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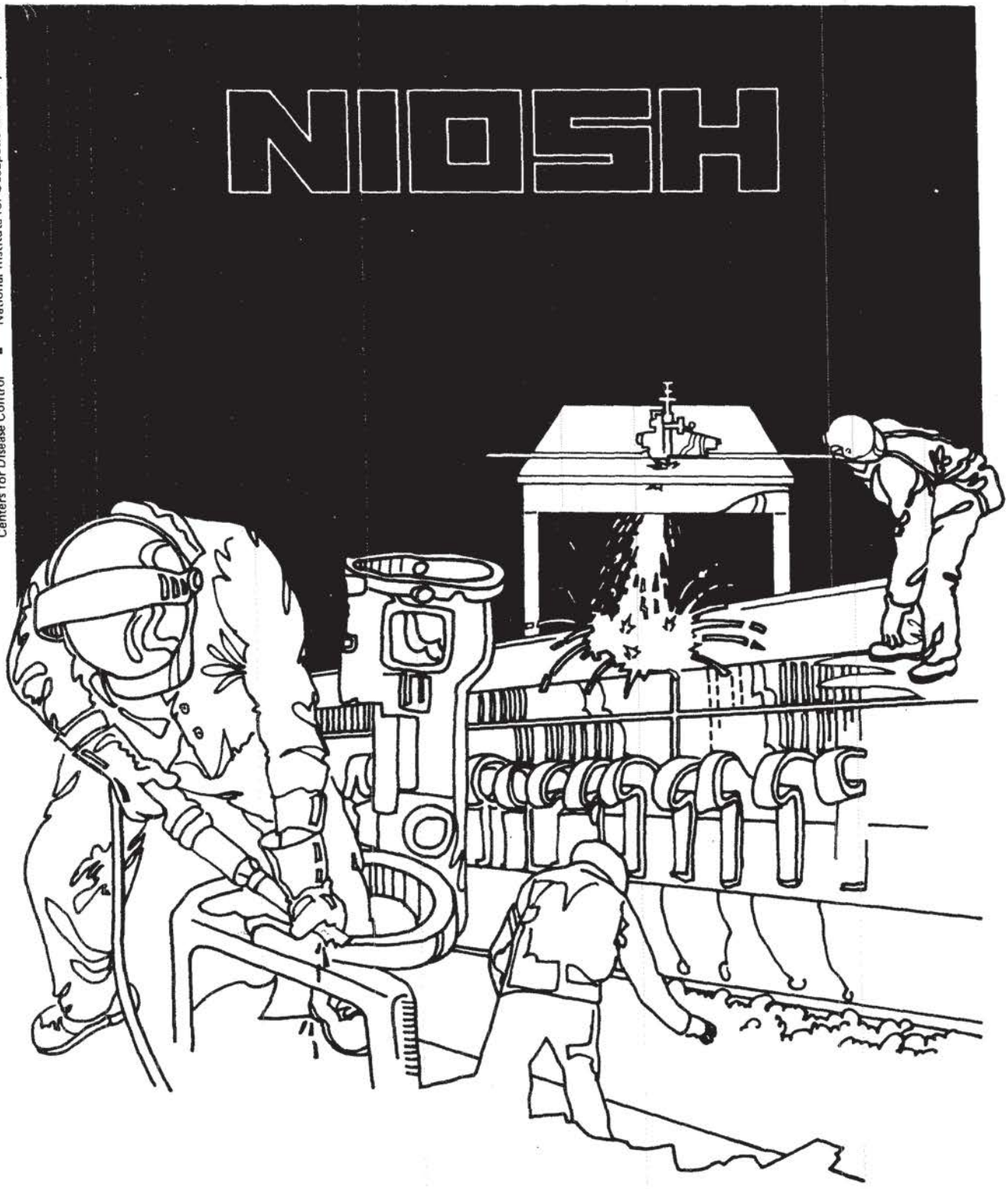

Health Hazard Evaluation Report

HETA 81-063-869
CLERMONT COUNTY CHILDREN'S
DENTAL CLINIC
BATAVIA, OHIO

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.

