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HEALTH HAZARD EVALUATION REPORT 72-68-25
HAZARD EVALUATION SERVICES BRANCH
DIVISION OF TECHNICAL SERVICES

Establishment: North American Rockwell
Reinforced Plastic Operation
Ashtabula, Ohio 44004

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

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The results of an investigation conducted during the period September 11, 1972 to November 9, 1972 by Officers of the National Institute for Occupational Safety and Health (NIOSH) to "....determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found," have indicated that there is a significant hazard to the health and well-being of the approximately 550 workers employed in the Reinforced Plastic Operations at North American Rockwell in Ashtabula, Ohio.

A colation of the Environmental and Medical conclusions of the Hazard Evaluation and the basis for these conclusions, in the best judgement of the authors, ensues:

1. Exposures to airborne dust in many areas of the plant are far in excess of ACGIH recommended standards, as well as, OSHA promulgated standards. An appreciable fraction of airborne dust in this plant has been demonstrated to be of respirable character. These exposures have caused damage to the skin, nasal and pharyngeal mucosa, as well as having caused conjunctival irritation in workers at this facility. Furthermore, the respirable fraction of this dust may present an unknown potential danger to the pulmonary structures of these workers.

2. Many chemical vapors are simultaneously present in several of the plant work areas and have been documented to reach transient, high concentrations. Acetone, cellosolve acetate, isobutyl alcohol, isopropyl alcohol, methyl cellosolve, methyl isobutyl ketone, methylene chloride, methyl ethyl ketone, normal butyl acetate, styrene, toluene, and xylene have all been found in the plant atmosphere. Although none of the organic vapor samples collected by NIOSH exceeded individual Federal Standards, the NAR Officials of the Ashtabula facility have themselves documented the presence of light hydrocarbons (i.e., pentane, hexane, etc.) (upper range 1,000 to 1,200 ppm), methylene chloride (200 to 8,000 ppm), styrene (600 to 1,200 ppm), toluene (350 ppm), and xylene (300 to 1,850 ppm). However, to date these concentrations have been only measured as peak transient levels and do not represent time-averaged concentrations. In addition, there is a potential exposure to unknown chemical combinations and possible potentiation of toxic effects of certain chemicals. In our judgement, the exposure to various organic vapors has led to subjective symptoms of headache, nausea, vomiting, dizziness, generalized weakness and possibly chronic fatigue in the workers at this establishment.

3. The plant ventilation system as a whole is grossly inadequate. Local exhaust ventilation is all but nonexistant. Paint booths and other ventilated work areas (downdraft sanding lines, preform machines etc.) suffer from poorly designed and maintained air moving systems.

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HEALTH HAZARD EVALUATION REPORT 72-68
NORTH AMERICAN ROCKWELL
(REINFORCED PLASTICS OPERATIONS)
ASHTABULA, OHIO

DECEMBER, 1972

I. SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to an unknown substance(s) at the Reinforced Plastics Operations (RPO) of the North American Rockwell (NAR) facility in Ashtabula, Ohio.

The substances used or found in the workplace with potentially toxic properties are listed below with their respective exposure standards as promulgated by the U.S. Department of Labor (Federal Register, Volume 37, §1910.93, October 18, 1972).

SUBSTANCE	STANDARD CONCENTRATION*
Acetone	1000 ppm **
Dimethyl Aniline	5 ppm
Isobutyl alcohol	100 ppm
Isopropyl Alcohol	400 ppm
Normal butyl acetate	150 ppm
Methyl Cellosolve	25 ppm
Methyl ethyl ketone	200 ppm
Methyl isobutyl ketone	100 ppm
Methylene chloride	500 ppm
Styrene	100 ppm
Toluene	200 ppm
Xylene	100 ppm
Dust (Nuisance)	15 mg/m^3 ***
Fiberglas Dust (Considered a nuisance dust)	15 mg/m^3

*Eight-hour time weighted averages.

**ppm - parts of vapor or gas per million parts of contaminated air

***mg/m^3 - milligrams of substance per cubic meter of air.

Sufficient, tempered make-up air is not provided, and the relative locations of roof intake and exhaust structures makes air cross circuiting a definite possibility. Inadequate ventilation has undoubtedly contributed to the development of high concentrations of dust and transient high concentrations of organic vapors and the consequent symptomatology found in the workers at this facility.

4. The exposure to harsh chemicals without adequate skin protection has led to the frequent occurence of irritant cutaneous eruptions.

5. Appropriate warning labels for the materials used in this plant are virtually unknown. In general, the employee population exhibited very little knowledge concerning the toxic properties of the materials in their workplace.

6. There is no program in this facility to educate workers about the use and maintenance of personal protective equipment. Furthermore, the management and workers displayed a distinct lack of knowledge regarding the need for such equipment.

7. The health capabilities of this facility are insufficient for the number of workers employed and the types of hazards that are found in the workplace.

The following recommendations are suggested to alleviate hazardous in-plant conditions as outlined in this report:

1. Ventilation. There is a demonstrated need for an indepth study of the plant ventilation systems. This study should be conducted without delay. (Many ventilation problem areas already have been outlined in Sec. IV, part B.) It is suggested that a reputable ventilation and industrial hygiene firm be retained to do this work. If NAR has qualified ventilation and industrial hygiene personnel available at the corporate level, they may be able to provide this service. Once the study and design work are complete, new construction and modifications of existing equipment should proceed at once.

2. Respirators. In general, respirators should be used only when it is not feasible or possible to hold contaminants to an acceptable level by engineering controls. It is urged that such controls be provided wherever possible. Until such controls can be provided, there may still be areas in which workers should be required to wear respirators (eg. sanding operations). Even after controls are provided, there may still be areas in which respirators will be required (eg. paint spray booths).

A respiratory protective program should be established and maintained which includes the general requirements described in American National Standard Z88.2-1969, "Practices for Respiratory Protection".

3. Protective Clothing. Appropriate protective clothing should be provided in areas where harsh chemicals are used. The proper types of gloves and aprons if necessary should be made available to employees. The purchase and wearing of safety shoes should be encouraged. Certain types of head gear should be worn in sanding and paint spray areas to prevent dust from being deposited in the hair and ears of workers. Cloth muffs or soft cotton (applied to the ears before the shift) may provide adequate protection. Cloth caps or hats may adequately protect the hair.

4. Eye Protection. Safety glasses should be required in all work areas of the plant. Where added protection is necessary, chemical goggles or face shields should be provided.

5. Warning Labels. Appropriate warning labels should be affixed to all materials used in the plant. These labels should apprise the workers of potential hazards and provide directions for emergency action in the event of accidental over exposure via inhalation, ingestion, etc.

6. There is a demonstrated need for an improvement in the health capabilities of this facility. Recommended Guidelines for the design of an Occupational Health Program may be found in Appendix C of the Full Report.

Copies of the Summary Determination as well as the Full Report of the Evaluation are available from the Hazard Evaluation Services Branch, NIOSH, Rm 508 Federal Post Office Building, Cincinnati, Ohio 45202. Copies of both have been sent to:

a) North American Rockwell RPO
b) President of Local #1723 U.A.W.
c) Safety Representative of Local #1723 U.A.W.
d) U.S. Department of Labor - Region V.

For purposes of informing affected employees of the results of this investigation, the employer shall post a copy(s) of this Summary Determination for a period of 30 calendar days at or near the work places of affected employees.

II. INTRODUCTION

Section 20 (a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education and Welfare, following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to an unknown substance(s) at the Reinforced Plastics Operations (RPO) of the North American Rockwell (NAR) facility in Ashtabula, Ohio.

