

**Bell Laboratories**

subject: Carbon Monoxide and Asbestos  
Exposure Measurements at C&P  
Telephone CO. Garage  
Case: 48106-8

date March 30, 1982

from: P. Huggins  
MH 78691  
3A-205 X7927

### MEMORANDUM FOR RECORD

#### Introduction

Monitoring of airborne concentrations of carbon monoxide (CO) was conducted on February 22-26, 1982, at five Chesapeake and Potomac Telephone Company of Virginia (C&P of VA) garage locations. Personal monitoring was also conducted at selected locations to determine employee asbestos exposures during brake and clutch repair and inspection jobs. This survey was requested by Mr. Glen Smith, C&P Telephone Co., Richmond, VA.

#### Recommendations

1. Each employee monitored should be informed of the results of this survey.
2. Local exhaust ventilation for vehicles operated during the mechanics 8-hour work shift should be provided at locations 4 and 5 to maintain 8-hour CO exposure concentrations below the OSHA exposure limit of 50 ppm.
3. Local exhaust ventilations for vehicles operated during the mechanics work shift is also recommended for locations 1 through 3. If ventilation is not provided at these locations, further sampling should be conducted to determine daily variations in TWA CO concentrations over the mechanics 8-hour work shift.
4. Procedures developed to reduce asbestos exposure during brake and clutch maintenance should adhere to guidelines provided in AT&T GL documents 77-07-024 and 78-08-045 (attached).
5. GL 78-08-045 indicates that duster brushes should not be part of the asbestos vacuum system and that a crevice tool should be used. Until they are replaced with a crevice tool, brushes should be cleaned after each use.

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6. GL 78-08-045 indicates that an approved National Institute of Safety and Health (NIOSH) single use, disposable respirator should be provided with each set of vacuum filters and used only during vacuum filter replacement. After each use the mask should be discarded.

#### Materials and Methods

Continuous carbon monoxide sampling was conducted using an Interscan Carbon Monoxide Monitor (Model 1142A, Interscan Corp.). In each case the meter was positioned on a bench located within the mechanics work area. Results were recorded using an Esterline Angus Chart Recorder (Model S-22243-1A), operated at a speed of 6 cm/hr. Instrument calibration was performed at each location at appropriate intervals (~2-3 times/day) using prepared carbon monoxide/air mixture (ECO Span, Energetic Sciences, Inc.). Mixtures containing 22 ppm, 50 ppm and 250 ppm CO were used. In addition, MSA detector tubes were used to measure CO concentrations in vehicle exhaust.

Personal samples for asbestos were collected with a 0.8  $\mu$ m MCE filter and a calibrated personal sampling pump (Bendix HD-55), operated at a 2.0 l pm flow rate. Analysis of asbestos filters by phase contrast microscopy was performed by Patricia C. Payne, Bell Laboratories, Murray Hill, N.J.

#### Results

Time Weighted Average (TWA) concentrations obtained from continuous sampling with the Interscan CO monitor are listed in Table 1. Where possible, TWAs over the mechanics 8-hour work shift and over the entire sampling period are given. Figures 1a through d illustrate the distribution of peak CO concentrations over the total sampling period (17.5-23.2 hours). Chart recorder readings for each location during the periods 4 pm - 12 am and 7 am - 11 am are contained in Appendix 1. MSA detector tube systems were used to determine the CO concentration in vehicle exhaust. Readings indicated that concentrations of CO in the exhaust varied from ~25-1000 ppm.

Results of personal monitoring for asbestos are given in Table 2. Each sample number (1 through 4) represents one individual's exposure over the test period. Separate samples were collected to determine exposure during each of the tasks evaluated (e.g., clutch replacement, brake replacements, brake shoe inspection and asbestos vacuum cleaner filter replacement). Eight hour TWA exposure concentrations were calculated assuming no exposure during the remaining work period. These calculated values are also listed in Table 2.

## Discussion

### Carbon Monoxide Monitoring

Results indicate that employee Time Weighted Average (TWA) exposure over the mechanics 8-hour work shift (~4pm-12pm) range from  $16 \pm 1.8$  ppm to  $49 \pm 5.5$  ppm. TWA concentrations over the total sampling period varied from  $3 \pm 0.8$  ppm to  $49 \pm 5.5$  ppm. The current Occupational Safety and Health Administration (OSHA) 8-hour TWA exposure limit for CO is 50 ppm. The 50 ppm TWA exposure limit was exceeded during the mechanics work shift at locations 4 and 5.

