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 and 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.

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MBL-USA
OTTAWA, ILLINOIS

NIOSH INVESTIGATOR:
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SUMMARY

In September 1994, the National Institute for Occupational Safety and Health (NIOSH) conducted a health hazard evaluation (HHE) at MBL-USA, Ottawa, Illinois. Submitted by the United Auto Workers Local 2323, the HHE request concerned potential employee exposures to N-nitrosamines during the manufacture of rubber power transmission belts. The union was also concerned about potential exposures to crystalline silica and asbestos during the coating of rubber belts with a lubricating powder. A site survey was conducted at MBL-USA on September 7-8, 1994, during which personal breathing-zone (PBZ) and general area (GA) air samples were collected for N-nitrosamines. A PBZ air sample collected on the employee assigned to the powder spraying operation was gravimetrically analyzed for respirable particulate. A bulk sample of this same lubricating powder was also analyzed for asbestos and crystalline silica.

Air sampling conducted at MBL-USA during a previous Occupational Safety and Health Administration (OSHA) inspection had measured nitrosodiethylamine (NDEA) concentrations in the Ring and Press Curing areas, ranging from 0.27 to 0.32 micrograms per cubic meter ($\mu g/m^3$). In this NIOSH HHE, 20 personal breathing-zone (PBZ) and general area (GA) air samples were collected at operations where rubber stock, belts, or jackets were handled, heated, or stored. Production levels and working conditions were similar to those evaluated during the OSHA inspection. These samples were analyzed for NDEA, nitrosodimethylamine (NDMA), nitrosodipropylamine (NDPA), nitrosodibutylamine (NDBA), nitrosopiperidine (NPIP), nitrosopyrrolidine (NPYR), and nitrosomorpholine (NMOR) using a capillary column gas chromatograph and a mass spectrometer (MS) in the selected-ion-monitoring (SIM) mode. The limits of detection (LOD) and quantitation (LOQ) for this sample set were 0.01 and 0.03 µg/sample, respectively.

Only NDEA was detected, at concentrations ranging from below the minimum detectable concentration (MDC) to 0.55 $\mu g/m^3$, time-weighted average (TWA) over the period sampled. No asbestos was detected in the bulk sample of the powder used to coat the belts. The powder was also analyzed (using x-ray diffraction) for both quartz and cristobalite (two types of crystalline silica). Neither quartz nor cristobalite were detected. A PBZ air sample collected on the powder applicator measured 0.13 milligrams of respirable particulate per cubic meter of air (mg/m^3), a concentration well below the OSHA Permissible Exposure Limit (PEL) for nuisance particulate of 5 mg/m^3.

No health hazards were documented in this evaluation resulting from overexposures to N-nitrosamines, crystalline silica, or asbestos. Based on good industrial hygiene practive, this report includes recommendations for improving the effectiveness of the canopy hood ventilation systems in the Cure Press area. Recommendations were also made to improve the personal protective equipment used by employees in the Banbury area.

Keywords: SIC 3052 (Rubber and Plastics Hose and Belting), N-nitrosodiethylamine, N-nitrosodimethylamine, silica, asbestos, nitrosamines, rubber.

INTRODUCTION

The United Auto Workers (UAW) Local 2323 submitted a request for a National Institute for Occupational Safety and Health (NIOSH) health hazard evaluation (HHE) at the MBL-USA facility in Ottawa, Illinois. The request was prompted by concerns about potential N-nitrosamine exposures to curing operators, Banbury personnel, and calender workers during the manufacture of industrial and automotive power transmission belts. The union requesters decided to contact NIOSH and submit an HHE request after reviewing the results of an earlier Occupational Safety and Health Administration (OSHA) compliance inspection conducted at MBL-USA in December 1992. During this OSHA survey, air sampling for N-nitrosodiethylamine (NDEA), coal-tar pitch volatiles, and 1,3-butadiene was conducted in the wrap-mold area. N-nitrosodiethylamine concentrations measured by OSHA ranged from 0.27 to 0.32 micrograms per cubic meter ($\mu g/m^3$). Since NDEA was detectable in the wrap-mold area, the union was concerned that it may also be present in adjacent molding and curing departments. The union was also concerned with the potential presence of asbestos and crystalline silica in a lubricating talc-like powder which was spray-coated onto selected belts prior to shipment.