This facility is involved with the manufacture of reinforced plastic (fiber glass) truck parts for the Ford Motor Company (FMC), International Harvester Company (IHC), Mack and Dodge Trucking concerns.

III. BACKGROUND HAZARD INFORMATION

There are more than sixty bulk chemicals utilized in the RPO and through indirect and direct research, the following list of potentially toxic substances has been identified from the original formulary.

The occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, Part II, 1910.93, Table G-3) applicable to substances of this evaluation are as follows:

SUBSTANCE	EIGHT HOUR TIME - WEIGHTED CONCENTRATION
Acetone	1000 ppm
Dimethyl Aniline	5 ppm
Isobutyl alcohol	100 ppm
Isopropyl alcohol	400 ppm
Normal butyl acetate	150 ppm
Methyl Cellosolve	25 ppm
Methyl ethyl ketone	200 ppm
Methyl isobutyl ketone	100 ppm
Methylene chloride	500 ppm
Styrene	100 ppm
Toluene	200 ppm
Xylene	100 ppm
Dust (Nuisance)	15 mg/m^3
Fiberglas Dust (considered a nuisance dust)	15 mg/m^3

The following list of substances contain the most recent TLV's adopted by the American Conference of Governmental Industrial Hygienist (ACGIH), as well as, certain physical properties and known toxic effects reported in the scientific literature.

Methyl Ethyl Ketone - Threshold Limit Value (TLV) - 200 parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mmHg. pressure (ppm); Physical properties - boiling point (b.p.) - 79.6°C, vapor pressure (v.p.) - 100 mmHg., vapor density (v.d.) - 2.4 (air=1), evaporation rate (e.r.) - 2.7 (ether=1), flash point (f.p.) - 86°F. Toxicity - Vapors are known to cause marked irritation to the eyes and mucous membranes so that harmful exposures should not occur unless the worker cannot extricate himself from the area[1].* In humans[2], concentrations of 300 ppm or higher, usually give rise to complaints of headache, throat irritation, and other symptoms of upper respiratory discomfort. At 500 ppm, nausea and vomiting have been reported without adequate protection. It is of interest that in one instance[3], two women became unconscious when exposed to a mixture of methyl ethyl ketone (MEK) (398-561 ppm) and acetone (330-496 ppm). One of the patients noted gastric upset prior to central nervous system (CNS) effects. Recovery was complete. This suggests that a synergistic action between these two compounds may take place. The TLV was set at the present level on the basis of experimental and industrial experience with humans as described above and in other investigations[4.5].

Methyl Isobutyl Ketone - TLV - 100 ppm; Physical properties - b.p. - 116°C, v.p. - 7.5 mmHg., e.r. - 5.6, f.p. - 64 F. Toxicity - Human volunteers have reported that vapors of methyl isobutyl ketone (MIBK) at concentrations of 200 ppm or higher cause definite eye irritation and an objectionable odor at this level[6]. Elkins[2] has reported that workers exposed to about 100 ppm complained of headache and nausea. A tolerance developed during the work week but was lost over the weekend. Animal studies are the only source for chronic effects of MIBK and these are limited to narcosis, characterized by depression of body temperature, respiratory rate, heart rate, as well as inhibition of corneal, auditory and equilibratory reflexes[7]. There are no fatalities on record attributable to MIBK[8] but based on the human experience reported by Elkins, the present TLV may be too high, however, it is low enough to prevent narcosis if not the other objectionable symptoms.

*References may be found in Sec. VI.

Acetone - TLV - 1000 ppm; Physical properties - b.p. - 56°C, v.p. - 226 mmHg., e.r. - 1.9, f.p. - 0. Toxicity - Reports of poisonings due to repeated exposures have usually involved a solvent consisting of acetone in combination with other materials(9). Chronic respiratory tract irritation, eye irritation and dizziness have been reported in workers so exposed to levels of 1000 ppm for an average of three hours per day(10). Acetone is a mild skin irritant due to its defatting property(11). Oglesby and his co-workers(12), have done studies over a period of 15 years and reported that acetone has no significant chronic effects in concentrations averaging 2000 ppm and with the paucity of reported illness due to this chemical, the TLV was set at 1000 ppm.

Styrene(monomer) - TLV - 100 ppm; Physical properties - b.p. - 145°C, v.p. - 4.3 mmHg., v.d. - 3.5, f.p. - 86°F. Toxicity - Chronic exposure to styrene may cause eye and nasal irritation. Halitosis (from styrene vapors) has been reported(13). A degreasing of the skin may occur, leading to drying and cracking of exposed areas. A systemic illness called "styrene sickness" has been described which produces symptoms of nausea, vomiting, general weakness and loss of appetite. In the latter instance, the workers were exposed to levels ranging from 200 - 700 ppm(13). Duration of symptoms is no more than a few hours once the individual is removed from areas of exposure. The TLV has been set on the basis of experimental work on volunteers which was reported by Stewart(14). He demonstrated vapor exposures at 100 ppm produced mild, untoward but transient subjective symptoms in 50 per cent of the exposed subjects.

Toluene - TLV - 200 ppm; Physical properties - b.p. - 110°C, v.p. - 30 mmHg, v.d. - 3.2, f.p. - 40°F. Toxicity - This agent is well known for its powerful narcotic effects. Acute exposure(15) to 200 ppm for 8 hours produced mild fatigue, confusion and paresthesias of the skin.

Fatigue lasted for hours. At 300 ppm for 8 hours, symptoms were more pronounced. At 600 ppm for 3 hours, mental confusion was prominent and nausea, headache, dizziness were reported. Pupils were noted to be dilated and accomodation was impaired. Effects at this concentration persisted for hours and subjects complained of insomnia, fatigue and nervousness on the second day post-exposure. These studies lasted for 3 months and there were no findings of chronic systemic toxicity. It has been stated[16] that industrial experience fails to provide evidence for a TLV below 200 ppm on the basis of irritative and narcotic effects in workers exposed at or near this concentration.

Xylene - TLV - 100 ppm; Physical properties - b.p. 138-44°C, v.p. - 10 mmHg., v.d. - 3.7, f.p. - 63-77°F. Toxicity - Similar to toluene though more pronounced[2]. Gerarde[17] has listed headache, fatigue, lassitude, irritability and gastrointestinal disturbances such as nausea, annorexia and flatulence as the most frequent manifestations of excess xylene exposure. The TLV is recommended to prevent irritant and narcotic effects. It is believed that no significant chronic injury will result from continued occupational exposure at this level[18].

Methylene Chloride - TLV - 500 ppm; Physical properties - b.p. 40°C, v.p. 440 mmHg., v.d. - 2.93. Toxicity - Dizziness, nausea, paresthesias, headache (sense of fullness in the head), sense of heat, dullness, lethargy and stupor have all been reported in connection with exposure to methylene chloride vapors[19]. Very high concentrations may lead to loss of consciousness. Industrial exposures[20,21,22], ranging from 500 - 5000 ppm have led to poisonings from narcotic effects. Neurasthenic disorders, digestive disturbances, and liver disease has also been attributed to this chemical. Until quite recently, methylene chloride was considered the least toxic of all the chlorinated hydrocarbons and a TLV was proposed at 500 ppm. However, during the last year, Stewart[23] has demonstrated that methylene chloride will induce the formation of carboxyhemoglobin by an unknown mechanism. This will occur with levels as low as 200 ppm and until the exact significance of this ominous finding is determined, the TLV Standards Committee has proposed lowering the acceptable level to 250 ppm.

