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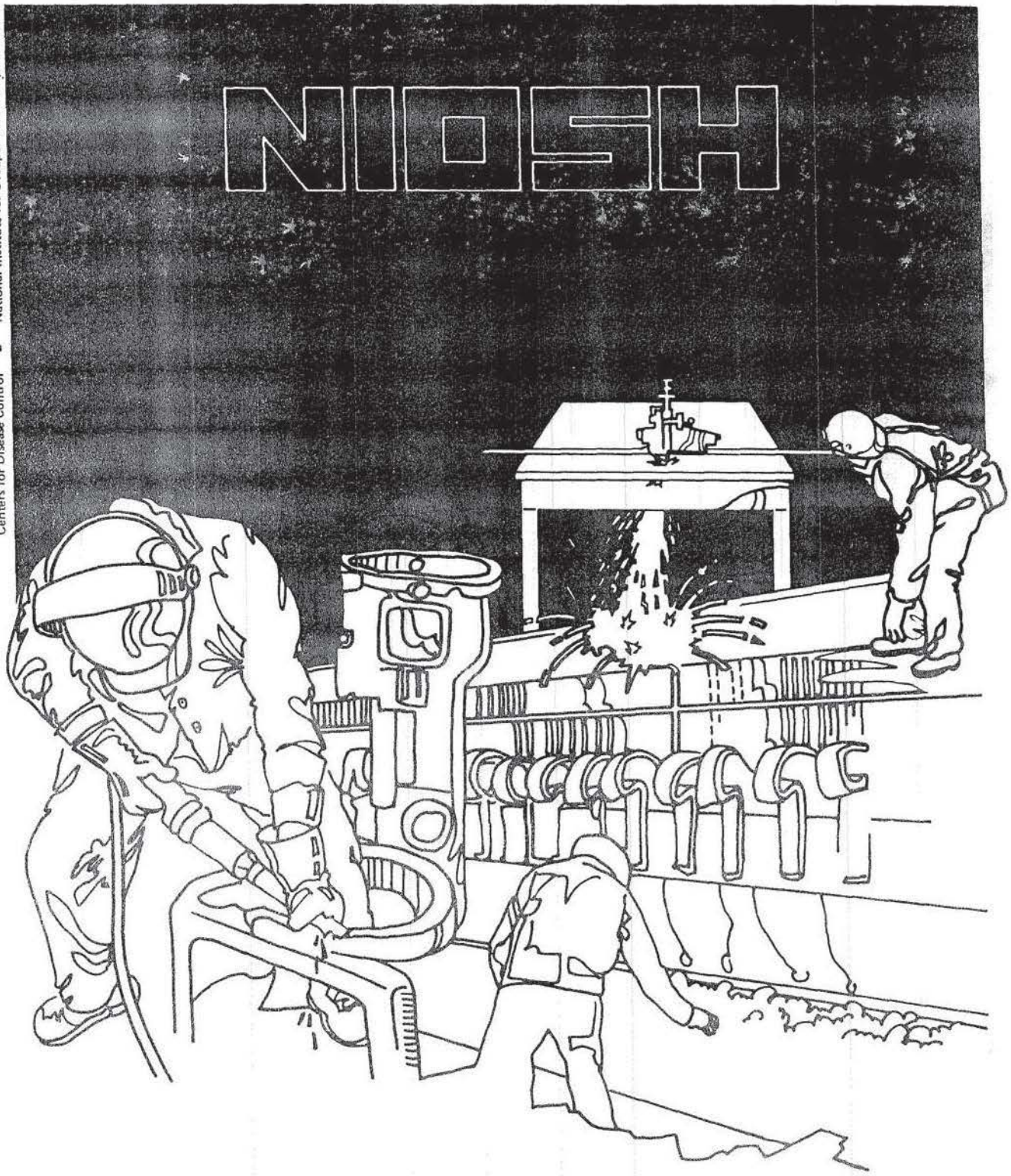

Health Hazard Evaluation Report

HETA 81-280-1042
HARLEM HOSPITAL CENTER
NEW YORK CITY, NEW YORK

PREFACE

The Hazard Evaluations and Technical Assistance Branch of 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 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.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) 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.