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

HETA 81-063-869
May 1981
Clermont County Children's Dental Clinic
Batavia, Ohio

NIOSH INVESTIGATOR:
Richard L. Stephenson, IH

I. SUMMARY

In November 1980, the National Institute for Occupational Safety and Health (NIOSH), received a request from the Clermont County Children's Dental Clinic administration, Batavia, Ohio, to evaluate employee exposure to mercury. In response to this request, a NIOSH survey was performed on January 14, 1981. Thirty-two personal and area air samples and 30 direct reading measurements were taken to determine the presence of particulate and elemental mercury concentrations. Mercury vapor values found with a portable mercury vapor meter ranged from non-detectable (ND) to 0.04 mg/M^3 (mean 0.01 mg/M^3). The 3M[1] mercury vapor passive monitor personal and area sample values were 0.002 - 0.008 mg/M^3 (mean 0.004 mg/M^3). Sorbent tube mercury vapor samples were ND - 0.001 mg/M^3 (mean 0.004 mg/M^3). All filter samples for determining particulate mercury exposure showed no detectable levels. None of the air sample results exceeded the NIOSH recommended standard for mercury of 0.05 milligrams per cubic meter of air (mg/M^3), 8 hour time-weighted average (TWA).[2]

During this investigation it was determined that a health hazard due to mercury exposure did not exist at the Clermont County Children's Dental Clinic. Recommendations to assure continued safe working conditions are included in this report.

KEYWORDS: SIC 8020 (dental office), mercury.

II. INTRODUCTION

In November 1980, the National Institute for Occupational Safety and Health (NIOSH), received a request from the Clermont County Children's Dental Clinic administration, Batavia, Ohio, to evaluate dentists', dental assistants', and clerks' exposure to mercury. The request was primarily because of mercury spills and of the recognition of the potential health hazard associated with exposure to mercury.

III. BACKGROUND

The Clermont County Children's Dental Clinic, located on the third floor of the three-story Clermont Service Center in Batavia, Ohio, operates on a 5 day 40-hour-per week schedule. The dental clinic consists of 6 rooms, including 2 operatories, each about 110 ft.^{2}, with 6" square tile flooring, and 1 carpeted general administrative office about 300 ft.^{2} The clinic has been at the same location for 15 years.

The staff of 8 includes 1 full time dentist-director, 3 part-time dentists, 1 dental hygienist, 1 dental assistant, 1 secretary, and 1 receptionist. Routine dental services, including cavity restoration are administered to an average of 16 children per day. Usually, only 1 dentist works at a time.

The mercury handling procedures are similar to those found in many dental offices. Mercury is purchased in one-pound bottles. The preparation of mercury amalgam dental filling consists of placing a 6-gram alloy tablet into a plastic capsule, adding a drop of mercury, and agitating this mixture on an amalgamator. Eleven amalgams were prepared on the day of the survey by the dental assistant who normally prepares such mixtures. Various metal constituents make up the amalgam including silver, copper, tin, zinc, and mercury (48-52 %). About 2 to 3 ounces of mercury are used per week, but use varies greatly with amalgam size, type, and number of restorations required.

IV. METHODS AND MATERIALS

Several screening measurements were made using a direct-reading Bacharach Model MV2 Mercury Sniffer. This instrument was not used to evaluate long-term personal exposures, but rather, to determine areas of mercury contamination.

Area and personal breathing zone samples for particulate and elemental mercury were obtained for periods of time approximating the entire work day. Dupont and Sipin low-flow sampling pumps calibrated to pull 200 cubic centimeters of air per minute (cc/m) were connected via tygon tubing to iodine-impregnated charcoal sorbent tubes followed by a 37mm cassette with an AA filter. The tube and filter were arranged so that the air being sampled was pulled through the filter first (to capture particulate mercury) and then the tube (for mercury vapor). In addition, samples for elemental mercury vapor were collected using charcoal sorbent tubes without an AA filter in series. The filter samples were analyzed by flameless atomic absorption spectrophotometry and the sorbent tube samples by flame atomic absorption spectrophotometry.[3]

The 3M passive dosimeters for mercury vapor were also used to collect area and personal breathing zone samples. Collection of mercury vapor by the monitor is accomplished by diffusion of the mercury through a barrier film and adsorption of the mercury onto a gold foil. The 3M company provided the analysis for the monitors.[1]

V. EVALUATION CRITERIA[3]

Mercury (Hg) is a heavy metal which is liquid and volatile at room temperature. Mercuric oxide (HgO) is a poorly soluble inorganic compound of mercury. Little has been published concerning the toxic effects of HgO. The toxicology of metallic Hg vapor, however, has been well documented.