A site visit was conducted at MBL-USA on September 6-8, 1994. Following an opening conference attended by management and union representatives, a walk-through of the plant was conducted. Personal breathing-zone (PBZ) and general area (GA) air sampling was conducted for N-nitrosamines on September 7-8 in the following departments: VL, VS, Timing Belt, Raw Edge, Jacket Making, Cog Press, Batch Off, Calender, Needer, Material Receiving, and Warehouse. An interim report, dated October 12, 1994, was provided to the company and union which contained the results of the asbestos, crystalline silica, and respirable dust sampling.

BACKGROUND

Established in 1974, MBL-USA manufactures a wide variety of v-belt, v-ribbed belts, and timing belts for both original equipment and service parts in the industrial and automotive markets. With a major expansion completed in 1990, the 190,000 square foot Ottawa facility employed approximately 210 workers at the time of this evaluation.

Production of rubber power transmission belts begins in the compounding department where ingredients are weighed out and added to the rubber stock. Following compounding, the ingredients are blended with the appropriate rubber stock (Banbury operation), pass through the Batch Off and Needer operation (warms up the rubber mixture), and is then transferred to the Calender and Wind-Up area. Table 1 summarizes the activities performed in the remaining departments at MBL-USA.

EVALUATION DESIGN

N-nitrosamines

Personal breathing-zone and GA air samples were collected in the Ring and Press Curing areas as well as at other operations where rubber stock, belts, or jackets were handled, heated, or stored. Since N-nitrosamines can also be present in cigarette smoke, a GA air sample was collected in the MBL-USA designated smoking area (located in a space near the employee entrance to the plant).[a] These air samples were analyzed for NDEA, nitrosodimethylamine (NDMA), nitrosodipropylamine (NDPA), nitrosodibutylamine (NDBA), nitrosopiperidine (NPIP), nitrosopyrrolidine (NPYR), and nitrosomorpholine (NMOR). The air samples were collected on Thermosorb-N sorbent media using Gillian® high-flow pumps operating at a flow rate of 1 liter per minute (l/min). The samples were subsequently analyzed in a NIOSH laboratory using a capillary column gas chromatograph and a mass spectrometer (MS) in the selected-ion-monitoring (SIM) mode. Specific N-nitrosamines were detected by monitoring the characteristic NO^+ ion during the expected chromatographic elution time of the analyte. The limits of detection (LOD) and quantitation (LOQ) for this sample set were 0.01 and 0.03 µg/sample, respectively.

Asbestos

A bulk sample of the powder used by MBL-USA to lubricate selected power transmission belts was collected and analyzed for asbestos using NIOSH Method No. 9002 (polarized light microscopy). Using this analytical technique, the percentage of fibrous asbestos is estimated by a microscopic examination of the sample.

Crystalline Silica

A bulk sample of this same powder was analyzed for crystalline silica according to NIOSH Method No. 7500 (x-ray diffraction). Two modifications were made to the method: (1) the sample filter was dissolved in tetrahydrofuran rather than being ashed in a furnace; and (2) standards and sample were analyzed concurrently rather than using the suggested normalization procedure. The LOD and LOQ for this bulk sample were 0.75% crystalline silica per sample and 1.5% crystalline silica per sample, respectively.

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[a] Some of the employees who wore PBZ air samplers for n-nitrosamines also smoked cigarettes. This GA air sample was collected in the smoking room to evaluate if the cigarette smoke may have contributed to the worker's overall n-nitrosamine exposure.

Respirable Dust

A PBZ air sample was collected on the employee responsible for applying the lubricating powder to selected belts. The sample was collected on a tared, 37-millimeter diameter, polyvinyl chloride (PVC) filter (pore size of 5 micrometers) at a flow rate of 1.7 liters per minute (lpm). A gravimetric analysis was performed on the sample following NIOSH Method 0600. The total weight of the sample was determined by weighing the sample plus the filter on an electrobalance and subtracting the previously determined tare weight of the filter. The estimated LOD for this method is 0.02 milligrams (mg) per filter.[b]

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ evaluation criteria for the assessment of a number of chemical and physical agents. The primary sources of environmental evaluation criteria for the workplace are the following: (1) NIOSH Criteria Documents and Recommended Exposure Limits (RELs), (2) the OSHA Permissible Exposure Limits (PELs), and (3) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs®).[1,2,3] The objective of these criteria is to establish levels of exposure to which the vast majority of workers may be exposed without experiencing adverse health effects.