Isopropyl Alcohol - TLV - 400 ppm; Physical properties - b.p. 82.4°C, v.p. - 44 mmHg., v.d. - 2.08, f.p. - 53°F. Toxicity -- The principal effects are those of narcosis[24]. Nelson[25], has found 400 ppm to cause mild irritation to the yes, nose and throat but not narcosis. A small part of isopropyl alcohol is bio-converted to acetone in vivo[26,27,28] and in combination with acetone exposure, one might infer that a synergistic action will ensue. The TLV has been set at the present level on the basis of Nelson's work.

Isobutyl Alcohol - TLV - 100 ppm; Physical properties - b.p. - 108°C, v.p. - 12.2 mmHg., v.d. - 2.56, f.p. - 82°F. Toxicity - This chemical is slightly irritating to the skin of man[28], however, most of the toxic symptoms are based on animal studies which have shown that isobutyl alcohol and n-butyl alcohol have similar effects. These include irritation of the nose, throat and eyes, corneal inclusions, headache, vertigo and drowsiness. With levels of 100 ppm, these symptoms are reportedly minimal and a TLV on the basis of known human work with n-butyl alcohol has been suggested at 100 ppm[29].

n-Butyl Acetate - TLV - 150 ppm; Physical properties - b.p. - 124.6°C, v.p. - 15 mmHg, v.d. - 4.0, f.p. - 84°F. Toxicity - The signs of excessive exposure have been described as irritation of the eyes, nose and throat followed by a relatively slow gradual onset of narcosis.

The recovery is slow as well after the exposure ceases[30]. It has been reported that no anesthetic symptoms occur at levels of 400-600 ppm for 2-3 hours duration but eye irritation may occur at 200-300 ppm. The TLV has been recommended to prevent significant irritation to the eyes and respiratory passages[31].

Methyl Cellosolve - TLV - 25 ppm; Physical properties - b.p. - 125°C v.p. - 9.7 mmHg., v.d. - 2.6, f.p. - 150°F. Toxicity - In human exposures the cardinal findings are weakness, somnolence, headache, gastrointestinal upset, nocturia, loss of weight, burning of the eyes and transient mental retardation[32]. Macrocytic anemia has been reported as a common finding in cases where chronic exposure has occurred[33]. Exposures in the latter instance revealed that levels of 25 ppm were found with the windows open and 75 ppm with the windows closed in this place of work. Skin absorption is reported to be appreciable in animals[34]. On the basis of Greenberg's findings[33], the TLV has been set at the present level.

Dimethyl Aniline and Diethyl Aniline - TLV (DMA) - 5 ppm; Physical properties - (DEA) - b.p. - 215°C: (DMA) - b.p. 192.5°C, v.d. - 4.2, f.p. - 170°(open cup). Toxicity - These chemicals are capable of producing methemoglobin formation in vivo[35,36]. The formation of methemoglobin will result in a decreased ability of hemoglobin to carry oxygen and result in fatigue, weakness, tachycardia, headache, dizziness, shortness of breath, and with very high concentrations, hypotension, coma and death. Cyanosis is prominant feature of methemoglobinemia. This has been called "blue lip" or "huckleberry pie" face and this sign may be recognized with levels of methemoglobin at 15 per cent. The above described symptoms will begin to appear as levels approach 40 per cent. Without any definitive therapy other than removal (provided that thorough cleansing has taken place). These compounds are readily absorbed through cutaneous structures and even dust that remains in contact with the mucous membranes of the nose or throat may prolong recovery[37]. In view of the seriousness that certain authorities relate to the effects of exposure to these compounds, a low TLV has been set[38].

Isophthalic Acid and Phthalic Anhyride - TLV - (phthalic acid) 2 ppm; Physical properties - b.p. - 284°C(phthalic anhyride). Toxicity - A potent skin, eye and upper respiratory irritant and causes skin and possibly pulmonary sensitization[39]. In workers exposed to this group of chemicals in a plant involved with their manufacture, conjunctivitis, bloody nasal discharge, bronchitis and emphysema were found. Air concentrations of 30 mg. per cubic meter cause definite conjunctival irritation[40]. The above information has led to a low permissable standard.

Dust (Nuisance) - TLV - 10 milligrams per cubic meter (mg/m^3). Toxicity - Nuisance dusts are called biologically "inert" but the latter term is inappropriate[41] to the extent that there is no particulate which does not evoke some cellular response in the lungs when inhaled in sufficient amounts. Excess amounts of these dusts may seriously reduce visibility, may cause unpleasant deposits in the eyes, ears and nasal passages, or cause injury to the skin or mucous membranes by chemical or mechanical action per se or by vigorous cleansing procedures necessary for their removal. The TLV is based on the above information and is described for air-suspended particles that are greater than respirable diameter. If particles of respirable diameter are present or are collected, a limit of 5 mg/m^3 must be attained.

Fiberglas-Plastic Dust (also Fibrous Glass Dust) - TLV - classified as an inert nuisance dust. Toxicity - The only well accepted effects of this material are that of upper respiratory tract irritation[42], eye and skin irritation[43]. In California, during the period extending from January 1960 to June 1962, 691 cases of occupational disease were attributed to fibrous glass exposure. Of these, 38 were primarily problems of respiratory tract irritation and the remainder involved the effects of fibrous glass on the skin and eyes. The most commonly reported respiratory problems attributed to this exposure were bronchitis, pharyngitis, rhinitis, asthma, laryngitis, sinusitis and in one case a nosebleed. Skin exposure is usually manifest by pruritis to which the exposed individuals usually develop a tolerance and eye effects are usually limited to a mild conjunctivital irritation. To date, many investigators have examined humans and animals exposed to fibrous glass for evidence of pulmonary lesions[44,45,46]. All evidence tends to place this dust in an inert category, however, it should be pointed out that a well-defined epidemiologic study to conclusively prove this theory is lacking. Some investigators have shown that when the material has a calcium carbonate filler rather than a calcium sulfate filler, it may be capable of producing transient and reversible pneumoconiotic lesions[47]. This has not been shown in humans.

It is important to note at this point that there is relatively little known about the additive effects of these compounds except to say that the concensus on this point favors enchanced toxicity. Also, the potential formation of new compounds or recombinant chemical forms is also an area in which a paucity of knowledge exists. In one area, however, the observed synergism between sulfur dioxide and particulates[48] suggests that the former is probably absorbed onto the surface of particles of respirable size and could deliver an injury at the site of impaction (i.e., lungs). This suggests a vector by which other vaporous substances in the presence of an inert but respirable particulate might cause unsuspected damage to pulmonary tissues.

The physical properties of many of the aforementioned substances permit them to gain ready access to the work environment. For example, the vapor pressure exerted by methyl ethyl ketone is 100 mmHg, and that of acetone and methylene chloride are 100 and 440 mmHg. respectively. In other words, these chemicals will readily evaporate at ambient plant temperatures. Furthermore, all chemicals noted herein have flash point temperatures below those temperatures used in plant ovens. This means they will be vigorously vaporized within the confines of the oven and if parts are removed from ovens prematurely, these vapors will escape into the atmosphere. The vapor density for most of these chemicals is 2-3 times greater than air, which would cause the vapors to gravitate towards Earth on a windless day. This latter point will take on greater significance in light of some of the ventilation data to be presented later in the report.