The primary route of entry of Hg vapor or dust is via inhalation. It may also enter the body through ingestion (especially with poor work practices) and through skin absorption. If inhaled, mercury vapor is readily absorbed into the bloodstream through the lungs.

Excessive exposures to mercury can produce mercury poisoning, either acute (short-term, intensive exposure) or chronic (usually long-term, lower level exposure). Chronic mercurialism is most frequently seen in industrial settings and results from a slow accumulation of Hg in the body. The symptoms of chronic mercury poisoning may include the following:

Behavorial or Psychic Changes: Irritability, depression, moodiness, nervousness, headache, insomnia, poor memory, shyness, quarrelsomeness, and neglect of family and job.

Neurologic Changes: Tremor (shakiness), muscle weakness, unsteady walk, lack of coordination, muscle twitching or jumping.

Gastrointestinal/Oral Changes: Tender, swollen gums which may bleed easily or show a dark line or spots. Metallic taste, excessive salivation, loose teeth, sore mouth, upset stomach, diarrhea or constipation, loss of appetite and weight.

General: Nosebleeds, muscle ache or cramps.

Mercury has a cumulative effect but does not remain in the body indefinitely; it is gradually eliminated over a period of time - primarily via the urine. Small amounts are also excreted in feces, sweat and saliva.

No ideal biological indicator is available for evaluating the risk of mercury intoxication through the inhalation of mercury vapour. For the assessment of individual exposure neither mercury in blood nor mercury in urine is satisfactory as an indicator. However, on a group basis mercury levels in blood and urine parallel exposure, but the levels are influenced by recent exposure and reach a steady state with exposure only after continuous exposure for one year or more.[4]

The NIOSH recommended standard for occupational exposure to inorganic mercury is 0.05 milligrams of mercury per cubic meter of air (mg/M^3), based on an 8-10 hour time-weighted average (TWA). (The current OSHA standard for all forms of mercury except organic is 0.1 mg/M^3 - 8 hour TWA).

VI. RESULTS AND DISCUSSION

During the survey there were some deficiencies noted in regards to the clean up and disposal of accidentally spilled mercury. Certain precautions must be taken in the preparation, use, and handling of mercury and amalgams to prevent employee exposure to mercury. Spills of mercury should be promptly cleaned up either mechanically or chemically, not by blowing or dry sweeping. When vacuum cleaners are used, they should be equipped with mercury filters to prevent dispersal of mercury vapors into the air. The recommendations in mercury hygiene as set forth by the American Dental Association[5] (Section VII) should be followed.

Results of the direct-reading mercury vapor meter measurements can be found in Table I. 'Measurements were taken throughout the dental clinic in both morning and afternoon. The mercury vapor values (excluding the 0.8 mg/M^3 sample value found directly above a mercury scrap container) were 0.0 - 0.04 mg/M^3 with a mean concentration of 0.01 mg/M^3.

The 3M mercury vapor monitor badge personal and area sampling results (Table II) ranged from 0.002 - 0.008 mg/M^3 with a mean of 0.004 mg/M^3.

Findings of the long-term personal and area samples are included in Table III. No particulate mercury was detected. Mercury vapor concentrations ranged from 0.00 - 0.01 mg/M^3 with a mean of 0.004 mg/M^3. All mercury air levels were well below the NIOSH recommended standard of 0.05 mg/M^3.[2]

According to clinic administrative officials there were no known mercury exposure symptoms amongst the employees.

VII. RECOMMENDATIONS

1. Floor cleaning devices such as mops and brooms should be discarded frequently to prevent accumulation of mercury.[6]

2. Clean up any spilled mercury immediately. Droplets may be picked up with narrow bore tubing connected (via a wash-bottle trap) to the low-volume aspirator of the dental unit.[5]

3. Floors should be cleaned and coated with a non-skid wax frequently.[7]

4. Design the dental offices with seamless flooring that extends two inches up each wall.[5]

5. Avoid carpeting dental operatories, as decontamination is not possible.[8]

6. Use tightly closed capsules during amalgamation.[8]

7. Use a no-touch technique for handling the amalgam.

8. Perform preplacement and periodic urine mercury determinations on all personnel regularly employed in dental offices.[9]

9. Have periodic mercury vapor level determinations made in operatories.

10. Alert all personnel involved in handling of mercury, especially during training or indoctrination periods, of the potential hazard of mercury vapor and the necessity for observing good mercury hygiene practices.