In addition, the National Institute for Occupational Safety and Health (NIOSH) recommends a 200 ppm CO ceiling concentration. This is suggested as a maximum peak exposure value which should not be exceeded. Excursions above the 200 ppm ceiling concentration occurred at location 5 (Figure 1d).

All locations have an open plan design with the mechanics work area situated near a vehicle entry/exit door. At locations 1, 2, 3, and 5, the garage areas are not ventilated. Air exchange occurs primarily through natural infiltration and draft. Heating is provided at location 4. Review of the distribution of CO peaks (Figures 1a through 1d) indicates that increases in CO concentrations correspond to periods when vehicles are operated inside the garage. Peaks occurring between 4 pm and 12 am are a result of the mechanic's vehicle operation during repair procedures. An additional set of peaks can be observed between 7am-11am when vehicles are driven from the garage.

Results indicate that CO concentrations in garages having similar design construction and ventilation are variable. This variability can be correlated with the number of vehicles operated as well as the CO concentration in the exhausts of the vehicles operated. Measurements taken at the vehicle tailpipe indicated the CO concentration varied from ~25 ppm to 1000 ppm, depending on vehicle engine and catalytic converter efficiencies. During the mechanics 8-hour work shift, interlocation differences in CO concentrations ranged from 0 to 67%. The OSHA 8-hour exposure limit is exceeded only at locations 4 and 5.

Since concentration differences are related to the number and types of vehicles operated, it should be anticipated that intralocation variability will reflect the differences observed between locations. Results suggest a probability of exceeding 8-hour TWA exposure limits and the recommended ceiling concentrations at any of the locations sampled. Further sampling would be required to characterize the daily variation in CO

concentrations during the mechanics work shift at locations 1 through 3. This would define the probability of exceeding exposure limits and determine if exhaust ventilation is sometimes required.

Local exhaust ventilation should be provided to maintain CO concentrations below exposure limits. Local exhaust ducts which ventilate emissions directly from the vehicle exhaust pipe are currently used at other C&P of VA garage locations and would be appropriate for this use at these locations. Results indicate that exposure limits are not exceeded at locations 1 through 3 during the sampling period. However results also indicate that the CO concentration measurements may vary depending on the types of vehicles operated and the frequency of vehicle operation in the garage. At locations 1 through 3, use of local exhaust ventilation would ensure compliance, independent of potential daily variations in 8-hour TWA CO concentrations.

#### Asbestos Monitoring

Results of personal monitoring to evaluate employee exposure to airborne asbestos fibers are presented in Table 2. Exposures during four job tasks were measured and 8-hour TWA asbestos exposure concentrations were calculated, assuming no exposure for the remaining work period.

Results indicate that concentrations are well below the OSHA ceiling limit of 10 fibers/cc, the 8-hour permissible exposure limit of 2 fibers/cc, and the 8-hour exposure action level of 0.1 fiber/cc.

During brake inspections, brake drums are cleaned using vacuum hoses equipped with brushes. Use of duster brushes on vacuum systems is not recommended (see attached GL 78-08-045). Until brushes are replaced with crevice tools, they should be cleaned after each use to avoid accumulation of fibers. In addition, during each of the tasks observed, workers wear protective dust masks. GL 78-08-045 recommends supplying a NIOSH approved single use, disposable respirator for vacuum filter replacement jobs only. Respirators should be disregarded or their filters replaced after each use to avoid mask contamination. Results (Table 2) indicate that respiratory protection is not required when performing brake and clutch maintenance operations if recommended procedures are followed. As noted in GL-78-08-045, single use respirators should be used during vacuum filter replacement. Single use respirators such as those provided with the Tempo vacuum filters should not be reused or used by different individuals.

TABLE 1

TIME WEIGHTED AVERAGE (TWA) CARBON  
MONOXIDE CONCENTRATIONS AT EACH  
GARAGE LOCATION, C&P OF VA

FEBRUARY 22-26, 1982

| Location<br>No. | Garage Type<br>& Location                                                        | Garage<br>Capacity (#<br>of Vehicles) | Sampling<br>Period<br>(Hrs.) | TWA<br>(ppm)                 |
|-----------------|----------------------------------------------------------------------------------|---------------------------------------|------------------------------|------------------------------|
| 1               | Installation,<br>Repair, &<br>Construction<br><br>Lynn Street<br>Norfolk, VA     | 50-60                                 | 8.0<br>23.2                  | 16 $\pm$ 1.8<br>12 $\pm$ 1.4 |
| 2               | Installation,<br>Repair &<br>Construction<br><br>39th Street<br>Newport News, VA | 25-30                                 | 2.8                          | 3 $\pm$ 0.3                  |
| 3               | Installation &<br>Repair<br><br>Worwick Blvd.<br>Newport News, VA                | 25-30                                 | 8.0<br>19.5                  | 16 $\pm$ 1.8<br>7 $\pm$ 0.8  |
| 4               | Installation &<br>Repair<br><br>Gust Lane<br>Portsmouth, VA                      | 35-40                                 | 8.0<br>20.5                  | 49 $\pm$ 5.5<br>41 $\pm$ 4.6 |
| 5               | Installation &<br>Repair<br><br>Kerr & Pine Streets<br>Onancock, VA              | 25-30                                 | 7.7<br>17.5                  | 49 $\pm$ 5.5<br>49 $\pm$ 5.5 |