IV. HEALTH HAZARD EVALUATION

A. Observational Survey

This establishment was visited September 11,14,15,25,27,28,29, and November 9, 1972. In connection with the investigation, we have met with ~~Mr. Clare Koster~~, Plant Manager, NAR-RPO; ~~Mr. R.P. Bentner~~, Industrial Relations Manager, NAR-RPO; ~~Mr. Ron Strelecki~~, Supervisor of Safety and Personnel, NAR-RPO; ~~Mr. C. John Rozas~~, Manager Industrial Hygiene, HAR-Pittsburgh (corporate offices); ~~Mr. Bob Suthonia~~, Director Industrial Relations, NAR-Automotive Products Division (Detroit); ~~Mr. Bill Long~~, Divisional Safety Co-ordinator, NAR-Automotive Products Division (Detroit); ~~Mr. Alex Elenen~~, Chief Maintenance Engineer, NAR-RPO; ~~Mr. Earnest Billhart~~, Assistant Supervisor of Maintenance, NAR-RPO; ~~Mr. John MacFarlane~~, Manager of Safety and Environmental Health, NAR-Automotive Products Division (Detroit); ~~Mr. R. Lang~~, Industrial Engineer, NAR-RPO; ~~Mr. J. Sullivan~~, NAR-RPO; ~~Mr. John Travers~~, Manufacturing Manager, NAR-RPO; ~~Mr. Mike Sohokovsky~~, Plant Manager, 3rd Shift, NAR-RPO; ~~Sheppard A. Burrows~~, M.D., NAR-Plant Physician; ~~Virginia Johnson~~, NAR-Occupational Nurse; Katherine Morse, NAR-Occupational Nurse; ~~Mr. David Paddon~~, Industrial Hygienist, United Auto Workers Union (UAW) Detroit; ~~Mr. Frank Taberner~~, President of UAW Local #1723; ~~Mr. James Ringer~~, Safety Representative for UAW Local #1723; meetings with all 559 members of UAW Local #1723 at the NAR-RPO Facility.

The NAR-RPO is located approximately fourty miles Northwest of Cleveland, Ohio in proximity to the south shore of Lake Erie. The mailing address of the facility would place the operation in Ashtabula, Ohio, however, the Township Line divides the site and in reality, building No. 3 is in Saybrook Township. Since buildings numbered one and three were originally identified as the primary areas of concern, this report will address only those problem areas. The entire RPO is comprised of five buildings, with Buildings 1 and 3 situated in a West-East fashion respectively (see Fig. 1, Sec. VII). These two structures are connected by a surface annex which serves as a storage area.

There are approximately 550 workers employed in the RPO at present. The labor force distributed in the two buildings of interest works on a three shift schedule in which there is a decrement in the number of people on the job with each successive shift. The third or all night shift has a mere skeleton crew to keep operations in working order for the day and evening activities. Approximately 60 per cent of the workers are women. The United Auto Workers Union (UAW) represents the labor force at this facility.

A description of the processes observed in our many walk-throughs begins with the transport of chemicals from areas outside of the buildings. All chemicals are brought into the Eastern most area of Building No. 1, into a section called the "mixing room". The principal components of the unfinished truck parts are a styrene resin material which is in a liquid form and may be either of a relatively new "low shrinkage" variety or an older conventional resin; and bulk fiber glass in sheets or reels of cord. Men in the mix room are charged with the distribution of these substances and most other chemicals to the areas of the plant in which they are used. In addition, these men are responsible for the formulation of certain paints and other compounds which impart a distinctive, unpleasant odor to this work area. The area is poorly ventilated (see Ventilation Survey, Sec. IV B. for all specific references to general ventilation in this section).

The Light Press Area occupies a major part of the Eastern section of Building No. 1 and the Heavy Press Area is more centrally located in this building. (Each of these operations is essentially concerned with the manufacture of a similar product.) In the Light Press Area, workers line small molds with pre-cut sheets of fiber glass over which they pour liquid resin described above. This mold is then placed under the press which has a heated metal form that is tooled to create the desired shape. After 10-15 minutes of heating, a shiny plastic truck part can be lifted out of the press. Motor driven sanding machines are operated manually to smooth rough edges of the part before it is transported to assembly and finishing areas for further work. The press operators in this area were noted to be exposed to visible dust generation with no local exhaust systems to clear their working environment. They were not provided with personal protective gear.

The Heavy Press Area (See Photo. 1, Sec. VII) is used for the production of large sized parts. Initially, there are many large rotating screens ("pre-forms") that conform to the shape of the desired part. There is a suction draft on these screens that causes adherence of the crushed fiber glass being sprayed onto their surface. Simultaneously, the fiber glass mat being formed on the surface of the screen is sprayed with a binding agent that acts like a glue, permitting the soft form to hold its shape after it is peeled off the suction "pre-form". There are two operators at each "pre-form" who are exposed to airborne glass fibers. In all instances, the workers interviewed during the walk-through, complained of an itching of exposed skin which was especially troublesome when they had originally started on this particular job. They were provided with no protective gear. At any rate, this large, soft form is then taken to a heavy press operator who covers the part with a liquid resin and places it into the press. Again, the part is heated into a hardened plastic form and then sanded at this site prior to its transport to other areas of the facility. The dust level generated in this area is of a greater magnitude than the Light Press Area and there is either ineffective or absent exhaust provisions for this section of the plant. Workers are provided with no protective gear.

In the various assembly and finishing areas of Buildings No. 1 and 3 the parts undergo further processing before they can be painted. In both operations, the workers are using a polyester solka floc bond which is referred to as 50-50 bond. This 50-50 bond is comprised of a mixture of solka floc, cab-o-sil, styrene and also contains DMA. It has two separate components which must be combined at the work site. The reaction was noted to be grossly exothermic and produced a distinctive obnoxious odor. The 50-50 bond is used to cover defects in the truck forms, as well as providing a type of glue function where metal reinforcing struts will ultimately be placed.

In the Buck assembly areas (See Photo. 5, Sec. VII), different parts of the form are attached together (eg. where applicable, for instance, headlight forms are fastened to a truck hood). These pieces are then placed into a "Buck" where they are prepared for reinforcing metal inserts. The preparation consists of manually wiping areas of the hood with methylene chloride. The methylene chloride is applied with a rag by workers who are neither supplied with rubber gloves nor respirators. Then, the 50-50 bond is placed over the methylene chloride and a mechanical buck is set in motion to press the metal pieces into the structure. These assembled parts are transported to the finishing areas.

The assembly and finishing operations as noted in Figure 1 are adjacent to the painting lines in all instances. After the assemblers and finishers' have completed application of the bonding agent, they must then sand down the protrusions and rough spots in preparation for painting. At this time a great deal of dust is created and the heat of the sander on the resin and bond generates a fume which can be detected in these areas. (See Photo 2,3, Sec. VII). Infrequently, workers in these areas were noted to wear useless surgical face masks to "protect themselves from the dust and fumes (See Photo. 4, Sec. VII)". Also, an occasional worker was noted to wear a U.S. Bureau of Mines approved dust respirator. These people unanimously voiced complaints that they could not breathe well through the respirators. One worker who refused to wear the protective device stated that he was not aware that the respirators had a changeable filter and when he had worn them he could not breathe well after a short time. Another worker stated that there was no schedule for changi ng dust filters and sometimes she changed hers once a week. However, for the most part, respirators are not used by the NAR work force.