Full-shift and shorter duration criteria are available depending on the specific physiologic properties of the agent. Full-shift limits for chemical agents are based on the time-weighted average (TWA) airborne concentration of a substance that workers may be repeatedly exposed to during an 8- or 10-hour work day, up to 40 hours a week for a working lifetime, without adverse health effects. Some substances have short-term exposure limits (STELs) or ceiling limits (CLs) which are intended to supplement the full-shift criteria where there are recognized irritative or toxic effects from brief exposures to high airborne concentrations. STELs are based on 15-minute TWA concentrations, whereas CL concentrations should not be exceeded even momentarily.

Occupational health criteria are established based on the available scientific information provided by industrial experience, animal or human experimental data, or epidemiologic studies. Differences between the NIOSH RELs, OSHA PELs, and ACGIH TLVs may exist because of different philosophies and interpretations of technical information. It should be noted that RELs and TLVs are guidelines, whereas PELs are standards which are legally enforceable. The Occupational Safety and Health Administration PELs are required to take into account the technical and economical feasibility of controlling exposures in various industries where the

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[b] The limit of detection is estimated since the weight of an unused PVC filter may vary by up to 0.02 mg.

agents are present. The NIOSH RELs are primarily based upon the prevention of occupational disease without assessing the economic feasibility of the affected industries. The ACGIH is not a government agency; it is a professional organization whose members are industrial hygienists or other professionals in related disciplines and are employed in the public or academic sector. The TLVs are developed by consensus agreement of the ACGIH TLV committee and are published annually. The documentation supporting the TLVs (and proposed changes) is periodically reviewed and updated if believed necessary by the committee.

Not all workers will be protected from adverse health effects if their exposures are maintained below these occupational health exposure criteria. A small percentage may experience adverse effects due to individual susceptibility, a pre-existing medical condition, previous exposures, or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, or with medications or personal habits of the worker (such as smoking) to produce health effects even if the occupational exposures are controlled to the limit set by the evaluation criterion. These combined effects are often not considered by the chemical specific evaluation criteria. Furthermore, many substances are appreciably absorbed by direct contact with the skin and thus potentially increase the overall exposure and biologic response beyond that expected from inhalation alone. Finally, evaluation criteria may change over time as new information on the toxic effects of an agent become available. Because of these reasons, it is prudent for an employer to maintain worker exposures well below established occupational health criteria. The evaluation criteria for the compounds analyzed during this health hazard evaluation are discussed in the following section.

N-nitrosamines

Nitrosamines are compounds characterized by the -N--N=O functional group. They result from the combination of primary, secondary, or tertiary amines with nitrite. These reactions can occur in the laboratory; in various food, household, or industrial products; in industrial processes; and in vivo. Because of the variety of amines and reaction conditions possible, there are hundreds of nitrosamines; and because of the large number of exposure sources, including formation in vivo, there is a complicated matrix of total nitrosamine exposure. Occupational exogenous exposures have been observed in rubber industries, leather tanning industries, metal working industries, chemical industries, mining, pesticide production, detergent production, and fish factories.

Most nitrosamines are suspected to be human carcinogens, but direct causal associations have not yet been proven. Cancer is believed to be a multistage process, beginning with (1) *exposure* to a carcinogen or procarcinogen and followed by (2) *initiation* of a cell to a genetically altered cell by damage to the DNA; (3) *promotion* of the altered cell to a preneoplastic lesion; (4) *conversion* of the preneoplastic lesion to a malignant tumor through a genetic change; and finally (5) *progression* of the tumor to clinical cancer. Exposure to a carcinogen must result in a genetic change in order to initiate a cell; likewise, there must also be a genetic change for a preneoplastic lesion to convert into a malignant tumor.[4] These genetic changes can occur from spontaneous mutations, and they can also occur with DNA adduct formation from exposure to carcinogens that are initiators or promoters, or both. These genetic changes also must occur in certain chromosomal locations in order to cause the next step in carcinogenicity. Mutations in some of these chromosomal locations have been identified, such as activation of proto-oncogenes or inactivation of tumor suppressor genes, but these and other processes are still being researched.[4]

There are many confounding factors that prevent every exposure to a carcinogen from resulting in clinical cancer. Genetic predisposition—inheritance of certain genetic mutations, variations in activity of metabolizing enzymes and DNA repair enzymes, variations in immunity and immune cell enzymes—plays an important role in the development or lack of development of cancers. Variations in lifestyle and overall health can also play a part as these may affect immune function and intracellular repair processes.