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TABLE 2  
RESULTS OF PERSONNEL MONITORING  
FOR ASBESTOS, C&P OF VA

FEBRUARY 22-26, 1982

| Sample No. | Job Task                           | Sample Duration (Mins.) | Concentration *Filters/cc | 8 Hour TWA |
|------------|------------------------------------|-------------------------|---------------------------|------------|
| 1          | Clutch Replacement                 | 310                     | 0.04                      | 0.03       |
| 2          | Brake Shoe Replacement             | 53                      | 0.06                      | 0.02       |
|            | Brake Shoe Replacement             | 135                     | 0.04                      |            |
| 3          | Brake Shoe Inspection              | 19                      | 0.15                      | 0.02       |
|            | Asbestos Vacuum Filter Replacement | 8                       | 0.71                      |            |
|            | Brake Shoe Inspection              | 13                      | 0.22                      |            |
| 4          | Brake Shoe Inspection              | 15                      | 0.31                      | 0.01       |

\*Fibers >5  $\mu$ m length aspect ratio >3:1.

FIGURES 1 a-d  
DISTRIBUTION OF PEAK CARBON MONOXIDE (CO)  
READINGS AT EACH LOCATION

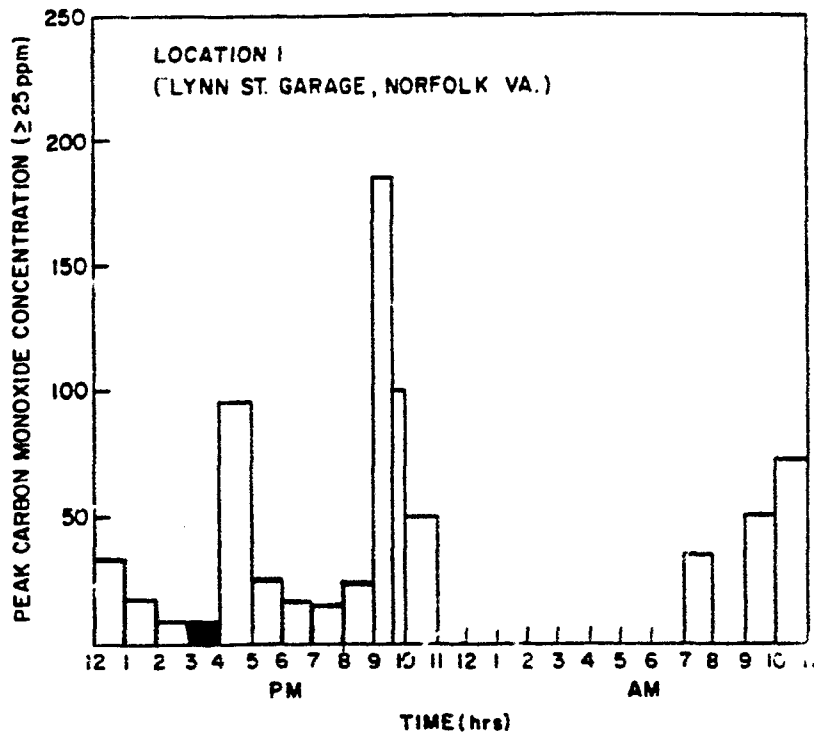
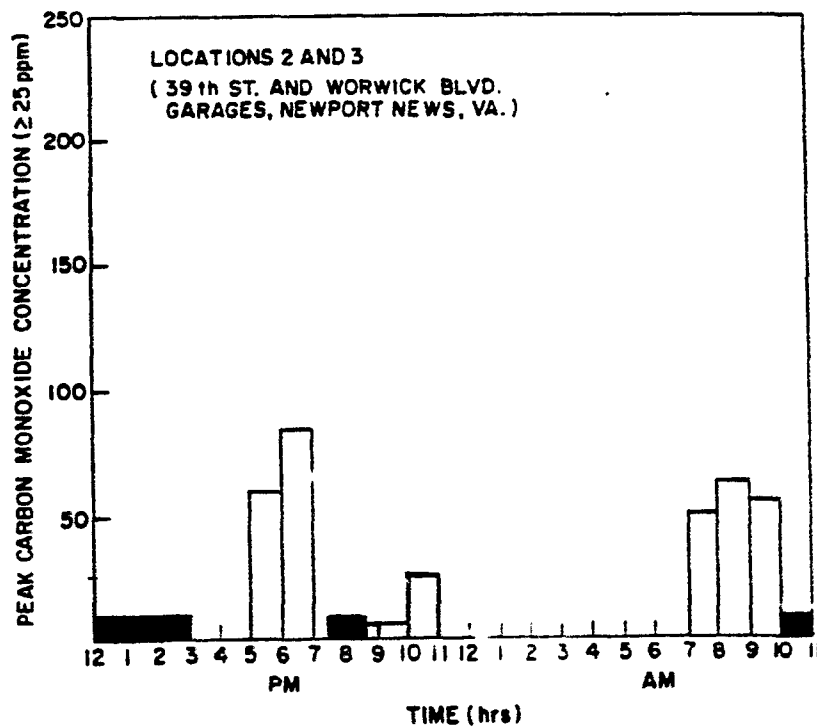