At different stages along this flow of action, certain parts are sent through pre-bake ovens which are utilized to set the bond properly. All parts eventually reach the finishers who were noted previously to work in a dusty environment and in proximity to the painting booths. These booths are found in two varieties in the plant. In one instance, an enclosed booth manufactured by Binks Company utilizes its own down-draft exhaust system and in the other case, parts are painted in front of a water wall, also with its own exhaust. Not infrequently, there was considerable overspray emanating from the booth (See Photo. 6, Sec. VII). This was especially prominent on one occasion in the Binks No. 2 in Building No. 1. In the water wall booths, there is no provision for painting both sides of the part (which is suspended on wires) as the conveyor moves them through the booth. As a result, the painter must spray in a direction away from the water wall, which obviously renders the entire exhaust mechanism ineffective (See Photo 7, Sec. VII). Workers in the latter instance were noted to have paint spray on their face and in their hair which was particularly annoying to them.

The conveyor then moves the freshly painted parts directly to the ovens where the finish is baked in. In some instances, parts are routinely routed back through finishing lines to patch obvious defects before they can pass quality control. The ovens are all in close proximity to the assembly and finishing lines and the question of vapor leakage was raised repeatedly by the workers as we made our inspections. These ovens are fossil fueled and attain temperatures between 230-290°F. depending on the type of oven and the type of part passing through it.

Once the final part passes quality control it is then ready for shipping to the appropriate truck manufacturer. Many of the fine details of this operation have been deleted for the sake of a succinct presentation. As mentioned, upwards of 60 bulk chemicals are being utilized in the facility and many of these are solvents capable of organic vapor emmission. It should be mentioned at this point that the powerful smell of styrene pervades every area of this facility and tends to obscure other unpleasant odors which can only be detected when one is in direct contact with them. On all occasions of our inspections, the authors themselves developed headache and nausea which frequently necessitated moving out of doors for a few moments of respite in the fresh air. This is noted at this point in the report as it made an unusual impression during our plant walk-throughs.

There was adequate empirical evidence from our observational surveys to suggest the following:

1. The worker complaints elicited on walk-throughs (and described in more detail in the medical section) were valid and related to a sub-standard work enviornment in many instances.

2. Many areas of the plant were excessively dusty (This had been documented on previous occasions by other investigative agencies.) (See Photo. 8, Sec. VII).

3. Poor work practices were noted in many areas of the facility. Some of these are mentioned above in terms of the lack of protective gear for workers using fiber glass; improper paint spraying techniques again with no protective gear; open chemical dumping in an area outside of the North wall of Building 1; the handling of potentially harsh chemicals without rubber gloves; excessive dust generation in the absence of effective exhaust or ventilation techniques.

4. There was generally poor ventilation provisions for both Buildings No. 1 and 3.

5. In light of the above findings, the strong possibility of one or more chemicals causing a type of organic vapor intoxication seemed quite plausible.

6. It was determined that there was significant intra- and inter- departmental strife in the spheres of management and labor relations. This may or may not have played a role in the present dilemma but most certainly, the aura of cooperative effort between effected parties was lacking. Undoubtedly, this situation served to retard positive actions to bring forth a solution designed to help the NAR worker.

B. ENVIRONMENTAL EVALUATION

On September 14 and 15, 1972, a follow-up environmental survey was conducted by Dr. Bobby J. Gunter and Messrs. Raymond L. Ruhe and Robert E. Rosensteel. The purpose of this survey was to obtain measurements of employee exposure to dusts and vapors.

Employee exposures to airborne dust were measured using personal air sampling equipment which sampled air in close proximity to the employee's actual breathing zone. MSA Model G, battery powered vacuum pumps were used to draw air through open-face Millipore air monitors fitted with analytically preweighed, 37 mm Type AA, 0.8 micrometer pore size cellulose filters. Air sampling rates were maintained at two (2) liters per minute by periodically adjusting the calibrated rotameter of each MSA pump, throughout sampling periods of one to one and one-half (1 to 1.5) hours duration. Filter monitors were attached to workers in an inverted orientation at the lapel or collar. In this matter sixty-six (66) personal exposure dust samples were gathered. These filter samples were returned to Cincinnati where they were analytically conditioned and weighed.

Calculated personal dust exposures are presented in Table V, Sec. VII. It should be noted that only part of the full working shift was sampled. However, due to the repetitive nature of the work in the plant, these concentrations should closely approximate eight-hour, time weighted average exposures. It is readily apparent from the data that in many areas of the plant, personal dust exposures far exceed the American Conference of Governmental Industrial Hygienists' recommended time-weighted-average nuisance dust standard of 10mg/m^3 and also the OSHA nuisance dust standard of 15mg/m^3. It should be noted that the nuisance dust standard is applied to these dust exposures with reluctance. Data regarding the long term effects of exposure to resin and glass fiber dusts are not complete. Certainly their composition makes them potentially more active than "inert" dusts, especially when the possibility exists that a variety of solvent vapors may be adsorbed on or absorbed by the dust particles. The magnitude of the dust exposure problem is made worse by the fact that only a few scattered workers in the dusty work areas were wearing appropriate dust respirators or safety goggles. Almost every dusty area lacked even rudimentary dust control ventilation.

Employee exposures to various chemical vapors were measured using personal air sampling equipment similar to that used in assessing dust exposures. MSA Model G, battery powered vacuum pumps were used to draw air through MSA charcoal sampling tubes designed for organic vapors. (Each batch of charcoal tubes received is statistically sampled and subsequently checked for absorptive and desorptive characteristics.) Air sampling rates were maintained at one (1) liter per minute by adjusting each pump's calibrated rotameter. Sampling duration ranged from four to thirteeh (4 to 13) minutes. Charcoal sampling tubes were attached to employees in an inverted orientation at the lapel or collar. In this manner, forty-seven (47) personal exposure vapor samples were gathered. These charcoal tube samples were returned to Cincinnati where they were analyzed by gas chromatographic techniques for xylene, toluene, stryene, methylene chloride, methyl cellosolve, methyl ethyl ketone, and isopropyl alcohol. (Each charcoal tube vapor sample is desorbed in carbon disulfide and injected into a computer controlled, analytical gas chromatograph for individual compound identification by retention time and quantitative measurement of each compound's presence in the sample by peak area integration.)

Calculated personal exposures to vapors are presented in Table VI, Sec. VII. It is apparent from the data that no exposure standards for individual chemical vapors were exceeded during the period samples. It must remembered that samples were only a few minutes duration. There can be only speculation as to what true contaminant levels exist on an eight-hour, time weighted average basis. Considering the wide variety of chemical substances used in the plant, it is strongly suspected that other vapors may also be present in the work atmosphere at various times. Many plant processes involve the direct handling of volatile chemicals. Due to the general lack of local exhaust ventilation within the plant, the possibility exists that chemical vapors may be transiently present in high concentrations. To accurately document employee exposure in these types of conditions would require extensive environmental sampling. Obtaining a statistically sound number of samples would be relatively easy. However, each charcoal tube air sample requires approximately four hours of analytical time for complete analyses. With this situation prevailing, it is necessary to proceed with a modest number of samples keeping in mind the limitations of the data.

Another consideration in this evaluation is that little is known regarding human or animal exposure to a number of chemical vapors all present at the same time. The American Conference of Governmental Industrial Hygienists in their 1972 TLV publication suggest that "in the absence of information to the contrary, the effects of different hazards should be considered additive". Furthermore, they state that "when a given operation or process characteristically emits a number of harmful dusts, fumes, vapors or gases, it will frequently be only feasible to attempt to evaluate the hazard by measurement of a single substance. In such cases, the threshold limit used for this substance should be reduced by a suitable factor, the magnitude of which will depend on the number, toxicity and relative quantity of the other contaminants ordinarily present."

