# NIOSH HEALTH HAZARD EVALUATION REPORT:

# HETA #2002-0157-2887
# City of Cleveland Heights
# Cleveland Heights, Ohio

## January 2003

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

# 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 Gregory A. Burr of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Analytical support was provided by DataChem Laboratories, Inc., and Ardith Grote, a NIOSH research chemist in the Division of Applied Research and Technology. Desktop publishing was performed by Robin F. Smith. Review and preparation for printing were performed by Penny Arthur.

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# Highlights of the NIOSH Health Hazard Evaluation

# Evaluation of the Dominic Tomaro Public Works Garage

In March 2002 the National Institute for Occupational Safety and Health (NIOSH) received a confidential request for a health hazard evaluation (HHE) from employees at the Dominic Tomaro public works complex. Workers were concerned with a variety of possible hazards, including asbestos in the Transfer Station and diesel exhaust and non-working exhaust fans in the City Garage.

## What NIOSH Did

- We took bulk samples of insulation from the Transfer Station to look for asbestos.
- We sampled for carbon monoxide (CO) and diesel exhaust in the City Garage at the beginning of the work day when vehicles are first started.

## What NIOSH Found

- All of the bulk samples from the Transfer Station contained asbestos.
- The levels of CO and diesel exhaust were very low on the day we sampled.
- Exhaust fans on the north wall of the City Garage were not operating on the day we sampled.
- Most vehicles idled for less than one minute before leaving the garage. However, some vehicles were allowed to idle for up to 35 minutes.

## What City Managers Can Do

- It is not necessary to remove the asbestos-containing insulation from the Transfer Station.
- It is necessary to have a plan to keep the asbestos-containing material in the Transfer Station in good shape.
- Replace the non-working exhaust fans on the north wall with louvers and install exhaust fans on the south wall to improve the ventilation in the City Garage.
- Encourage employees to idle the vehicles for less than one minute.

## What the City Employees Can Do

- Avoid damaging the insulation present in the Transfer Station.
- Tell management about any damaged insulation that you see.
- When you start your work vehicle in the City Garage, idle the engine for no more than one minute.

**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 #2002-0157-2887

# Health Hazard Evaluation Report 2002-0157-2887
# City of Cleveland Heights
# Cleveland Heights, Ohio
# January 2003

**Gregory A. Burr, CIH**

## SUMMARY

In March 2002 the National Institute for Occupational Safety and Health (NIOSH) received a confidential request for a health hazard evaluation (HHE) from employees at the Dominic Tomaro Public Works Garage Complex in Cleveland Heights, Ohio. Several workers were concerned with a variety of possible hazards, including asbestos (specifically in the municipal waste transfer station), diesel exhaust in the city garage, and inoperable exhaust fans. Immediately after an opening conference on April 30, 2002, a walk-through of the Transfer Station and City Garage was conducted. On May 1, bulk and area air monitoring was conducted for asbestos, carbon monoxide (CO), and diesel exhaust.

Eight bulk samples of insulation were collected from the Transfer Station and analyzed for asbestos. All of the samples contained more that 1% asbestos, with two bulk samples of damaged (friable) pipe insulation containing between 20% to 50% asbestos. The U.S. Environmental Protection Agency (EPA) considers any substance containing greater than 1% asbestos to be asbestos-containing material (ACM).

The CO concentrations measured in the City Garage during the morning period (coinciding with the highest level of worker activity) averaged 4 parts per million (ppm), with the highest peak CO exposure at 73 ppm. These results were well below the NIOSH recommended exposure limit for CO of 35 ppm for an 8-hour time-weighted average (TWA) exposure and the NIOSH ceiling limit of 200 ppm. Diesel exhaust concentrations (measured as elemental carbon, EC) ranged from trace amounts (between 0.19 to 0.94 micrograms per cubic meter, $\mu g/m^3$) to 1.1 $\mu g/m^3$, well below the proposed American Conference of Governmental Industrial Hygienists' Threshold Limit Value of 20 $\mu g/m^3$ for diesel exhaust for up to an 8-hour TWA exposure.

