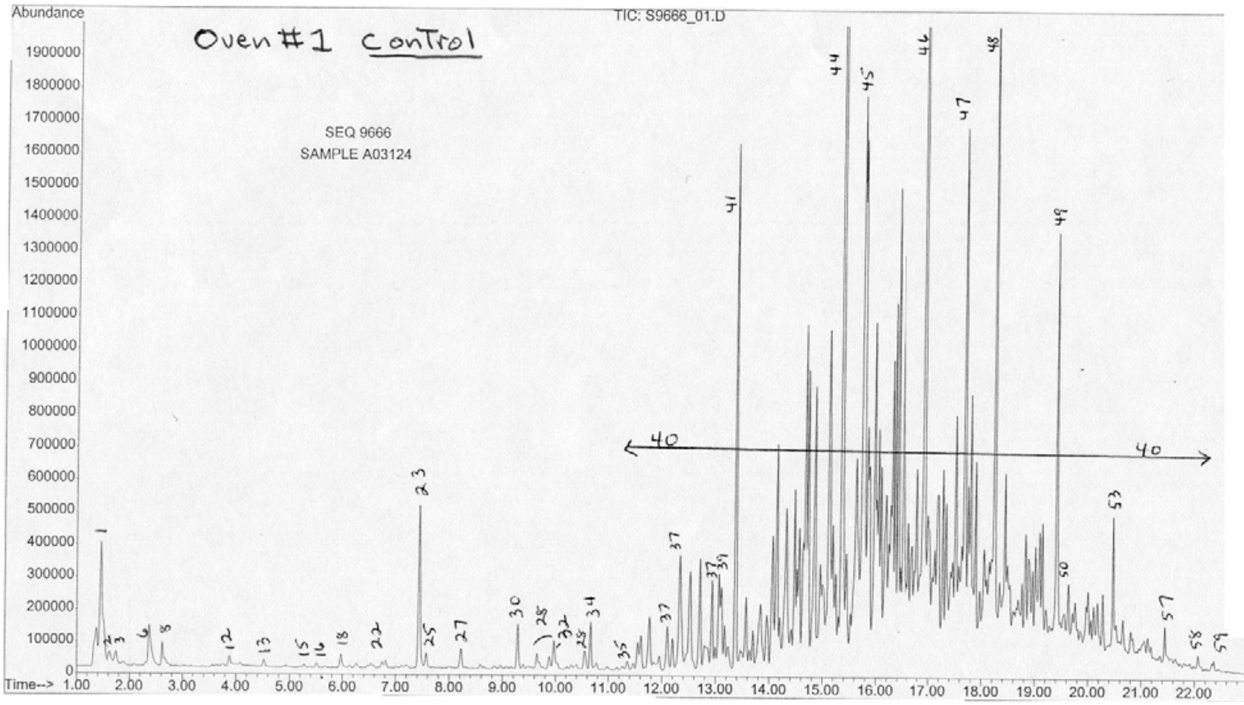
*Also present on some media and/or field blanks.



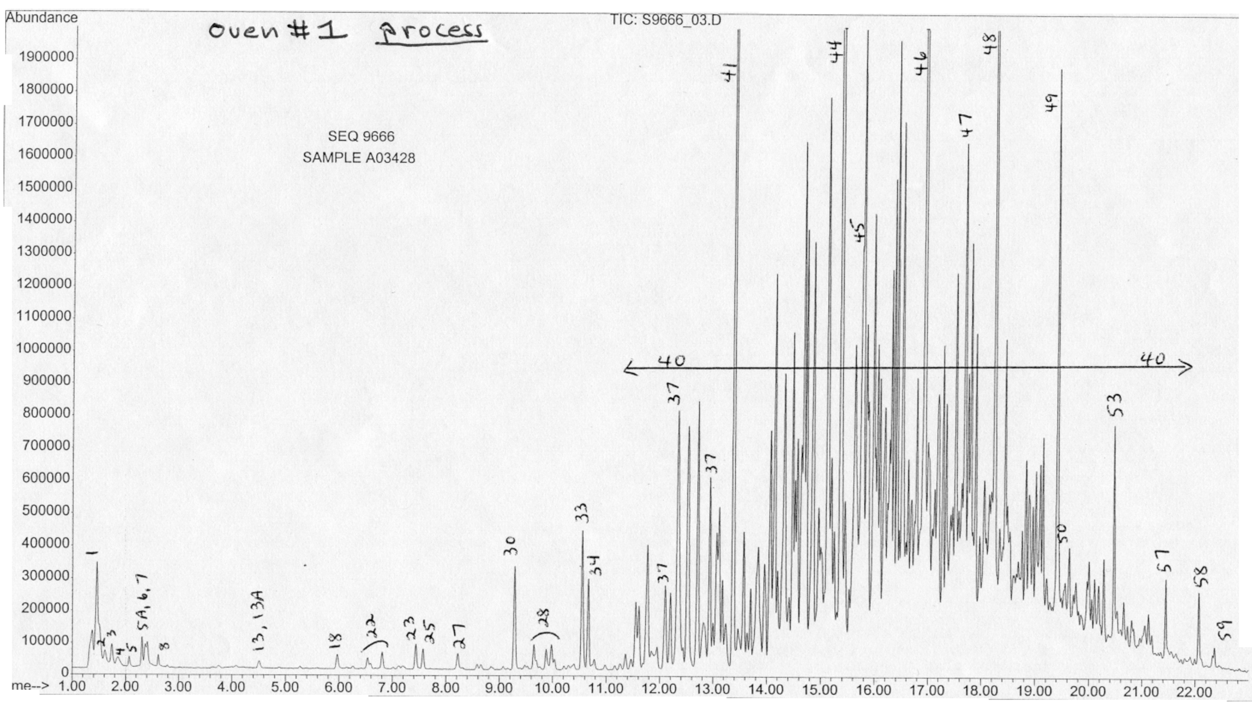
Administrative Office Control Sample (Prior to Oven Operation)