The suspected mechanism of carcinogenesis of nitrosamines is that nitrosamines, from exogenous or endogenous sources, are metabolized into reactive intermediates which can then covalently bind to macromolecules, including DNA. If the adducts to the DNA result in a genetic mutation during the replication process, and if that mutation is in certain areas of the genome, the cell could undergo the second and third stages of carcinogenesis—initiation and promotion. If there was a second genetic change in the right place, conversion to a malignant tumor could result.

Although a causal association between nitrosamine exposure and human cancer has not yet been firmly established, there is circumstantial evidence that nitrosamines could cause cancer in humans. In 1956, Magee and Barnes demonstrated the carcinogenic potential of NDMA in rats.[5] Since then, nitrosamines have been studied extensively in laboratory animals. Approximately 90% of the 300 tested nitrosamines have shown carcinogenic effects in bioassays and laboratory animals. The animals that have been studied include mammals, birds, fish, and amphibia. Of the approximately 40 animal species tested, none has been resistant. The tumor sites depend on the specific nitrosamine, the species tested, and the route of administration. Nitrosamine affects have been demonstrated in the bladder, bronchi, central nervous system, earduct, esophagus, eyelid, duodenum, forestomach, glandular stomach, hematopoietic system, intestine, jaw, kidney, larynx, nasal cavity, oral cavity, ovary, liver, mammary glands, pancreas, pelvis, peripheral nervous system, pharynx, respiratory tract, skin, testes, trachea, uterus, and vagina.[6] Dose-response studies with rats have shown "no effect levels" corresponding to dietary concentrations of 1 part per million (ppm) NDMA, 1 ppm NDEA, and 1 ppm NPYR.[6] These N-nitrosamines and others appear to be very potent carcinogens.

All of the biochemical, pathological, and experimental data provides little evidence that humans might be resistant to the carcinogenic potential of nitrosamines.[7] Human tissues from the trachea, bronchus (lung), esophagus, colon, pancreatic duct, bladder, and buccal mucosa have been shown to metabolize nitrosamines into DNA-binding compounds.[7] Human liver tissue appears to metabolize nitrosamines with a similar activity to rodent liver tissue, and rodents have similar acute symptoms of liver necrosis and cirrhosis that have been observed in humans.[7] A few human DNA adduct studies have revealed higher levels of nitrosamine-related DNA adducts in cancer cases than in controls.[8,9] Studies in experimental animals have shown similar DNA adduct formation to those detected in the human studies.[10-12]

Only one nitrosamine, nitrosodimethylamine, is regulated in the United States. Both OSHA and NIOSH regulate NDMA as an occupational carcinogen, recommending that its exposure be reduced to the lowest feasible concentration. There are no established *numerical* exposure limits in this country.

Germany has strict regulations for occupational exposures to nitrosamines. In general industry, the total exposure to all nitrosamines present may not exceed 1 $\mu g/m^3$. In special cases, such as the tire storage warehouses, exposures to all nitrosamines present may not exceed 2.5 $\mu g/m^3$. In addition to these regulations, eight nitrosamines are regulated individually—nitrosodimethylamine, nitrosomorpholine, nitrosopiperidine, phenyl-ethylnitrosamine, phenyl-methylnitrosamine, di-N-butylnitrosamine, di-iso-propylnitrosamine, and diethylnitrosamine.

Asbestos

In testimony to OSHA, NIOSH has testified that there is no safe airborne concentration of fibers for any asbestos mineral.[13,14,15] 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 recommended exposure limit (REL) for asbestos is 0.1 f/cc.[13] 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.[16] 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.[13,15] National Institute for Occupational Safety and Health 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.

