PRELIMINARY SURVEY REPORT:

CONTROL TECHNOLOGY FOR BRAKE LINING

AT

Northwest Local School District
Cincinnati, Ohio

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Division of Physical Sciences and Engineering
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FACILITY SURVEYED:	Northwest Local School District Cincinnati, Ohio
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SURVEY CONDUCTED BY:	Frank W. Godbey Thomas C. Cooper James D. McGlothlin Dennis M. O'Brien John W. Sheehy
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EMPLOYEE REPRESENTATIVES CONTACTED:	No Employee Representatives

I. INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) is the primary Federal agency engaged in occupational safety and health research. Located in the Department of Health and Human Services (formerly DHEW), it was established by the Occupational Safety and Health Act of 1970. This legislation mandated NIOSH to conduct a number of research and education programs separate from the standard setting and enforcement functions carried out by the Occupational Safety and Health Administration (OSHA) in the Department of Labor. An important area of NIOSH research deals with methods for controlling occupational exposure to potential chemical and physical hazards. The Engineering Control Technology Branch (ECTB) of the Division of Physical Sciences and Engineering has been given the lead within NIOSH to study the engineering aspects of health hazard prevention and control.

Since 1976, ECTB has conducted a number of assessments of health hazard control technology on the basis of industry, common industrial process, or specific control techniques. Examples of these completed studies include the foundry industry; various chemical manufacturing or processing operations; spray painting; and the recirculation of exhaust air. The objective of each of these studies has been to document and evaluate effective control techniques for potential health hazards in the industry or process of interest, and to create a more general awareness of the need for or availability of an effective system of hazard control measures.

These studies involve a number of steps or phases. Initially, a series of walk-through surveys is conducted to select plants or processes with effective and potentially transferable control concepts or techniques. Next, in-depth surveys are conducted to determine both the control parameters and the effectiveness of these controls. The reports from these in-depth surveys are then used as a basis for preparing technical reports and journal articles on effective hazard control measures. Ultimately, the information from these research activities builds the data base of publicly available information on hazard control techniques for use by health professionals who are responsible for preventing occupational illness and injury.

This facility was visited as part of a study of asbestos control during the maintenance and repair of vehicular brakes. The study will evaluate the effectiveness of various control technologies designed to reduce asbestos exposure to brake mechanics. Ultimately, this project will result in reports and articles describing the effectiveness of such controls.

II. FACILITY AND PROCESS DESCRIPTION

FACILITY DESCRIPTION

This facility is the school bus service center for the Northwest Local School District in Colerain Township. The garage maintains approximately 100 school buses, performing approximately 100 brake inspection and repair jobs each year. The asbestos dust is controlled using a wet method. Also available is an enclosure using compressed air and vacuum to contain and remove asbestos dust from the brake-shoe assembly. This latter method is designed for 16" diameter wheels.

PROCESS DESCRIPTION

At this facility the primary method for controlling and collecting dust during brake servicing is a system of wet washing and good work practices. First, the mechanic removes the wheel and brake drum as a unit. He then thoroughly wetted the brake-shoe assembly and wheel hub using windshield washer fluid (most any liquid in a pump-spray bottle can be used). Next, a cleaning solution, water and Chem-eze®, is liberally sprayed onto the brake-shoes/wheel hub to wet and wash the area. The operator used a NAPA® Aspirator nozzle in which he varied his finger pressure on the trigger to adjust the air pressure during this phase of cleaning. Approximately one half gallon of cleaning solution is used per brake-shoe assembly. After spraying, the operator removes the used brake shoes while they are still wet. He again sprays the wheel hub to remove any dust still remaining. Next, he sprays the hub with a brake cleaner to dry the area, thoroughly wipes the spindle with a rag, and installs the new brake shoes. Before the mechanic changes the brake drum, which is attached to the removed tire and wheel, he vacuums the inside of the drum to remove any loose dust. The drum is unbolted from the wheel and replaced with a new drum. No water is used during the drum replacement phase of the operation.

Also available for bus brake service is a Per-Lux® Model 5000 enclosure-type brake assembly cleaner designed to be connected to shop air and a vacuum system. The unit is designed to fit 16-inch wheel hubs. The Per-Lux® unit is a rigid cylinder 12" long, approximately 16" in diameter, and open on the end that fits over the wheel hub and brake-shoes. The other end of the cylinder is a plyable plastic-like material to which the air line and vacuum line are attached. Once the wheel has been removed, the Per-Lux® unit is positioned over the brake-shoes and onto the wheel hub. The compressed air line and vacuum line are connected and the vacuum, a Pullman-Holt® Shop Vacuum cleaner, is turned on. The air pressure is controlled by a variable trigger leading to the wand inside the Per-Lux® unit. The operator squeezes the trigger and aims the wand, which is inside the unit, to dislodge the dust from the brake-shoe/wheel hub assembly. This dust is removed from the unit by the vacuum system. Air washing is continued for about two minutes, then the operator first turns of the air, the vacuum, and finally he removes the Per-Lux® unit. The operator then visually inspects the cleaned area for any dust that may not have been removed during airwashing.

III. CONTROLS

PRINCIPLES OF CONTROL

Occupational exposures can be controlled by the application of a number of well-known principles, including engineering measures, work practices, personal protection, and monitoring. These principles may be applied at or near the hazard source, to the general workplace environment, or at the point of occupational exposure to individuals. Controls applied at the source of the hazard, including engineering measures (material substitution, process/equipment modification, isolation or automation, local ventilation) and work practices, are generally the preferred and most effective means of control both in terms of occupational and environmental concerns. Controls which may be applied to hazards that have escaped into the workplace environment include dilution ventilation, dust suppression, and housekeeping. Control measures may also be applied near individual workers, including the use of remote control rooms, isolation booths, supplied-air cabs, work practices, and personal protective equipment.