HETA 81-280-1042
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Harlem Hospital Center
New York City, New York

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I. SUMMARY

In April 1981, the National Institute for Occupational Safety and Health (NIOSH) was requested by representatives of District Council 37 to aid in an investigation of environmental conditions at Harlem Hospital Center, 506 Lenox Avenue, New York City, N.Y. 10037. The request primarily concerned conditions in the eighth floor laboratories, where about 185 employees and students work. On March 23, 1981, personnel on the 8th floor began to experience respiratory problems, nausea, eye irritation, headache and dizziness. Over the next few days, 58 individuals were evaluated at the center's emergency room. Blood tests indicated that 26 individuals (45%) had hypoxia (pO_2 arterial levels less than 80% of expected), which improved upon removal from the 8th floor environment. Three persons were hospitalized briefly for observation. Fifty-eight individuals were placed on administrative leave for up to two weeks while the situation was being investigated.

The Center's administration requested the services of the New York City Department of Health and the New York City Department of Environmental Protection which sampled the environment at the time of the incident. District Council 37 (representing the public sector employees) requested the services of the New York State Department of Labor. District 1199 (representing the private sector employees) filed a complaint with the Occupational Safety and Health Administration (OSHA). It was determined that the N. Y. State Department of Labor and OSHA were legally required to respond to their requests; that the other governmental agencies would lend personnel and material support as requested; and that NIOSH would prepare a final report, based on the findings of the various investigations.

Surveys were conducted to determine exposure to organic solvents, chlorine, vinyl chloride, sulfur dioxide, oxygen content, formaldehyde, hydrogen sulfide, and mercury vapor. No contaminants were detected except for low concentrations of airborne xylene and ethyl benzene detected on one sample.

No excessive exposure to any environmental contaminant was found in the laboratory areas at the times of the surveys. The incident appears to have been transient and has not recurred. Several recommendations, based on established industrial hygiene principles, were made. These recommendations concerned the maintenance of the ventilation system, the "Somat" system, the waste acid tanks, fume hoods and drains in the laboratories.

KEYWORDS: SIC 8062 (General Medical and Surgical Hospitals), hydrogen sulfide, formaldehyde, organic vapors, indoor air pollution, laboratories.

II. INTRODUCTION

On April 15, 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request to perform a health hazard evaluation at the Harlem Hospital Center (HHC), 506 Lenox Avenue, New York City. The official request was made by a representative of District Council 37, American Federation of State, County and Municipal Employees (AFSCME), AFL-CIO. At about the same time, the administration of the HHC telephoned a request for NIOSH's aid in investigating conditions at the Center. The requests were prompted by an incident in which 58 workers in the 8th floor laboratories of the Martin Luther King Building became ill and received medical attention at the HHC emergency room.

III. BACKGROUND

Harlem Hospital Center is a large health care complex centered on Lenox Avenue and 135th Street in Manhattan. The center employs about 3,400 persons in several buildings. The request concerns about 185 employees and students who work in laboratories on the 8th floor of the Martin Luther King building, which is about 10 years old. The 8th floor has about 6,000 square feet in area with 10 foot high ceilings. The laboratory area is divided into 35 individual laboratories and a few offices, and is supplied with tempered air from a central source. The laboratories have expanded over the years and are crowded with both personnel and equipment. Several of the laboratory operations are not equipped with adequate exhaust ventilation, and instead have temporary "hoods" which exhaust xylene and formaldehyde vapors through activated charcoal filters into the laboratories' air.

The laboratories are open around the clock, with about 130 workers on duty during the normal day shift and skeleton crews working during the evening and night shifts. Fifty-two of the laboratory workers are employees of Columbia University, a private concern with which the HHC is affiliated. These employees are represented by the United Health and Hospital Workers, District 1199. The remainder of the workers are employees of New York City Health and Hospital Corporation and are represented by AFSCME, District Council 37. At the start of the incident, the HHC had requested the services of the New York City Department of Health and of the New York City Department of Environmental Protection. Soon afterward, District 1199 requested the services of Occupational Safety and Health Administration (OSHA). District Council 37 requested the services of the New York State Department of Labor and NIOSH.

On April 28th, a meeting was held among the five governmental agencies, the two unions, the administration of the HHC and representatives of the workers from the laboratories. The purpose of the meeting was to obtain a chronology of the incident, to determine the extent of the problem, to assign responsibility for future actions and to coordinate those actions.

It was determined that the New York State Department of Labor (DOL) and OSHA had legal commitments to conduct environmental sampling in responce to complaints from public sector (DOL) and private sector (OSHA) employees; that the other governmental agencies would lend personnel and material support as requested; and that NIOSH would prepare a final report, based on the findings of the various investigations.

The purposes of environmental monitoring in emergency situations are two-fold: If environmental monitoring can be performed during the incident, it may be possible to determine if there is an environmental contaminant which causes or contributes to the situation. If only post-incident monitoring is possible, environmental monitoring may determine if hazardous levels of contamination persist after the incident. With the information obtained from environmental monitoring, recommendations can be made to protect the health of exposed personnel, to indicate treatment and to make recommendations to safeguard against the recurrence of the incident.