Crystalline Silica

Crystalline silica (quartz) and cristobalite have been associated with silicosis, a fibrotic disease of the lung caused by the deposition of fine particles of crystalline silica in the lungs. Symptoms usually develop insidiously, with cough, shortness of breath, chest pain, weakness, wheezing, and non-specific chest illnesses. Silicosis usually occurs after years of exposure, but may appear in a shorter period of time if exposure concentrations are very high.[17] The NIOSH RELs for respirable quartz and cristobalite, published in 1974, are 50 $\mu g/m^3$, as TWAs, for up to 10 hours per day during a 40-hour work week.[18] These RELs are intended to prevent silicosis. However, evidence indicates that crystalline silica is a potential occupational carcinogen and NIOSH is currently reviewing the data on carcinogenicity.[19,20] The OSHA PELs and the ACGIH TLVs for respirable quartz and cristobalite are 100 and 50 µg/m^3, as 8-hour TWAs, respectively.[2,3]

Nuisance Dust

Often the chemical composition of the airborne particulate does not have an established occupational health exposure criterion. It has been the convention to apply a generic exposure criterion in such cases. Formerly referred to as nuisance dust, the preferred terminology for the non-specific particulate ACGIH TLV criterion is now *"particulates, not otherwise classified (n.o.c.),"* [or *"not otherwise regulated"* (n.o.r.) for the OSHA PEL].

The OSHA PEL for total particulate, n.o.r., is 15.0 milligrams per cubic meter (mg/m^3) and 5.0 mg/m^3 for the respirable fraction, determined as 8-hour averages.[2] The ACGIH recommended TLV for exposure to a particulate, n.o.c., is 10.0 mg/m^3 (total dust, 8-hour TWA).[3] These are generic criteria for airborne dusts which do not produce significant organic disease or toxic effect when exposures are kept under reasonable control.[21] These criteria are not appropriate for dusts that have a biologic effect (for example, if the particulate contains asbestos or crystalline silica).

RESULTS AND DISCUSSION

N-nitrosamines

Table 2 contains the results from the PBZ and GA air samples collected on September 7-8, 1994. Only N-nitrosodiethylamine (NDEA) was detected in the samples, at levels ranging from not detected (ND) to 0.55 µg/m^3, TWA over the period sampled. The following N-nitrosamines were analyzed for but ND in these air samples: nitrosodimethylamine (NDMA), nitrosodipropylamine (NDPA), nitrosodibutylamine (NDBA), nitrosopiperidine (NPIP), nitrosopyrrolidine (NPYR), and nitrosomorpholine (NMOR). All of the NDEA concentrations measured on September 7-8, 1994, at MBL-USA were below the German general industry occupational exposure criteria of 1 µg/m^3 (total exposure to all nitrosamines).

The highest NDEA exposures at MBL-USA were obtained from samples collected on employees assigned to the Batch Off, Needer, and Calender machines. These machines, situated near one another, were involved in handling heated rubber stock. At the Batch Off machine, the hot rubber stock emerging from the Banbury mixer is cooled and divided into small batches for further processing. The Needer machine warms previously cooled and batched rubber stock to prepare it for further processing. Finally, considerable heat can be generated during the Calender operation.

It is possible that the handling of heated rubber stock at these operations may be associated with the slightly higher NDEA concentrations from this area. For example, on September 8, 1994, the Calender operator was processing friction rubber from 7:00 a.m. to 10:00 a.m. on . Friction rubber was a product which, according to the Calender operator, generated a higher amount of heat during processing (as compared to other types of rubber stock). The highest NDEA concentration, 0.55 $\mu g/m^3$, was obtained during this operation.

Asbestos

No asbestos was detected in the bulk sample of the powder used to lubricate selected power transmission belts.

Crystalline Silica and Respirable Nuisance Particulate

The bulk sample of lubricating powder was analyzed (using x-ray diffraction) for both quartz and cristobalite (two types of crystalline silica). Neither quartz nor cristobalite were detected. Since no asbestos and crystalline silica was present in this powder, the result from the PBZ air sample collected on the powder applicator was compared to the respirable nuisance particulate standard. The 0.13 milligrams of respirable particulate per cubic meter of air (mg/m^3) was well below the OSHA PEL for nuisance particulate of 5 mg/m^3.