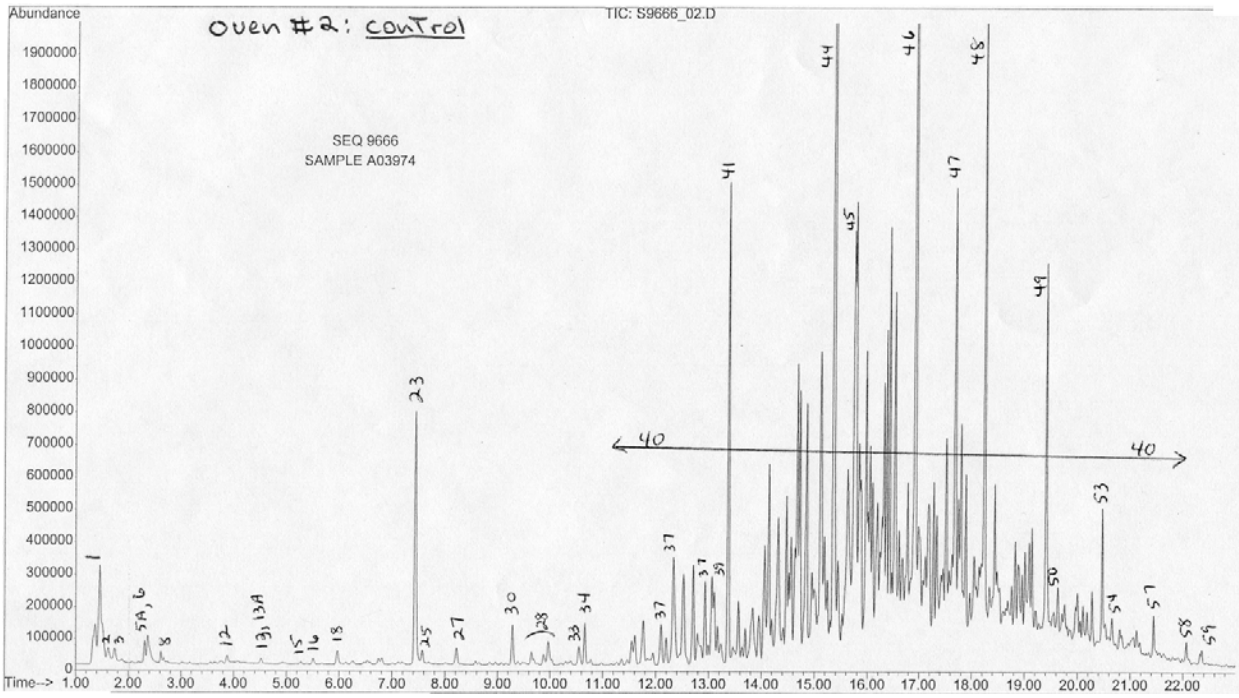
Administrative Office Process Sample (During and After Oven Operation)