This NIOSH investigation found that a potential health hazard existed from the ACM in the insulation on walls, beams and piping in the Transfer Station. NIOSH, along with the EPA, does not consider removal of ACM as necessarily the best course of action, since improper removal can create a dangerous situation where none previously existed.[1] Instead, an operations and maintenance (O&M) program for managing asbestos in place should be developed. The major program elements should include notification, surveillance, controls, work practices, record keeping, worker protection, and training. Although concentrations of CO and diesel exhaust in the City Garage were below applicable occupational exposure limits on the day of this evaluation, the general dilution ventilation should be increased (by replacing non-functioning wall exhaust fans) and the time that vehicles are allowed to idle in garage should be reduced.

Keywords: SIC Code 4953 (Refuse Systems), asbestos, carbon monoxide, diesel exhaust, ventilation, garage, municipal employees

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# INTRODUCTION

In March 2002 the National Institute for Occupational Safety and Health (NIOSH) received a confidential request for a health hazard evaluation (HHE) from employees at the Dominic Tomaro Public Works Garage Complex located in Cleveland Heights, Ohio. Workers were concerned with a variety of possible hazards, including asbestos (specifically in the municipal waste transfer station), diesel exhaust in the city garage, and inoperable exhaust fans.

A site evaluation was conducted on April 30-May 1, 2002. An opening conference was held on April 30, which was attended by the Public Works Director, his Assistant Director, the Chief Steward of the National Production Workers Local 707, and a Union Steward. Immediately following this meeting a walk-through of the City Garage and Transfer Station was conducted. On May 1, bulk and area air monitoring was conducted. A NIOSH interim letter dated May 21, 2002, was sent to officials with the City of Cleveland Heights and the Union which summarized observations made during the walk-through and the sampling which was performed.

# BACKGROUND

The Dominic Tomaro Public Works Garage Complex includes two buildings–the City Garage and the Transfer Station. Of the approximately 85 people who work here, the majority are located in the City Garage. The following is a brief description of the activities performed in these two buildings that were observed during this evaluation.

City Garage:

Vehicle Maintenance:

Approximately 8 people work in this area performing vehicular repairs. There was a functional vehicle tailpipe local exhaust ventilation (LEV) system available to the workers.

Small Equipment Repair:

One person works in this area. In addition to an LEV tailpipe system, a new (but currently non-functional) canopy hood had been installed on a work bench.

Vehicle Body Repair:

Two or three employees work in this area performing activities such as tire changing, brake repair, and vehicle body repair. A large spray booth used for vehicle painting was located in this shop, and a paint storage room was adjacent to this area. All visible paint containers and related paint storage equipment appeared properly bonded and grounded. There was an additional storage area containing roadway line-striping equipment.

The spray booth operator was provided with a NIOSH approved full-face piece supplied air respirator (a source of Grade D breathable air was available). NIOSH approved filtering facepiece respirators (3M© brand) were also used. The employees stated they had received training in the use and care of these respirators.

Forestry Division/Wildlife:

No activities were occurring at the time of the walkthrough.

Vehicle Storage Garage:

Approximately 40 drivers and field workers depart from this garage daily. About 60 vehicles (either gasoline- or diesel-powered) are parked in this covered garage, including garbage trucks, dump trucks, street sweepers, and pick-up trucks.

General ventilation is provided by four wall-mounted supply fans. Two of these fans, however, were not in operation at

the time of this survey due to citizen complaints of noise in the adjacent residential area. In the warmer months additional ventilation is provided by two overhead doors. During this survey these doors remained opened during the workday.

Transfer Station:

This approximately 40-year old, 3-story brick building is used to transfer garbage from individual garbage trucks to larger, enclosed semi-truck trailers which haul the garbage to a landfill. Two to three workers direct garbage trucks and garbage haulers in and out of the facility and control the gravity transfer of garbage from the third floor to the first floor. Several employees assigned to this area expressed concern that the visible sprayed-on insulation on the steel superstructure and insulation surrounding pipes located on the first level may contain asbestos.