CONCLUSIONS

- No asbestos or crystalline silica was detected in a bulk sample of the powder applied as a coating to some of the automotive belts.

- The powder applicator's exposure to respirable particulate was well below the OSHA September 8, 1994PEL for nuisance particulate of 5 mg/m^3.

- The only N-nitrosamine detected in personal breathing and general area air sampling performed on September 7-8, 1994, was nitrosodiethylamine (NDEA). The concentrations of NDEA measured at MBL-USA *were below* the German general industry occupational exposure criteria of 1 $\mu g/m^3$ (total N-nitrosamine exposure). Neither NIOSH nor OSHA have exposure criteria for NDEA.

RECOMMENDATIONS

1. Based on visual observations made during the work day on September 7, 1994, the canopy hood local exhaust ventilation (LEV) system for Cure Presses Nos. 4 and 5 appeared to be ineffective in capturing or controlling the emissions generated during a

curing cycle. The effectiveness of this LEV system was diminished, among other reasons, by the use of 90º tees in the exhaust ducts, an arrangement which increases the air resistance and can reduce the performance of the ventilation system. During interviews with employees, operators in the Press Cure area also mentioned that the canopy hood on Cure Press No. 7 was also ineffective in controlling emissions generated during belt curing.

In general, canopy hoods are neither efficient nor effective as a LEV control for most processes. *Based on good industrial hygiene practice*, alternative ventilation designs, such as back draft slotted hoods, may be more effective in exhausting Cure Press emissions. If the existing arrangement of canopy hoods remain in use, the overall effectiveness of this ventilation system may be increased by replacing the 90º tees with tapered elbows and installing dampers which would enable the press operators to close off hoods from presses which are not currently in use. These changes should increase the effectiveness of the remaining canopy hoods by increasing the exhaust flow rates.

2. The existing LEV system at the weigh-out station located in the Banbury area (consisting of a rectangular flanged vent approximately 8" by 16" situated near the storage bins) would provide little, if any, control when transferring raw materials from adjacent barrels to the smaller storage bins, an activity that is occasionally performed by the operator. A larger back draft slotted hood situated behind the barrels may be more effective in controlling particulate during material transfer activities.

3. It was observed that operators in the Banbury Area wore unlined cotton gloves when handling raw ingredients during weigh-out and transfer operations. Some of the ingredients which were handled (such as Vanox® MTI and Vanox® MBM) are (according to their Material Safety Data Sheets [MSDSs]) possible skin and/or eye irritants. General purpose gloves using natural rubber, butyl or neoprene rubber should offer adequate protection. Of course, the exact properties of the gloves selected will depend on the hazards of the work and the requirements of the job to be performed.

4. Based on good industrial ventilation design, the weather cap on the exhaust stack leading from the belt groove grinder should be removed and replaced with a "no loss" stack. This change may also help to lower the noise created by the dust collector which preceeds the exhaust stack.

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Copies of this report have been sent to:

1. MBL-USA, Ottawa, Illinois
2. United Auto Workers, Local 2323
3. OSHA Region V
4. NIOSH

For the purpose of informing affected workers, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table 1
Description of Production Operations at MBL-USA
HETA 93-0962