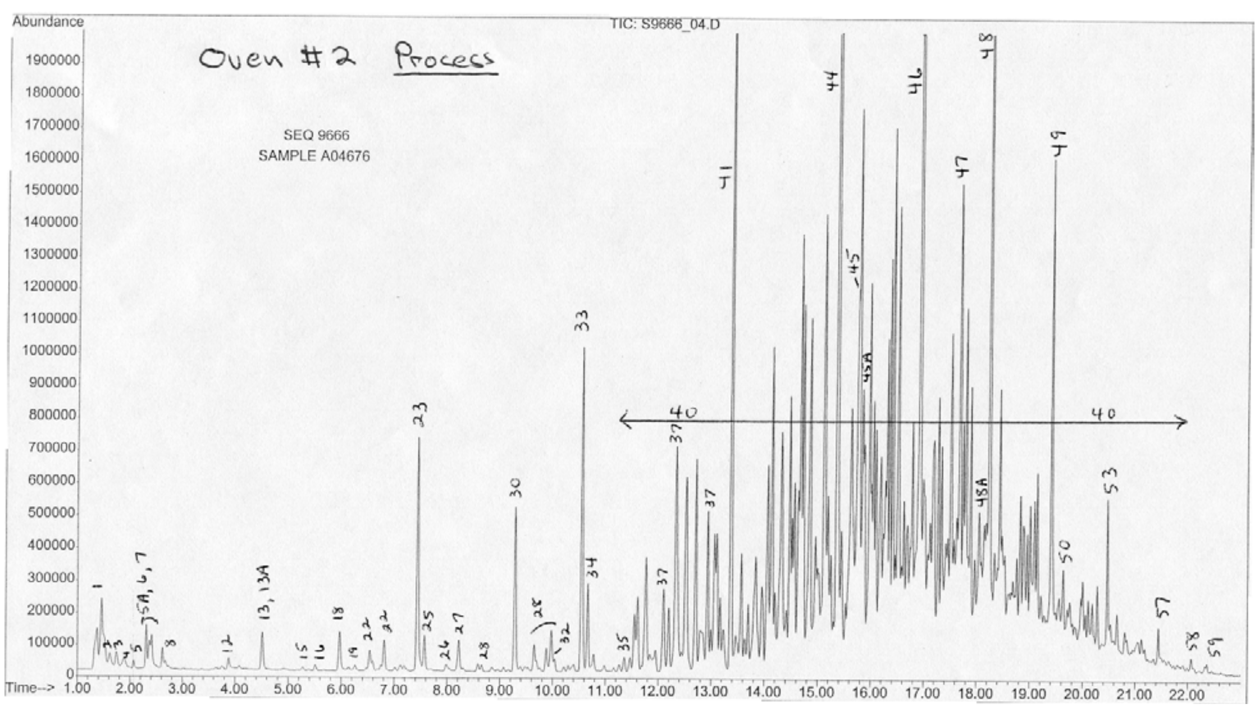
Oven #1 Control Sample (Prior to Oven Operation)



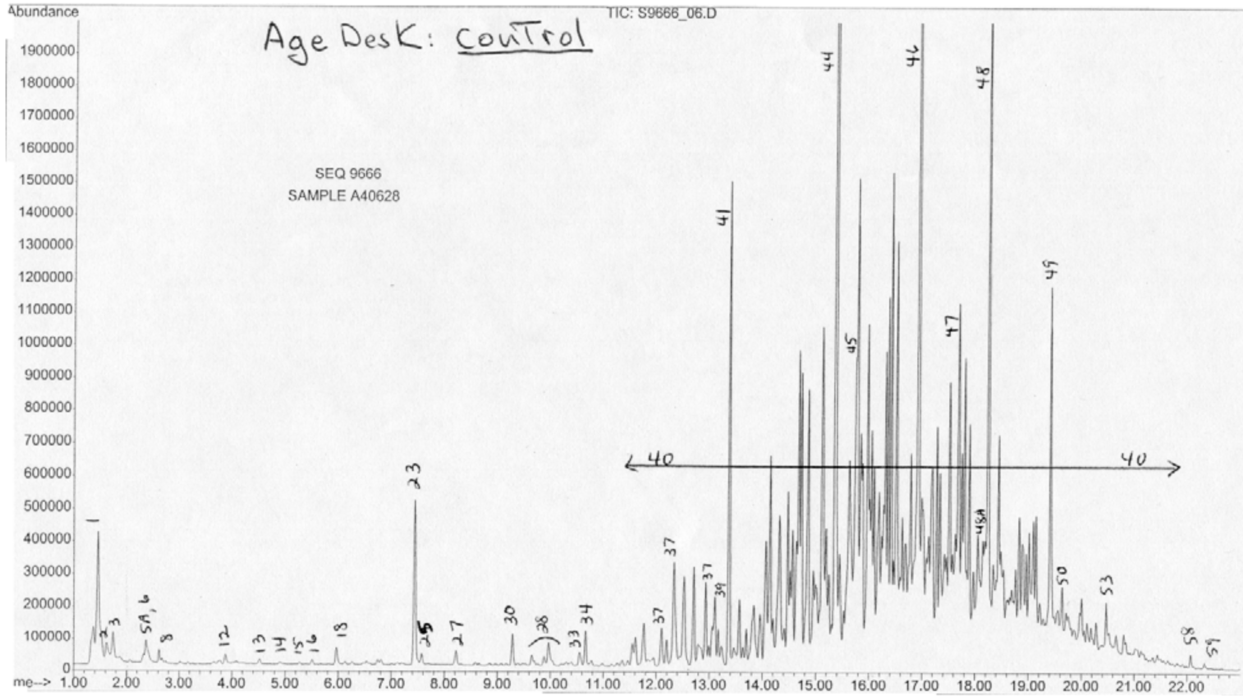
Oven #1 Process Sample (During and After Oven Operation)