Calculated vapor concentrations are presented in Table VII, Sec. VII. These vapor concentrations are indicative of general air concentrations in the work area during the period sampled and are not to be interpreted as breathing zone samples. Although none of the chemical vapors exceeded their respective exposure standards, the number of vapor contaminants documented to be present in the working environment has now grown to twelve. (Acetone, cellosolve acetate, isobutyl alcohol, isopropyl alcohol, methyl cellosolve, methylene chloride, methyl ethyl ketone, methyl isobutyl ketone, normal butyl acetate, styrene, toluene and xylene.)

At six (6) of the long term vapor sampling locations, both total and respirable dust sampling were conducted simultaneously with vapor sampling. Total dust was collected on open-face, analytically preweighed, Millipore filters (37mm Type AA, 0.8 micrometer pore size) held in Millipore air monitors. The monitors were mounted on MSA Model G, battery operated vacuum pumps in a horizontal orientation. Respirable dust was collected on an analytically preweighed, Millipore filter (37mm Type AA, 0.8 micrometer pore size) following an MSA size selective cyclone. The cyclone is designed to remove particles from the sampled air which would normally not be respirable by humans. The cyclone allows respirable particles to be deposited on the filter following the cyclone. (As with any particle size selecting device, these cyclones approximate the true respirable - non-respirable separation. They are sufficiently accurate for their specific application of supplying crude particle size data for this evaluation.) The cyclones were attached to MSA Model G, battery powered vacuum pumps in a vertical, upright orientation. (It should be noted that all MSA Model G pumps used in this survey were equipped with pulsation dampeners.) Flow rates for both total and respirable dust sampling were maintained at one and seven-tenths (1.7) liters per minute by periodically adjusting each pump's calibrated rotameter. Sampling duration ranged from one to two (1 to 2) hours. Most sampling locations were three to four (3 to 4) feet above the plant floor and at the center of department work areas.

These filter samples were returned to Cincinnati where they were analytically conditioned and weighed. Several of the filter samples were also examined by microscopic techniques. Calculated area dust concentrations for total and respirable dust are presented in Table VIII, Sec. VII.

It can be seen from the data that measured area dust concentrations were much lower than the personal exposure or breathing zone concentrations reported earlier in Table V, Sec. VII. Two reasons for lower concentrations are (1) generally, dust is generated very near the worker's breathing zone and is strongly diluted once it travels a few feet, and (2) on the day that the area dust sampling was conducted activity in the plant was low, and all doors and windows were open even though the outside ambient temperature was quite cool. Although area dust concentrations were low, they do show than an appreciable percentage of the dust generated in some areas is respirable. Microscopic analysis of the dust samples by phase-contrast technique revealed that few whole glass fibers were present in the dust, but that a large number of broken glass particles were present in both total and respirable dust samples. In situations where respirable dusts are present in the workplace, the American Conference of Governmental Industrial Hygienists recommends that dust levels be maintained below 5mg/m^3 on a time weighted average exposure basis.

In addition to the environmental sampling conducted on November 9, 1972, an examination of the plant's ventilation system was made by Messrs. Clark Humphreys and Alan Gudeman from NIOSH's Engineering Division. The results of their survey shall be discussed at length in the paragraphs to follow. The discussion is arranged by work area and ventilation system. Recommendations for improvement of ventilation are made within the discussion.

Building No. 1, Heavy Press #42

The sanding operation at this location produced significant quantities of dust in the worker's breathing zone. (See Sample No. 48, Table V, Sec. VII.) An attempt was being made to capture the dust by means of a hood located fifteen to thirty (15 to 30) inches from the point of dust generation. (See Photo. No. 1, Sec. VII.) The face area of this hood was considerably smaller than the part being sanded. This operation could be greatly improved by providing a booth of proper size with adequate exhaust.

Similar sanding operations were noted in other area of the plant to have no dust control.

Building No. 1, Preform Machines #9 and #10

These units were apparently intended to be completely recirculating. The centrifugal fans, which draw the air through the forms, discharge into large screened enclosures at the top of the units. These screened enclosured were supposed to remove the entrained fiber glass and return clean air to the workplace. (See Photos. Nos. 9 & 10, Sec. VII.) These screened enclosures were found to be open and the fiber laden air from the centrifugal fans was being partially exhausted through the roof of the building by large axial flow fans. The fiber capture and exhaust was not complete, as indicated by the fiber glass falling back to the plant floor.

Two methods by which the above conditions might be improved are described below:

a) Change existing centrifugal fans to discharge directly to the outside, as now being done on some of the smaller preform machines.

b) Hand skirting from the ceiling to enclose the top of the units as much as possible. This would in effect provide a hood over the machines. Hooding would reduce the amount of room air that would have to be exhausted to achieve acceptable conditions. (Note: Even with hoods over the machines, the volume of air discharged by the axial fans must be greater than that discharged by centrifugal fans. The relative capacities of the two types of fans should be checked.)

<u>Building No. 1, Canopy Hood in Chrysler Engine Cover Line</u>

This hood was not in operation during our visit and therefore, we had no opportunity to observe its operation. The horizontal dimensions of the hood appeared small for the work area under it, but the fan size seemed more than adequate. When in operation, worker's are reportedly located on opposite sides of the hood. The hood could be made more effective by closing the other two sides.

<u>Building No. 1, Binks No. 2 Spray Booth</u>

This down draft spray booth was operating very unsatisfactorily at the time it was examined. Swirls of paint spray were being carried up the outside walls of the booth and then blown down into the worker's breathing zone. Ocassionally, clouds of paint spray were noted to escape the paint booth and travel into the outside work area. It was reported that a Binks representative had already made recommendations for the installation of baffles to eliminate these difficulties. Changes of this nature are needed and should be made immediately. The workers in this booth were not wearing respirators at the time of the survey.

Building No. 1, Water-Wall Paint Spray Booths in Ford and White Fender Line

The spraying procedures used in these booths at the time they were examined were unjustifiable. Flat parts, perhaps ten inches wide and three to four feet long were moving through the booths on a conveyor line. To paint both sides of the parts, the spray painter had to stand, first on one side of conveyor line and then on the other. This forced the painter to stand between the water-wall and the conveyor half of the time. (See Photo No. 7, Sec. VII.) It is suggested that parts be suspended from the conveyor line in a manner that would permit the painter to rotate and paint both surfaces from the upstream side of the work.

The air velocity through these booths was noted to be quite low. This was due, at least in part, to poor design. Much of the air being handled by the fans was not flowing past the workers, but was entering at the ends of the booths between the conveyor line and the water-wall. Although the parts on the conveyor line were quite small, the openings at the ends of the booths were four to five feet wide and the full height of the booths. These openings should be baffled to provide only enough opening for the conveyor and the work to pass through. The baffles should be moveable so that they may be adjusted to suit the size of work on the conveyor. The large overhead opening between the two booths should also be closed. The purpose of the recommended baffling is to guide as much of the total air flow past the paint spray operator as possible.

Building No. 1, Mixing Room

At the time of examination, odors in this room were strong and ventilation was noted to be definitely inadequate. If the sources of air contaminants can be localized, they should be hooded and ample local exhaust ventilation provided. If local exhaust is not feasible, adequate general ventilation should be provided.