# METHODS

Based on observations made during the walk-through, as well as conversations with randomly selected employees, a variety of bulk and air sampling was performed on May 1, 2002. Eight bulk samples of insulation which had been applied to the metal superstructure of the Transfer Station were collected and submitted for asbestos analysis by polarized light microscopy following NIOSH Sampling and Analytical Method No. 9002. An area air sample for carbon monoxide (CO) was collected using a BioSystems ToxiUltra® direct-reading CO dosimeter. Area air samples for diesel exhaust were collected on 37 millimeter diameter quartz fiber filters using a flow rate of 2 liters per minute (lpm) and were submitted to the laboratory for evolved gas analysis of elemental carbon (EC) according to NIOSH Sampling and Analytical Method No. 5040. CO and diesel exhaust samples were collected in the City Garage at the beginning of the work day, a period coinciding with the greatest amount of worker activity. This period began when engines were first started (some vehicles were started and departed the complex as early as 6:20 a.m., but most left between 6:45 to 7:15 a.m.).

# 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 91–596, 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.

Asbestos

Numerous studies of workers exposed to asbestos have demonstrated an excess of asbestos-related disease, including lung and other cancers. In testimony to OSHA, NIOSH has testified that there is no safe airborne concentration of fibers for any asbestos mineral.[5,6,7] In testimony, NIOSH supported the OSHA proposal to reduce the PEL for asbestos to 0.1 fibers per cubic centimeter of air (f/cc) for all workers.

The current NIOSH REL for asbestos is 0.1 f/cc.[3] However, even at this concentration, OSHA has estimated that the mortality risk would be 3.4 deaths per 1000 workers for a lifetime of exposure to asbestos.[8] Therefore, NIOSH has urged that the goal be to eliminate exposures to asbestos fibers or, where they cannot be eliminated, to limit them to the lowest feasible concentration.[5,7] NIOSH investigators therefore believe that any detectable concentration of asbestos in the workplace warrants further evaluation and, if necessary, the implementation of measures to reduce exposures. The OSHA PEL for asbestos limits exposure to 0.2 f/cc as an 8-hour TWA.[9] OSHA has also established an asbestos excursion limit for the construction industry that restricts worker exposures to 1.0 f/cc averaged over a 30-minute exposure period.[10]

Carbon monoxide

CO is a colorless, odorless, tasteless gas produced by incomplete burning of carbon-containing materials; e.g., natural gas. The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea. These initial symptoms may advance to vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. Coma or death may occur if high exposures continue.[11,12,13,14]

The NIOSH REL for CO is 35 ppm for an 8-hour TWA exposure, with a ceiling limit of 200 ppm which should not been exceeded.[2] The NIOSH REL is designed to protect workers from health effects associated with carboxyhemoglobin (COHb) levels in excess of 5%.[2] The ACGIH recommends an 8-hour TWA TLV of 25 ppm.[3] The OSHA PEL for CO is 50 ppm for an 8-hour TWA exposure.[4]

Diesel Exhaust

Diesel exhaust is a complex mixture that consists of both a gaseous and particulate fraction. The composition will vary greatly with fuel and engine type, maintenance, tuning, and exhaust gas treatment.[19] The gaseous constituents include carbon dioxide, CO, nitrogen dioxide, oxides of sulfur and hydrocarbons. The particulate fraction (soot) of diesel exhaust is comprised of solid carbon cores produced during the combustion process. More than 95% of these particles are less than 1 micron diameter (μmd) size. It has been estimated that up to 18,000 different substances from the combustion process can be adsorbed onto diesel exhaust particulate.[19] Up to 65% of the total particulate mass may be these adsorbed substances and includes compounds such as polynuclear

aromatic hydrocarbons (PAHs), some of which are carcinogenic.[19] Particles in this size range are considered respirable because when inhaled they reach the deeper, non-ciliated portions of the lungs where they may be retained. In general, particles greater than 7-10 µmd are all removed in the nasal passages and have little probability of penetrating to the lung. In addition to the carcinogenic effects, eye irritation and reversible pulmonary function changes have been experienced by workers exposed to diesel exhaust.[15,16,17]