In general, a system comprised of the above control measures is required to provide worker protection under normal operating conditions as well as under conditions of process upset, failure, and/or maintenance. Process and workplace monitoring devices, personal exposure monitoring, and medical monitoring are important mechanisms for providing feedback concerning effectiveness of the controls in use. Ongoing monitoring and maintenance of controls to insure proper use and operating conditions, and the education and commitment of both workers and management to occupational health are also important ingredients of a complete, effective, and durable control system. These principles of control apply to all situations, but their optimum application varies from case to case. The application of these principles are discussed below.

ENGINEERING CONTROLS

The Per-Lux® Model 5000 brake assembly cleaner, designed to operate with compressed air and a vacuum system, removes asbestos fibers during the servicing of a vehicle's brakes. The system is designed to enclose the entire brake-shoe assembly on the vehicle, air wash the brake area, and remove asbestos dust before the mechanic removes the used brake shoes. At the Northwest Local School District garage, the Per-Lux® unit uses shop air and a Pullman-Holt® Shop Vacuum with a regular vacuum bag. When the unit is in position, it forms a dust seal on 16-inch wheels. A blast of compressed air aimed by the operator through the wand inside the unit dislodges the dust from the brake-shoe area. The loosened dust is exhausted from the enclosure directly to the shop vacuum cleaner. A major disadvantage of this unit is the lack of a window to view the area being cleaned.

The normal practice when changing brake linings is to use non-asbestos brake liners. One manufacturer, ABEX®, makes a compressed fiberglass brake shoe. The mechanic reports these brakes, although noisy at first, are as effective in stopping as asbestos brakes.

WORK PRACTICES

Definition: Good Work Practices are a conscientious act by the worker to use tools, machines, or equipment, such that exposure to hazardous physical or chemical agents is reduced or eliminated. Good work practices include: (1) awareness that exposure to a particular agent may be harmful, (2) having the knowledge and skill to prevent exposure, and (3) using this knowledge and skill to reduce exposure.

The brake maintenance worker at this facility cleans and changes brake assembles on approximately 3 buses per week. All four brakes are cleaned and changed for each bus. The task of cleaning and changing the 4 brakes takes approximately 6 hours, or 1 work day to complete. This worker has performed this job for the past year.

This worker performed a 7 step procedure to remove, clean, and replace a brake assembly. Listed below are the major tasks performed during brake maintenance of the right front wheel of a school bus:

1. The worker removed the front right wheel of the bus and wets down the brake assembly with windshield wiper fluid. The fluid was applied via a hand held pump spray bottle. This initial application allowed the worker to control the direction and amount of fluid applied to the brake assembly. This technique was instrumental in controlling the generation of brake dust.

2. The worker used Chem-Eze® liquid solution which was applied to the brake assembly through a NAPA® nozzle aspirated by compressed air. The amount of solution and force of application was controlled by the worker regulating the nozzle trigger. A 10 gallon bucket was located under the brake-shoe assembly to catch the spent solution and loose dust particles.

3. The worker removed the old brake-shoes while they were still wet.

4. The worker sprayed Brake Cleaner solution (Series #2) from a pressurized 16 oz can to clean and dry the wheel hub.

5. The wheel hub was wiped down with a cloth.

6. Next, the brake drum which was still attached to the wheel was vacuumed to remove lose dust particles.

7. The old brake drum is changed and a new one was added to complete the process.

The work practices for the wet method by this worker may be used as an example for others involved in brake maintenance operations. This worker used ordinary tools and equipment available in most maintenance shops to control dust generation. The work practices using the vacuum technique for the left front wheel of the school bus were not evaluated because it did not fit the wheel of the bus being serviced.

MONITORING

There is no air monitoring program in the garage area.

PERSONAL PROTECTION

A respirator for organic vapors and nuisance dust is available but usually it is not worn.

IV. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this survey was to examine two methods of brake maintenance: a vacuum technique (Per-Lux® brake assembly cleaner), and a wet technique. The vacuum technique was viewed to be inadequate and potentially hazardous because of an improper fitting adaptor assembly. The wet technique was examined, however, and appeared to be an excellent alternative to the vacuum technique for brake maintenance.

The Per-Lux® brake assembly cleaner lacks a view port to examine the area cleaned. As designed, the operator can not observe what he is cleaning and has to remove the unit to inspect the cleaned area, thus potentially exposing himself to any dust remaining on the shoes or hub. Also, this unit, designed to fit 16" wheels, does not form a tight seal on the smaller 15" wheels of the newer buses and is therefore a potential dust source. Possibly by installing an inflatible tube inside the Per-Lux® unit, a tight seal could be achieved to reduce this potential dust source when being used on smaller wheels.

The use of a shop vacuum with a regular filter bag may allow further distribution of asbestos fibers into the work environment. A vacuum with a HEPA-filter dust collector is suggested to contain and collect the asbestos dust.

At this facility, very good work practices using a wet washing method were observed. These good work practices and the resourceful use of available wetting agents signficantly reduce visible dust generation. The operator was aware of the hazards of asbestos dust and took extra care in the wetting and cleaning phases to collect and remove the brake dust. An in-depth evaluation of these work practices is recommended.

A bulk sample of the brake dust from non-asbestos shoes was submitted for size and elemental analysis from this facility.