11. The control measures in mercury hygiene as set forth in the Journal of the American Dental Association[5] (see below) should be followed. These recommendations include:

    a. Store mercury in unbreakable, tightly sealed containers.

    b. Perform all operations involving mercury over areas that have impervious and suitably lipped surfaces so as to confine and facilitate recovery of spilled mercury or amalgam.

    c. Salvage all amalgam scrap and store it under water.

    d. Work in well-ventilated spaces.

    e. Avoid heating mercury or amalgam.

    f. Use water spray and suction when grinding dental amalgam.

    g. Use conventional dental amalgam compacting procedures, manual and mechanical, but do not use ultrasonic amalgam condensors.

VIII. REFERENCES

1. 3M Brand Mercury Vapor Monitor. Occupational Health and Safety Products Division, 3M Company, 3M Center, St. Paul, Minnesota 55101.

2. NIOSH/OSHA Pocket Guide to Chemical Hazards, DHEW (NIOSH) Publication No. 78-210, September 1978.

3. Moseley, C.L., Health Hazard Evaluation and Technical Assistance Report TA 78-26, NIOSH, Cincinnati, Ohio, February 1979.

4. Recommended Health-Based Limits in Occupational Exposure to Heavy Metals, "Inorganic Merucry", Technical Report Series #647, World Health Organization, Geneva 1980 pp.107.

5. Rupp, N.W., DDS., et al., "Significance to Health of Mercury Used in Dental Practice: A Review," Journal of the American Dental Association, Vol. 82., June 1971.

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7. Kronoveter, K.J., Health Hazard Evaluation and Technical Assistance Report TA 78-9, NIOSH, Cincinnati, Ohio, March 1978.

8. Recommendations in Merucry Hygiene, Council on Dental Materials and Devices, Journal of the American Dental Association Vol. 88. February 1974 pp. 392.

9. American Industrial Hygiene Association, Hygienic Guide Series, "Mercury" March, 1956.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

a. Clermont County Children's Dental Clinic
b. NIOSH, Region V
c. OSHA, Region V

TABLE I

NIOSH DIRECT READING MERCURY VAPOR MEASUREMENTS*

CLERMONT COUNTY DENTAL SERVICE
BATAVIA, OHIO
January 14, 1981

TA 81-063

Time	Location	Results (mg/M^3)
10:15 am	Sample taken around NIOSH Field Asst. 3-M Badge and hands.	0.02
10:20 am	In hallway adjacent to Admin. Office. Sample taken near floor and in B.Z.	0.02 - 0.04
10:24 am	In storage room next to Admin. Office. Sample taken 2" above floor	0.02 - 0.03
10:30 am	Room #12 B.Z. sample	0.0 - 0.01
10:35 am	Room #10 Storage/Lab area. Sample taken in B.Z. and near floor	0.0 - 0.01
10:38 am	In Room #11. Sample taken in B.Z., around triturator, and near floor.	0.0 - 0.01
10:43 am	At top of stairway before entering dental clinic. Sample taken in B.Z., and 4" above floor.	0.0 - 0.005
10:45 am	Main corridor between offices, B.Z. and near floor.	0.007 - 0.01
10:47 am	Room #8. Around triturator, on the floor, and in B.Z.	0.01
10:49 am	Room #6. B.Z. and on floor and around intake filter adjacent to Room #2.	0.01
10:53 am	Room #7. B.Z. and on floor and adjacent to circuit breaker box	0.015
10:57 am	Main hallway outside Rooms #9 and #11, B.Z.	0.015 - 0.02
11:00 am	Admin. Office - carpet pre-scuff - after scuff	0.015 0.025 - 0.035
3:32 pm	Admin. Office B.Z. Carpet - before scuff Carpet - after scuff Desk top	 0.007 0.005 0.02 0.005
3:35 pm	Main hallway outside Admin. Office B.Z. and 2" above floor.	0.005 - 0.007
3:36 pm	Room #9 at triturator	0.04
3:37 pm	Room #6 Lunchroom Tile floor - pre scuff Tile floor - after scuff	 0.007 0.02 - 0.04
3:40 pm	Room #10, placed sniffer probe inside an empty previously used Caulk Saf-T-Cote Mercury dispensor Tile floor - before scuff Tile floor - after scuff	 0.07 - 0.1 0.007 0.04
3:45 pm	Room #11 Adjacent to triturator 2" above Hg dispensor 2" above can where scrap Hg was stored - - lid opened - lid closed In trash can and sink	 0.02 0.017 0.8 0.02 0.01