Assessing worker exposure to diesel exhaust is difficult because of the complex makeup of emissions, uncertainty about which specific agent(s) may be responsible for the carcinogenic properties, and the effect of other potential sources of similar compounds (e.g., tobacco smoke particles). NIOSH has investigated the use of EC as a surrogate index of exposure since the sampling and analytical method for EC is very sensitive, and a high percentage of diesel particulate (80-90%) is EC, whereas tobacco smoke particulate (a potential interference when measuring diesel exhaust) is composed primarily of organic carbon.[18]

Based on findings of carcinogenic responses in exposed rats and mice, NIOSH recommends that whole diesel exhaust be considered a potential occupational carcinogen and that exposures be reduced to the lowest feasible concentration.[19] The ACGIH has proposed a TLV for diesel exhaust (measured as EC) of 20 µg/m$^3$ for up to an 8-hour TWA.

# RESULTS

Table 1 presents the results from the asbestos analysis of the eight bulk samples of insulation collected from various surfaces in the Transfer Station. All contained chrysotile asbestos. All of the samples contained more that 1% asbestos, with two bulk samples of damaged (friable) pipe insulation containing between 20% to 50% asbestos. The U.S. Environmental Protection Agency (EPA) considers any substance containing greater than 1% asbestos to be asbestos-containing material (ACM).[20]

On May 1, 2002, CO concentrations were measured in the City Garage between 6:20 to 10:45 a.m. with a CO dosimeter positioned at the east end of the garage, between columns 964 and 966. The average CO concentration during this 4-hour period was 4 ppm, the highest peak CO exposure was 73 ppm, and the highest peak STEL was 17 ppm. These results are well below pertinent occupational exposure limits.

Diesel exhaust samples were collected between 6:20 to 10:45 a.m., a period during which most of the vehicles (both gasoline and diesel engines) were first started. Concentrations of EC ranged from trace amounts (between 0.19 to 0.94 µg/m$^3$) to 1.1 µg/m$^3$, while higher concentrations of organic carbon (concentrations ranging from 7.3 to 9.2 µg/m$^3$) were measured during this same period. Since diesel exhaust has been reported to contain EC levels between 60% to 80% of the TC (the sum of EC + OC),[21] the low EC:TC ratios measured in this survey (ranging from 7.5% to 13%) suggests that diesel exhaust was not substantially contributing to the air sampling results. Furthermore, the concentrations of EC measured in this survey were well below the proposed ACGIH TLV of 20 µg/m$^3$ for up to an 8-hour TWA.

# DISCUSSION AND CONCLUSIONS

Based on observations made during this survey, and the results of bulk and air sampling conducted, the presence of asbestos in the insulation used in the Transfer Station is the most significant problem. While asbestos is hazardous, the risk of asbestos-related disease depends upon

exposure to airborne asbestos fibers. Although the bulk samples collected throughout the Transfer Station clearly identified the presence of chrysotile asbestos on the insulation applied to walls, support beams and around piping, an individual must breathe asbestos fibers in order to incur any chance of developing an asbestos-related disease. The U.S. EPA does not consider removal of ACM as necessarily the best course of action, since improper removal can create a dangerous situation where none previously existed.[1] Instead, the U.S. EPA recommends a proactive, in-place management program whenever ACM is discovered. A recommendation outlining the elements of an effective operations and maintenance (O&M) program for asbestos is included in this report.

While concentrations of CO and diesel exhaust in the City Garage were below occupational exposure limits, several engineering or work practice problems were observed during this evaluation which, if changed, should further reduce the concentrations of these contaminants. In regards to general ventilation for the City Garage, the two wall-mounted exhaust fans on the north wall were not in operation on the day of this survey due to neighboring complaints regarding both noise and vehicle exhaust odors. In regards to work practices, several vehicles were allowed to idle for extended periods prior to leaving the building. For example, one gasoline-powered pick-up truck on the west end of the garage idled for 14 minutes, while a diesel-powered garbage truck remained running for 35 minutes prior to departure. It should be noted, however, that the majority of vehicles observed between 6:20 to 10:45 am on May 1, 2002, idled for less that one minute.