Building No. 3, Ford Dry Sanding Line

Sanding operations in this area produce significant quantities of airborne dust. (See Samples Nos. 54, 60, 63, 66, 69, 71, 74, & 75, Table V, Sec. VII, and Photo No. 3, Sec. VII.) A smoke tube check indicated some air flow at the eastern end of the line, but the flow appeared to be slow at the floor gratings. At the extreme western end of the line there was a definite upward flow from the floor gratings. The make-up air unit at the western end of the line was not in operation because the air it supplied was too cold for worker comfort. However, it is suspected that this unit would have little impact on the effectiveness of dust removal. At the eastern end of the line, the make-up air unit was operating and created enough turbulence to completely nullify any effects of the downdraft ventilation. The ventilation of this line should be studied and revamped as necessary to make it effective. Some of the workers on this line were wearing respirators of one sort or another.

Building No. 3, Downdraft Paint Spray Booth

This booth, while much more effective than the Binks No. 2 booth in Building No. 1, produced some swirling of paint mist. There was definite upward movement of air along the side walls. When a successful correction is found for Binks No. 2, it should be applied to all similar booths.

Building Nos. 1 and 3, Make-Up Air

The make-up air supply to both Building No. 1 and No. 3 was judged to be inadequate. At the time of examination, shipping doors and the continuous row of windows just below the ceiling were open, but it was reported that in colder weather that these openings are closed and an appreciable negative pressure exists in the buildings. Reportedly, plant management is aware of this situation and has planned to install six - 60,000 cfm make-up air units; four in Building No. 1 and two in Building No. 3. A judgment as to the adequacy of these units cannot be made at this time, however, they should be a step in the right direction.

Reportedly the make-up air units mentioned above are to be located over or near areas where large quantities of air are exhausted. It is recommended that the units be so located that the air supplied can move across, and provide general ventilation for, the large and open area from which it will be exhausted. In this way the make-up air would also aid in reducing contaminant levels throughout the plant.

Buildings Nos. 1 and 3, Supply and Exhaust Stacks on the Roof

At present, supply and exhaust stacks extend to approximately the same height above the roof. All exhaust stacks have weather caps which deflect the exhaust air horizontally. In some places supply and exhaust stacks are within six or eight feet of one another. (See Photos. No. 11 & 12, Sec. VII.) With these conditions prevailing, it is inevitable that exhausted air is being returned to the work area. With the air exhausted horizontally only a few feet above the roof, much of it must also find its way back into the work area through the continuous row of windows just below the roof line when they are open. It is understood that the company has been advised to correct this condition by lowering the exhaust stacks with weather caps still in place, and extending the inlet stacks to a height of ten feet above the exhausts. Some work on this recommendation has already been completed. (See Photo No. 13, Sec. VII.)

Recommended ventilation practice would suggest the reverse of the above described procedure. Fresh air inlets should be located at a height of four to five feet above the roof. Exhaust stacks should be extended to a height of at least ten feet above the inlets. Weather caps on the exhaust stacks should be removed and stacks should be sized to discharge air upward at a velocity of approximately 3,000 feet per minute. This would place the exhausted air at sufficient elevation to all but eliminate the possibility of recirculation. It would also greatly minimize the likelihood of contaminated air moving across the roof and entering open windows near the roof line.

It was pointed out in Sec. III of this report that the vapor densities of many of the chemicals being exhausted to the atmosphere are greater than that of air. This condition increases the likelihood of recirculating effluents when appropriate stack height and exhaust acceleration are absent.

Cleaning Exhausted Air

This evaluation has been limited to the problem of providing suitable environmental conditions within the plant. Local, state, and national air pollution regulations should be consulted to determine whether effluents must be cleaned before discharge to the atmosphere. Ideally, of course, they should be cleaned.

In addition to the environmental sampling and ventilation evaluation work which NIOSH has conducted at this plant, the company has hired the services of Envirolab, Inc. of Painesville, Ohio to analyze air contaminants collected within the plant. Over a period of several months air samples were gathered around the clock by NAR Officials during periods when air contamination was suspected. These samples were subsequently analyzed by Envirolab, Inc. This sampling was fruitful in documenting dramatically elevated, transient concentrations of air contaminants in the work environment. The possibility of transient elevated levels was postulated earlier in this section. Several of documented levels reported to NAR by Envirolab, Inc. are presented in Table IX, Sec. VII.

From the environmental and ventilation data available at this time several conclusions can be made.

1. Exposures to airborne dust in many areas of the plant are far in excess of ACGIH recommended standards, as well as, OSHA promulgated standards. An appreciable fraction of airborne dust in this plant has been demonstrated to be of respirable character.

2. Many chemical vapors are simultaneously present in several of the plant work areas and have been documented to reach transient high concentrations.

3. The plant ventilation system as a whole is grossly inadequate. Local exhaust ventilation is all but nonexistant. Paint booths and other ventilated work areas (downdraft sanding lines, preform machines, etc.) suffer from poorly designed and maintained air moving systems. Sufficient, tempered make-up air is not provided, and the relative locations of roof intake and exhaust structures makes air cross circuiting a definite possibility.

4. There is a demonstrated need for personal protective equipment in many work areas. Furthermore, workers and management displayed a distinct lack of knowledge regarding the need for, use, and maintenance of personal protective equipment.

5. Appropriate warning labels for materials used in the plant are virtually unknown. In general, the employee population knew very little about the toxic properties of the materials in their workplace.

C. MEDICAL EVALUATION

This establishment was visited on four different occasions by Dr. Steven Cohen and on certain of these occasions by Dr. Phillip L. Polakoff from the Medical Services Branch of the National Institute for Occupational Safety and Health. The alleged hazard, as well as a description of the facility and plant processes may be found elsewhere in this report. The procedure used to assess the validity of this medical hazard and ultimately define its nature has taken into account extensive, on-site worker interviews and discussion with management personnel; a review of available hospital records for the members of the labor force who have required this medical scrutiny as a result of "toxic fumes" inhalation; evaluation of a medical and occupational questionnaire prepared by our Institute for the NAR-RPO workers; inspection of all previous reports prepared by other agencies (regarding this particular problem); literature research of the materials found in the workplace that could be identified as potential intoxicants; and finally, close collaboration with our Industrial Hygienist in an effort to correlate findings with environmental data collected at the facility. An evaluation of the health capabilities at the plant will also be provided in this section of the report.

Statistics on the number of workers requiring medical attention for what has been described as a "gasing incident" may be found in Table II, Section VII. A total of 179 dispensary visits were made by workers experiencing a similar and characteristic group of symptoms (see below) during the period of time between May 22, 1972 to November 15, 1972. Sixty-two cases, or roughly one out of every three patients were hospitalized for one to three days. After discussion with numerous workers and a review of hospital and dispensary records, the following well-defined symptom complex was elicited with minor variations from all sources: the typical pattern is initiated with a burning sensation in the eyes, nose and/or throat which is followed by generalized weakness, nausea and vomiting (in some cases), dizziness, severe headache and paresthesias of the extremities. Other more variable complaints are shortness of breath and chills, as well as, a feeling of chronic fatigue experienced by these workers even in lieu of other symptomatology. One of the striking conclusions from our first visit to this facility was gleaned from our discussions with workers indicating that many of them were experiencing some of the above symptoms on a daily basis, albeit in some attenuated form that did not warrant a dispensary visit. Thus, our first and primary concern was with the possiblity that significant temporary or permanent systemic damage might occur in this setting.