FIGURE 1a



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■ - period not monitored

FIGURES 1 a-d  
DISTRIBUTION OF PEAK CARBON MONOXIDE (CO)  
READINGS AT EACH LOCATION

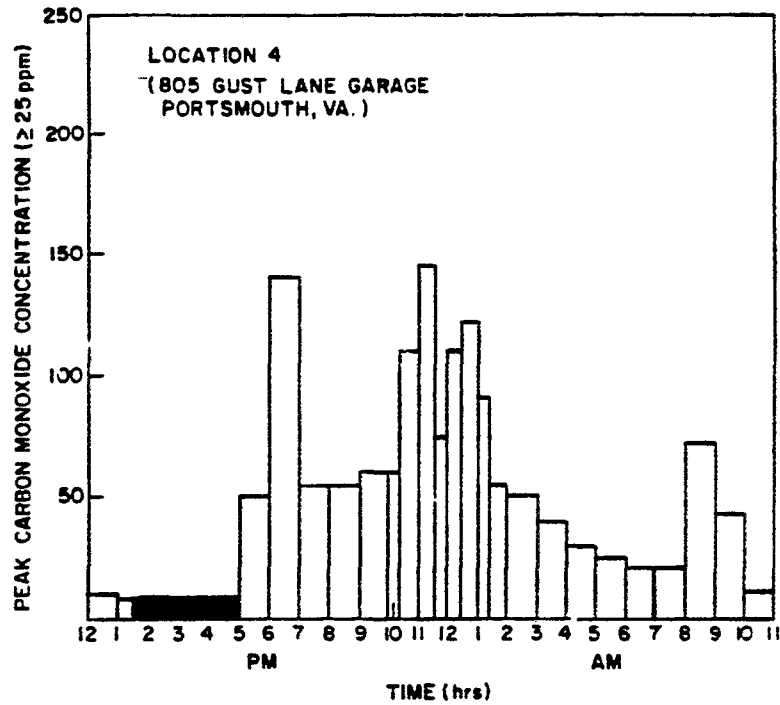


FIGURE 1c

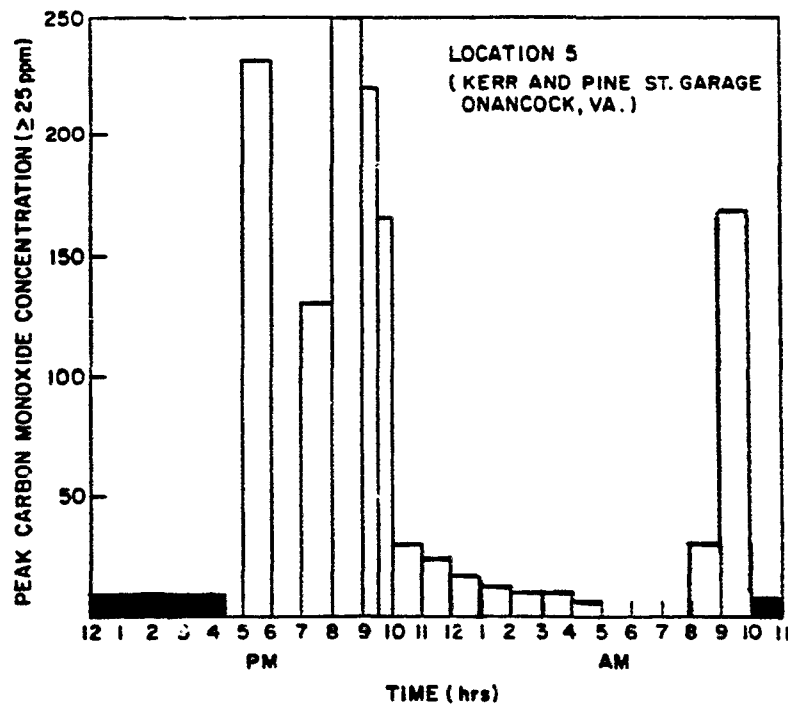


FIGURE 1d

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■ - period not monitored

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*Patricia Huggins*  
Patricia Huggins