# RECOMMENDATIONS

1. Develop an Operations and Maintenance program for managing asbestos in place in the Transfer Station. The major elements of such a program should include the following:

a. **Notification** (Tell workers where ACM is located, and how and why to avoid disturbing the ACM.)
b. **Surveillance** (Evaluate and document any changes in the ACM's condition.)
c. **Controls** (Provide a work permit system to control activities which may disturb the ACM.)
d. **Work Practices** (Institute procedures to avoid, or minimize, the release of fibers when work affecting the ACM is done.)
e. **Recordkeeping** (Document any activities affecting the ACM.)
f. **Worker Protection** (Provide medical and respiratory protection, as applicable.)
g. **Training** (Educate and train both the Asbestos Program Manager and the custodial and maintenance staff.)

A more detailed discussion of managing asbestos in place may be found in the U.S. EPA publication entitled: *Managing asbestos in place–a building owner's guide to operations and maintenance programs for asbestos-containing materials*. This document (No. 745K93010) is available from the U.S. EPA by contacting the National Service Center for Environmental Publications, P.O. Box 42419, Cincinnati, Ohio 45242-2419 (phone 800/490-9198; fax 513/489-8695). It can also be ordered from the U.S. EPA web site at http://epa.gov.

2. Although concentrations of CO and diesel exhaust in the City Garage were below applicable occupational exposure limits on the day of this evaluation, ventilation improvements to the City Garage building could be made which should further improve working conditions. It was learned during this evaluation that the Public Works division has proposed replacing the exhaust fans located on the north wall[a] of the City Garage building with louvers, and installing exhaust fans on the south side of the building. Providing additional general dilution ventilation for the area

[a] At the time of this survey these exhaust fans had been turned off due to noise complaints from adjacent property owners.

would be prudent and this proposal should accomplish this goal.

3. To help maintain CO and diesel exposures as low as possible, City Garage employees should be encouraged to keep the idling time for their vehicles at a minimum. While most of the vehicles observed on May 1, 2002, idled for less than one minute prior to leaving the garage, several vehicles (including one diesel-powered garbage truck) was left to idle for 35 minutes.

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**Table 1**
**Results of Bulk Sample Analyses for Asbestos**
**City of Cleveland Heights Transfer Station**
**Cleveland Heights, Ohio (HETA 2002-0157-2887)**
**Samples Collected on May 1, 2002**

| Bulk Sample Number | Location | Asbestos Content (% Chrysotile) |
|---|---|---|
| A-1 | Sprayed-on insulation on metal support beam, above the south truck loading bay on the second level. | 5 to <10% |
| A-2 | Sprayed-on insulation on metal support on the south chute assembly, second level. | 3 to < 5% |
| A-3 | Insulation applied to interior surface of the west wall adjacent to the south chute, beneath a window. | 3 to < 5% |
| A-4 | Sprayed-on insulation on metal support beam, above north truck loading bay on the second level. | 3 to < 5% |
| A-5 | Damage pipe insulation on main floor, between the truck loading bays. This pipe lagging was severely damaged. Sample one of two. | 40 to <50% |
| A-6 | Damage pipe insulation on main floor, between the truck loading bays. This pipe lagging was severely damaged. Sample two of two. | 20 to <30% |
| A-7 | Sprayed-on insulation on north wall of the main floor. | 5 to <10% |
| A-8 | Sprayed-on insulation from surface located between the loading chutes on the main floor. | 3 to < 5% |

a. Bulk samples were analyzed by polarized light microscopy according the 4th Edition of the NIOSH Manual of Analytical Methods, Method No. 9002.

b. All of these bulk samples were also analyzed for other forms of asbestos, including amosite, crocidolite, actinolite, tremolite, and anthophylite. None of these other asbestos types were detected (limit of detection is less than 1%).

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