Given usual time constraints, it is rarely possible to monitor for all possible contaminants. However, with knowledge of the symptoms of the affected personnel, the substances used at the work site, and a description of the odor(s) detected at the time of the incident, it is possible to select probable contaminants and to survey for their presence. Considering the chemicals used in the laboratories, the symptoms of respiratory irritation, and odors described as sweet or rotten egg, the probable contaminants of interest were the organic chemicals used in the various laboratories and hydrogen sulfide which may have been generated by the "Somat" system, a separate sewerage system which transports waste food from auxillary food handling stations on patient-care floors to a digestor in the basement.

The following is a reconstruction of the incident which developed at HHC in March 1981 and the findings of an environmental survey performed by the New York City agencies during that incident:

On the morning of Monday, March 23rd, employees working in the pathology chemical labs began to experience difficulty in breathing, coughing, dizziness and nausea. During the day, 14 employees from the chemistry, histology and coagulation laboratories went to the hospital's emergency room. Several were treated with oxygen and all were sent home. Representatives of the New York City Department of Environmental Protection (DEP) surveyed the laboratory for airborne contaminants that evening. They noted odors described as "sweet" and "rotten egg". Chlorine, vinyl chloride, sulfur dioxide, hydrogen sulfide and formaldehyde were not found to be present using direct-reading detector tubes. The oxygen level was 21%. Carbon dioxide and carbon monoxide levels were "normal". No organic vapors were detected using a MSA Combustible Gas Detector as the sampling instrument.

On the following day, 12 additional employees became ill with similar symptoms. They were treated in the Center's emergency room and sent home. Representatives of the DEP returned that afternoon. Several open

trays of xylene were found in the hematology laboratory. A few employees identified the odor of xylene as the odor that was noticeable throughout the day, but other employees disagreed. The DEP used a Miran I Variable Filter Gas Analyzer (which operates on an infrared absorption principle) to survey the laboratory area after the hematology laboratory was isolated. No contaminants were detected (analysis of laboratory air corresponded to analysis of outdoor air). Next, an area on the 3rd floor undergoing construction was investigated. The tile floor had been coated with a polyurethane sealant containing a toluene/cellosolve solvent. Again nothing was detected using the Miran instrument.

Representatives of the New York City Department of Health (DOH) joined the DEP in investigating the laboratory area on March 25th and for the several days during which the incident persisted. At no time during the investigation was an excessive concentration of any airborne contaminant found. However, several conditions were observed which may have allowed contaminants to enter the laboratory area:

1. Many of the traps in the acid waste and normal plumbing lines had been allowed to evaporate to dryness. This may have allowed gases to enter into the laboratory area.

2. The acid waste tanks on the 7th floor were improperly serviced and their covers were ajar. This also may have contributed to the contamination on the laboratory (8th) floor via holes in the ceiling of the 7th floor.

3. The ventilation unit which services the 6th and 8th floors was in disrepair--dirty and clogged filters, inoperable baffles, rusted cooling coils and a motor which had not been in operation for the two weeks preceding the incident. For several months the unit was intermittently not functional.

4. Fume hoods in some of the laboratories were not functioning. As a result, many employees would use the laboratory sinks to dispose of volatile liquids.

5. The histology laboratory lacked properly vented hoods. In the laboratory, pans of formaldehyde and xylene were fitted with plastic covers from which air is vented through activated charcoal filters into the laboratory atmosphere.

Recommendations were made to correct these conditions.

More employees reported similar symptoms through Friday, March 27th. A total of 58 employees and students were treated in the emergency room. Twenth-six of the individuals had evidence of respiratory toxicity as indicated by an initial low blood pO_2 (defined as less than 80% of normal for the person's age). The blood oxygen partial pressures returned to normal within a few hours after removal from the laboratory. Seventeen

individuals were given oxygen therapy in the emergency room, and 3 were admitted to the hospital for overnight observation. The 58 affected individuals were placed on sick leave and were reexamined on March 30th and 31st. It was determined that their pO_2 levels had returned to normal. Thirty-three individuals who had not been affected and who had remained working in the laboratory area were examined about this time. Their pO_2 levels were all normal. Table I summarizes the course of the March incident.

The following corrective measures were instituted, partially based on the recommendations of the New York City agencies:

1. The active drains on the 8th floor were filled with water; drains which are rarely used were sealed with mineral oil.

2. The acid waste tanks on the 7th floor were serviced and properly sealed.

3. The ventilation system was repaired--the duct work on the 8th floor was cleaned (approximately 4 1/2 cubic yards of dirt were removed), and all filters were changed. Measurements of the ventilation system indicated that it was operating within design specifications after the repair work.