Area/Activity	No. Of Employees	Activities Performed
Prep Section	≈ 8 workers	Cutting rubber sheets to length, pressing "cogs" in rubber sheets
Raw Edge/Rib Section	≈ 3 workers	A very automated building line which produces high-volume automotive belts. Production steps involved include adding a layer of material onto the rubber stock and "spinning" reinforcing fabric cord onto the rubber. Loading and unloading is performed automatically.
Jacket Making	Typically 1 worker	Butyl rubber stock (purchased from outside vendor) is shaped and cured to form "jackets." These jackets are used to hold the belts during the curing (vulcanizing) operation.
VS Area	Not obtained	Producing v-belts ranging in diameter from 20 inches to 80 inches.
VL Area	Not obtained	Producing larger diameter v-belts, ranging in size up to 120 inches.
Build-up	Not obtained	Using a horizontal rotating collapsible cylinder, the operators add the necessary rubber and fabric layers and wind (or spin) a reinforcing fabric cord to produce a belt.
Ring Cure	Not obtained	Curing belts up to 120 inches in diameter. The belts are loaded on to reusable steel molds, placed in butyl rubber jackets (see jacket making), and then heated (under pressure) to cure (vulcanize) the rubber.
Press Cure	Not obtained	Curing belts greater than 120 inches in diameter. The belts are fed through a press and then heated (under pressure) to cure (vulcanize) the rubber.
Compounding	1 worker	Weigh-out of rubber and additives to rubber in room located on the third floor. Gravity-fed to Banbury mixer located on second floor.
Banbury	1 worker	Blending of stock rubber and additives. Mixture is gravity-fed to Batch Off machine located on first floor.
Batch Off	≈ 2 workers	The Batch Off machine cools the rubber stock emerging from the Banbury mixer.
Needer	Typically 1 worker	Warms the rubber stock in preparation for the Calender.
Calender	Typically 1 worker	Rolls the rubber stock to desired thickness in preparation for subsequent processing.
Receiving	Not obtained	Rubber stock, rubber additives, and other raw materials needed for production are received by truck and stored until needed. Propane fueled lift trucks operate in this area.
Warehouse	Not obtained	Completed belts are stored in this area until shipped by truck. Propane fueled lift trucks operate in this area.

Table 2
Air Concentrations of N-nitrosodiethylamine (NDEA) at MBL-USA, Ottawa, Illinois
Sampling Dates: September 7-8, 1994
HETA 93-0962

Location	Activity	Sample Type	Sample No.	Sampling Period	Concentration (μg/m^3)
VL Area	Cure (Press)	PBZ	GB-3	7:36 am ➜ 11:00 am	Trace
VL Area	Cure (Press)	PBZ	GB-4	11:01 am ➜ 2:58 pm	Trace
VS Area	Cure (Ring)	PBZ	GB-5	7:26 am ➜ 3:01 pm	Trace
VS Area	Cure (Ring)	PBZ	GB-6	7:30 am ➜ 3:00 pm	Trace
VS Area	Cure (Ring)	PBZ	GB-7	7:33 am ➜ 3:02 pm	Trace
Timing Belt Area	Build/Cure Industrial Cog Belts	PBZ	GB-8	7:07 am ➜ 2:52 pm	0.11
Timing Belt Area	Build/Cure Timing Belts	PBZ	GB-9	7:08 am ➜ 2:50 pm	Trace
Raw Edge/Rib Area	Cure	PBZ	GB-10	7:14 am ➜ 2:55 pm	0.15
Raw Edge/Rib Area	Cure	PBZ	GB-11	7:16 am ➜ 2:55 pm	0.13
VL Area	Cure (Ring)	PBZ	GB-14	7:22 am ➜ 2:48 pm	Trace
Receiving Area	On work desk	GA	GB-15	6:59 am ➜ 11:58 am	Trace
Warehouse Area	On work desk, near "My Call" desk	GA	GB-16	7:02 am ➜ 12:01 pm	Trace
Designated Smoking Area	In air lock between exterior and interior doors	GA	GB-17	7:30 am ➜ 12:18 pm	ND
Needer Machine	Needer Operator	PBZ	GB-18	7:12 am ➜ 11:51 am	0.24
Cog Press	Cog Press Operator	PBZ	GB-19	7:16 am ➜ 11:48 am	Trace
Jacket Maker	Jacket Maker	PBZ	GB-20	7:20 am ➜ 11:48 am	0.12
VL Area	Builder, Machine No. 1	PBZ	GB-21	7:24 am ➜ 11:45 am	Trace
Calender SPM	Calender Operator	PBZ	GB-22	7:35 am ➜ 11:53 am	0.55
Batch Off Area	Batch Off Operator	PBZ	GB-23	7:37 am ➜ 11:55 am	0.17
Minimum Detectable Concentration (assuming a 425 liter air sample)					0.02
Minimum Quantifiable Concentration (assuming a 425 liter air sample)					0.07

Abbreviations:
PBZ = Personal breathing-zone air sample
GA = General area air sample
Trace = Concentration is between the Minimum Detectable and Minimum Quantifiable Concentrations
μg/m^3 = Micrograms of NDEA per cubic meter of air