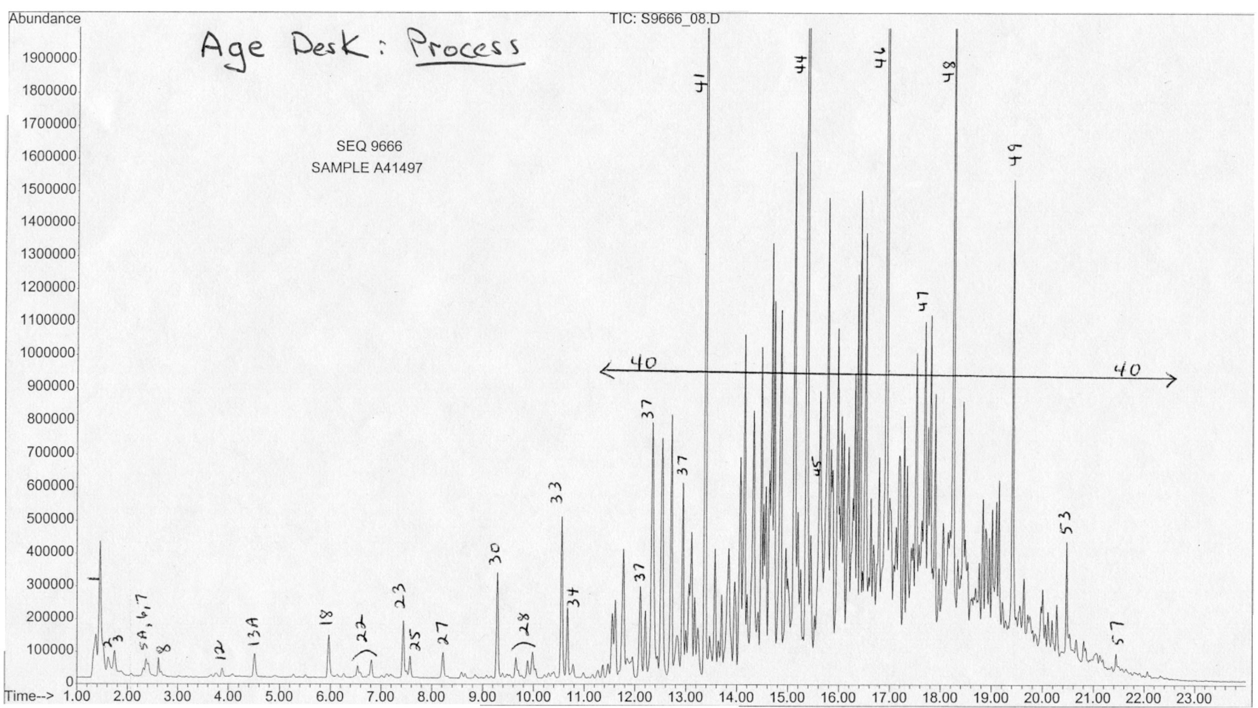
Oven #2 Control Sample (Prior to Oven Operation)



Oven #2 Process Sample (During Oven Operation)



Age Desk Control Sample (Prior to Oven Operation)



Age Desk Process Sample (During Oven Operation)

For Information on Other
Occupational Safety and Health Concerns

Call NIOSH at:
1–800–35–NIOSH (356–4674)
or visit the NIOSH Web site at:
www.cdc.gov/niosh