4. New procedures were instituted for the disposal of volatile liquids.

5. The fume hoods were inspected, and found to operate at less than capacity. Plans were made to repair the ventilation system of the fume hoods.

6. Several holes in the floor of the laboratories which may have allowed fumes from the 7th floor waste acid tanks to enter the laboratory area were sealed.

7. The "Somat" system, which transports and digests food wastes from auxiliary food handling stations was found to be a possible source of hydrogen sulfide and other irritating odors. Maintenance was increased on the unit in an effort to control the odors.

A representative of OSHA visited the hospital and toured the laboratory area on March 27th, near the end of the original incident. Her general assessment of the site agreed with that of the City agencies: the drains were dry, the waste acid treatment tank on the 7th floor was not maintained properly, laboratory hoods were not working properly and the ventilation system for the 6th and 8th floors was in disrepair with the main circulating motor being inoperable.

On April 27th, the OSHA representative collected full shift samples on the 8th floor for organic solvents, hydrogen sulfide and formaldehyde. She also sampled for mercury vapor at selected locations. No hydrogen sulfide, formaldehyde or mercury vapor was detected. Low concentrations

of xylene and ethyl benzene were determined in a cytology laboratory. All exposures were within OSHA's Permissible Exposure Limits and no violations were cited. Table II summarizes the results of OSHA's environmental sampling.

Representatives of the New York State Department of Labor (DOL) attempted to perform an environmental survey of the laboratory area on May 15th. At that time the laboratory was vacated except for 12 employees because extensive work was being done on the ventilation system, and environmental sampling could not be done.

Air flow measurements were made on the newly repaired fume hoods. The flow rates through the opened sashes were at least 100 linear feet per minute, which is the minimum flow rate recommended by the American Chemical Society.

The staff and administration of the HHC remained concerned about the intermittent complaints of odors occurring in the laboratory area, and wanted some type of monitoring of environmental conditions when these complaints happened. Because it is difficult for any governmental agency to respond immediately upon an odor complaint, the New York City Department of Environmental Protection loaned the HHC the use of a Miran-1 Variable Filter Gas Analyzer for one month, and gave instructions for its proper use. The instrument was used to analyze for contaminants when complaints of "odors" occurred. No excessive concentration of airborne contaminants were determined to be present whenever the atmosphere was tested as a result of an odor complaint. It should be noted that the unit is capable of identification and quantification of organic vapors and cannot be used to detect hydrogen sulfide. However, that compound has a distinctive "rotten egg" odor, which was not perceived during the month-long testing period.

Even though no excessive exposure to any contaminant could be found, either at the time of the incident in March or during sporadic investigations during the following two months, intermittent complaints continued. Most of the laboratory personnel were moved to other quarters while the ventilation system servicing the 8th floor was repaired during the months of May and June. The employees were returned to the 8th floor laboratories in late June or early July. Since returning to the laboratories following the repair of the ventilation system, minor complaints about the air quality have occurred infrequently, but no illness incidents have recurred.

IV. EVALUATION CRITERIA

Hypoxia is a condition when the cells of the body do not receive enough oxygen. This condition is assessed by measuring the oxygen content of the blood, since the blood carries oxygen from the lungs to the rest of the body. Low arterial oxygen tension in the blood - called hypoxemia -

occurs when the lungs do not provide an adequate amount of oxygen to the blood that passes through them. It can develop following exposure to a lower respiratory tract irritant. The irritating substance affects the lining of the small airways and alveoli (air sacs where oxygen transfer takes place) within the lungs, causing an inefficient transfer of oxygen from the air to the blood.

Hypoxemia is a non-specific effect of lower respiratory tract irritation and does not indicate the presence of any particular chemical. However, to cause lower respiratory tract irritation, a chemical must be sufficiently insoluble to pass through the nose and throat and reach the lower respiratory tract. Thus given the circumstances of the reported incident, the transient hypoxemia was likely due to a relatively insoluble chemical vapor(s) which caused lower respiratory tract irritation. Removal from exposure should result in complete reversal of the hypoxemia without permanent sequalae.