*Bacharach Mercury Vapor Meter. B.Z.: Breathing Zone
NIOSH Recommended Standard (8-hour TWA) 0.05 mg/M^3
OSHA Legal Standard (8-hour TWA) 0.10 mg/M^3

TABLE II

RESULTS OF 3M MONITOR BADGE SAMPLING FOR MERCURY VAPOR

CLERMONT COUNTY DENTAL SERVICE
BATAVIA, OHIO
January 14, 1981

TA 81-063

Sample Location Description	Time	Mercury Vapor Concentration TWA (mg/M^3)*
Personal sample-Dental Assistant	8:58am-4:55pm	0.008
Personal sample-Dental Hygienist	9:02am-4:30pm	0.004
Personal sample-Dentist	9:20am-3:54pm	0.006
Personal sample-Secretary	9:33am-4:30pm	0.002
Personal sample-NIOSH field personnel	9:00am-4:55pm	0.006
Personal sample-NIOSH field personnel	9:05am-4:55pm	0.003
Area sample-adjacent to lab storage area entrance	9:24am-4:35pm	0.004
Area sample-inside cabinet in lab storage area	9:25am-5:02pm	0.005
Area sample-Rm. 11 Operatory next to wiggle bug	9:27am-4:45pm	0.002
Area sample-on desk in lunch room	9:48am-4:23pm	0.004
Area sample-on file cabinet in Hallway	9:48am-4:28pm	0.002

*TWA - Time Weighted Average
mg/M^3 - milligrams of mercury per cubic meter of air

TABLE III

SUMMARY OF ENVIRONMENTAL DATA
PERSONAL BREATHING ZONE EXPOSURE AND AREA CONCENTRATION OF AIRBORNE MERCURY

CLERMONT COUNTY DENTAL SERVICE
BATAVIA, OHIO
January 14, 1981

TA 81-063

Sample Location	Sample Type	Time Sampled	Sample Volume (Liters)	Particule Hg (mg/M^3)	Elemental Hg (mg/M^3)
Dental Assistant	Personal	8:24am-12:05pm	42.0	N.D.**	0.005
Dental Assistant	Personal	8:27am-12:05pm	43.6	-	0.002
" "	Personal	12:37pm-4:01pm	39.4	N.D.	0.005
" "	Personal	" "	40.8	-	0.005
Dental Hygienist	Personal	9:12am-12:30pm	33.6	N.D.	N.D.
" "	Personal	" "	37.6	-	0.005
" "	Personal	12:20pm-4:01pm	37.1	N.D.	N.D.
" "	Personal	" "	44.2	-	0.005
Dentist	Personal	9:47am-12:50pm	33.7	-	0.006
"	Personal	12:50pm-3:51pm	34.7	-	0.006
Administrative Office on desk top	Area	1:08pm-4:40pm	40.8	-	N.D.
Operator - Rm #11 adjacent to wiggle bug	Area	8:45am-4:38pm	94.4	N.D.	0.007
" "	Area	8:45am-4:40pm	101.0	-	0.005
Operator - Rm #9 adjacent to wiggle bug	Area	8:54am-4:15pm	75.7	N.D.	0.015
" "	Area	8:54am-4:14pm	88.2	-	0.005
Lab storage area inside cabinet	Area	1:01pm-5:02pm	48.2	-	0.008
Lunchroom - on table top	Area	9:46am-1:20pm	41.2	-	0.002
" "	Area	1:20pm-4:04pm	31.3	-	N.D.
In hallway on top of file cabinet	Area	9:48am-1:11pm	38.0	-	N.D.
" "	Area	1:15pm-4:04pm	33.8	-	N.D.
Administrative Office - on desk top	Area	9:42am-1:00pm	39.6	-	N.D.

** - N.D. non-detectable
NIOSH Recommended Standard (8-hour TWA) 0.05 mg/M^3
OSHA Legal Standard (8-hour TWA) 0.10 mg/M^3
Analytical limit of detection = 0.1 ug/sample

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