Copy to  
G. Smith  
C. Deemer  
A. G. Bickelmann, M.D.  
A. J. Herbert, M.D.

N. J. DeCapua  
J. M. Degen  THIS COPY FOR  AT&T  
R. W. Stone, M.D.

W. J. Schreibeis  
G. M. Wilkening

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APPENDIX 1

CARBON MONOXIDE READINGS RECORDED DURING TIME  
PERIODS 4pm-12am and 7-11am AT EACH  
LOCATION

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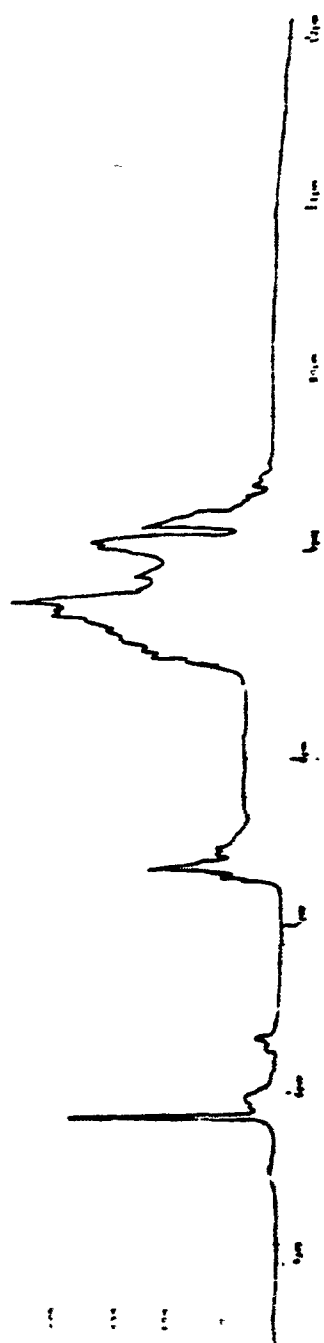
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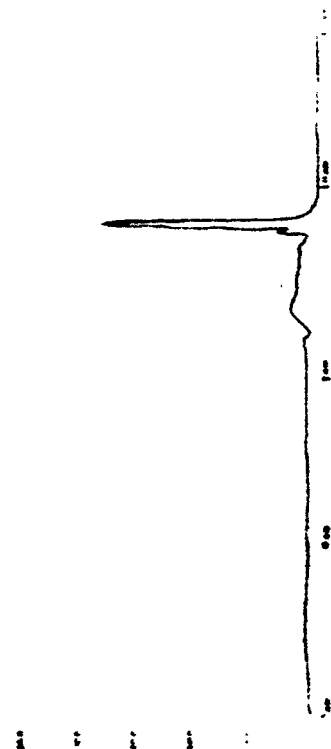
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time (hrs)



time (hrs)

CO (ppm)

CO (ppm)

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## ASBESTOS PROTECTION IN GARAGE

### 1. EQUIPMENT REQUIRED

- a. High efficiency vacuum (HEPA)
- b. Disposable respirator - Optional
- c. Brake assembly cleaner - Optional

### 2. WORK OPERATION

- a. Raise vehicle.
- b. Remove cover and wheel.
- c. Vacuum external parts.
- d. Vacuum parts removed.

### 3. HOUSEKEEPING

- a. Separate rags containing asbestos.
- b. Clean floors in work area with HEPA vacuum.

### 4. DISPOSAL

- a. Place rags, collectors and filters in marked plastic bag.
- b. Place asbestos dust in marked plastic bag.
- c. Carried to hazardous waste site every 90 days.

### RECOMMENDATIONS

1. Rewrite procedures to include wet methods.
  - a. Brake wash.
  - b. Aerosal cans.
2. This process is OSHA approved. (See attached letter)
3. No change in disposal procedures recommended.
4. Rewrite instructions to include complete procedures for garage operation.
  - a. Equipment required.
  - b. Work operations.
  - c. Housekeeping.
  - d. Disposal process.