V. RESULTS AND DISCUSSION

Twenty six of the 58 individuals seen in the emergency room had transient hypoxia, characterized by hypoxemia or lowered arterial blood oxygen tension. The lowered pO_2 levels may be explained as resulting from exposure to a lower respiratory tract irritant. Environmental sampling both at the time of the incident and during the next two months failed to reveal a possible environmental contaminant. Reports by affected workers indicate a contaminant with a rotten egg odor (hydrogen sulfide) or a sweet odor (organic vapor). Both of these contaminants are respiratory toxins. Possible sources of both contaminants exist--hydrogen sulfide may have entered the atmosphere of the laboratory through dried drain pipes or through holes in the floor, and the laboratories use a number of organic solvents. Excessive levels of carbon monoxide and hydrogen sulfide were not determined to be present in the atmosphere of the 8th floor laboratory area at any time during the incident nor during intermittent sampling during the two months following the incident.

The ventilation system which services the 8th floor had been inoperable for two weeks preceeding the March incident and the fume hoods in many of the laboratories were not functioning. This situation may have resulted in a transient accumulation of atmospheric contaminants.

VI. CONCLUSIONS

The lack of proof of exposure to any contaminant at the time of the incident makes it impossible to indicate an etiologic agent(s) for the incidents. The environmental sampling and subsequent medical evaluations indicate that the exposure was transient and there is currently no significant environmental health hazard.

VII. RECOMMENDATION

Repair of the ventilation system, repair of the fume hoods, sealing of the holes in the floor, sealing of the dried drains and improved maintenance of the waste acid treatment tanks and of the Somat digestor have led to a decrease in the number of complaints of poor air quality among workers in the 8th floor laboratories.

Harlem Hospital Center should institute a program of preventive maintenance of these systems to provide the laboratory area with an atmosphere free of excessive airborne contaminants.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

For the purpose of informing affected employees, the employer should post this report in a prominent place(s) near where employees work for at least 30 days.

Copies of this report will be available from NIOSH, Division of Standards

Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226 for 90 days. Thereafter, copies will be available from the National Technical Information Service (NTIS), Port Royal Road, Springfield, Virginia 22161. Information concerning its availability through NTIS can be obtained from the NIOSH Publications Office at the above Cincinnati address.

Copies of this report have been sent to:

Harlem Hospital Center
D.C. 37, AFSCME
District 1199
New York City Department of Health
New York City Department of Environmental Protection
New York State Department of Labor, Division of Safety and Health
U.S. Dept. of Labor, OSHA, Region II, New York City
U.S. Dept. of Health & Human Services, NIOSH, Region II, New York City
N.Y. State Dept. of Labor, Albany, N.Y.

TABLE I
HARLEM HOSPITAL CENTER
EMPLOYEE ADMISSIONS TO EMERGENCY ROOM
MARCH 23 TO 27, 1981

DATE	NUMBER EXAMINED IN EMERGENCY RM	NUMBER TREATED WITH OXYGEN*	NUMBER WITH EVIDENCE OF TOXICITY**
3/23	14	8	8
3/24	12	0	3
3/25	17	5	10
3/26	6	3	4
3/27	2	1	1
unknown	7	0	0
	58	17	26

*Three individuals were admitted to the hospital overnight for observation.

**Arterial oxygen tension (po_2) less than 80% of normal for age.

TABLE II
HARLEM HOSPITAL CENTER
ENVIRONMENTAL SAMPLING

LOCATION	ORGANIC SOLVENTS (1)	HYDROGEN SULFIDE (2)	FORMALDEHYDE (3)
Rm 8120 (surgical pathology)	--	--	0.12 ppm
Rm 8122 (histology)	N.D.	N.D.	0.03 ppm
Rm 8123 (chemistry)	N.D.	N.D.	0.02 ppm
Rm 8126 (SMA-12)	N.D.	N.D.	--
Rm 8155 (hematology)	N.D.	--	--
Rm 8160 (cytology)	24 ppm xylene[4] 5 ppm ethyl benzene[5]	N.D.	--

1. Analysis performed by a standardized gas chromatography/mass spectrophotometric method. This method of analysis is not specific for any particular organic solvent, but is valid over a spectrum of organic compounds. The limit of detection varies by compound, but generally is a few parts per million parts of air (ppm).

2. Limit of detection is approximately 1 microgram per cubic meter of air(ug/M^3).

3. Limit of detection is approximately 0.01 parts per million (ppm).

4. OSHA Permissible Exposure Limit and NIOSH Recommended Standard are both 100 ppm. Limit of detection for xylene was approximately 5 ppm.

5. OSHA Permissible Exposure Limit and NIOSH Recommended Standard are both 100 ppm. Limit of detection for ethyl benzene was approximately 5 ppm.

OSHA also sampled for mercury vapor in room 8155 (hematology lab) and in nearby laboratories. No mercury vapor was detected. Limit of detection was about 0.01 milligram per cubic meter of air ($mg./M^3$).

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