A detailed review of the hospital records (See Table III, Sec. VII) on patients treated at the Ashtabula General Hospital regarding episodes on May 22, June 22, August 16 and September 16, 1972, was undertaken. This information suggests that effects are transient and no permanent damage has been incurred, however, the shortcomings of this data need elaboration. First, the longest period of time that any worker could be followed was four months (i.e. in a few cases, workers have been hospitalized during the May 22 incident and the September 16 incident). Therefore, although we have negative information regarding blood counts, urinalysis, x-rays, etc., we can not state with certainty that chronic effects are not present. Second, the quality of physical examinations and historical information regarding these hospitalized workers is somewhat short of ideal. In some instances, the only recorded history is, "overcome", and the only physical finding is "within normal limits". This type of terminology is not interpretable. Third, most of the blood work which was performed, took place at least thirty minutes to three hours or more following an incident. This takes on significance particularly in the case of carbon monoxide determinations. If a worker received pure oxygen for a period of 30 minutes it is possible that the level of carboxyhemoglobin in his blood would be normal when in fact the chemical might have been responsible for the hospitalization. This occurs because the dissociation of carbon monoxide from the hemoglobin molecule is half completed following 30-40 minutes of pure oxygen administration. In addition, the Ashtabula General Hospital utilizes a qualitative technique for this measurement which is insensitive to any level below 20%. If a patient was admitted under these circumstances and had a carboxyhemoglobin level of 18 per cent (which is enough to give symptoms of intoxication), the hospital lab would report a normal value. Moreover, there have been no laboratory estimations of methemoglobin formation in the blood (caused by exposure to aniline derivatives), hippuric acid excretion in the urine (caused by exposure to styrene or toluene), pulmonary function tests or consistent reporting of many other parameters that might be utilized to assess potential damage being caused by chemical exposures.

Prior to November 15, 1972, we did not have the opportunity to be present during any of the incidents described above, however, on that date we were able to take a history and examine each of eight patients who reported to the dispensary with complaints of headache, and burning sensations in the eyes, nose and throat. Two of the woman reported nausea and one reported that she had chills. All of the patients were female and ranged in age from 23 to 55 years old. They all worked in Area No. 136 as sanders for the FMC parts. It was learned that they were working next to the Binks 2 paint spray booth and, after discussion with members of the management, we found out that the booth was malfunctioning and overspray was prominent. None of these woman were taking medications on a chronic basis and there was no history of chronic disease elicited from them. Physical examination revealed normal vital signs and a review of the head, ears, eyes, nose and throat demonstrated gross dust deposits in the hair, facial creases, around the eyes and ears and heavy deposits in the nasal passages which in some cases obstructed flow of air. Seven of the 8 women had mild conjunctival irritation. The most striking finding was that of intense redness surrounding shallow superficial erosions of the nasal mucosae in all 8 women. Examination of the chest revealed no evidence of wheezing or altered breath sounds and the rest of the examination was unremarkable. None of these workers were ill enough to require hsopitalization but a number of important things resulted from this encounter. We know these women were exposed to potentially toxic substances emanating from the faulty Binks 2. Xylene concentrations in this area have been measured on other occasions to be very high on a transient basis (See Table IX, Sec. VII) and other types of organic vapors have been found in the vicinity of this booth as well. (See Table VI, Sec. VII) We also know that the dust concentrations in an area no more than 50 feet from where these women were working, were averaging between 70 and 154 mg/m (See Table V, Sec. VII) This dust is primarily fibrous glass, coated with a resinous material containing styrene and other chemicals. In our judgement, the cause of this incident was a combination of a vapor intoxication and exposure to excessively high levels of dust. The relationship between chemical vapors and particulate matter is discussed elsewhere in this report. (See Sec. III).

In order to define the incidence of the above outlined symptoms in the larger body of workers, a medical questionnaire was designed to answer this question (See Appendix A, Sec. VIII). Approximately 450 of these questionnaires were returned to us following completion by the workers. This represents 80 per cent participation. Certain parts of the questionnaire have been analyzed and fully 36 per cent of all workers reported that they have occasional or frequent symptoms. A resume of this information is reported in Table IV, Sec. VII. The data was analyzed for the first and second shifts only, as not enough questionnaires were returned to get a valid sampling of the third shift (though there were symptomatic workers on the third shift). The most value we can ascribe to this information is to say that the problem is insidious, cuts across all job descriptions and is found in all manufacturing operations. The validity of other findings is not estimable as we have no control sample for comparison. However, we now have a heretofore unknown quantity: the exact incidence of the problem irrespective of hospitalization data.

It should be pointed out that this entire issue was recognized long before NIOSH started its investigations. A review of all the various reports from agencies that have attempted to define this problem since May 22, 1972, can be found in Appendix B, Section VIII. There are repeated references to "testing for hydrocarbons", "suspicion of faulty ventilation", "the need for a fundamental industrial hygiene survey of the facility". The latter was performed by George Clayton and Associates on June 1 and 2, 1972, and they included a strong indictment of the ventilation system in the plant and stated, "There is a demonstrated need for a comprehensive ventilation survey of the entire plant." This has yet to be done by the company. At any rate, we have definite clues about the etiology of these incidents from the reports. Furthermore, the NAR management itself has been collecting hydrocarbon data and having it identified and quantitated by a private laboratory. Some of this information has been reviewed elsewhere in this report but certainly one could find some of the answers to this problem from this data alone (See Sec. IV B).

Research into the materials used in this facility has been performed and recorded in Section II. All of these compounds with the exception of the phthalates have been found in measurable concentrations in the plant and although none of our data on vapor levels exceed the TLV for each chemical, it is apparent from work that NAR officials have had done that one need only be in the right place at the right time to document high levels. Table IX, Sec. VII records toxic concentrations of methylene chloride, toluene, styrene, and xylene that have been found in different areas. It is unfortunate that we could not be in the plant for more time to corroborate these findings but we have no reason to suspect their validity.

Each of the chemicals mentioned in this report has toxic properties in high concentrations. Any one or more chemicals is capable of causing a similar picture to the one found at this facility and serious acute effects might result from exposure to high transient concentrations. For instance, methylene chloride levels in the 8000 ppm range is close to the narcotic level recognized in animals[18] and also capable of inducing significant carboxyhemoglobinemia in man[23]. Toluene or xylene in concentrations of 500 ppm will lead to mental confusion, insomnia, fatigue and nervousness that may last for days after only three hours of exposure[15]. Workers may endanger themselves and their fellow workers while operating various plant equipment. It has also been pointed out in other sections of this report that vapor toxicity may be potentiated in the presence of particulate matter. The dust situation is yet another factor, in some areas breathing zone dust is 60 per cent respirable (ie. $<$ 5um in size) and the standard is being exceeded by as much as 60 times the acceptable level in this instance!. In addition, the mechanical effort needed to cleanse the skin of this much dust can cause damage to cutaneous structures[41]. Many of the workers were observed to be literally coated with this material (See Photo. 14, Sec. VII). Furthermore, the long term effect of fibrous glass on pulmonary tissue has not been thoroughly assessed and it is possible that future studies may link this substance to chronic disease in the lungs. In our judgement, all of these conditions are being caused and exacerbated by the inadequate plant ventilation and recirculation of effluents pointed out in the Environmental Evaluation. Needless to say, this situation is very complex without ever considering possible chemical interactions, additive effects or the formation of new compounds.

Finally, a word about the health capabilities of this facility. There is a small dispensary located in Building No. 1 that is staffed by a nurse on the first shift and a nurse on the second shift. There is no coverage for the third shift. A local physician, who is a urologist by training, is available in the plant for consultation on one morning a week for a two hour session. The dispensary has one examining couch and one examining table, as well as the routine first aid equipment. Pre-employment physical examinations are brief and do not include blood tests, urinalysis, x-rays, pulmonary function tests, etc. There is no periodic examinations or termination examinations.

A review of the information accrued from the Medical Evaluation has led to certain conclusions and based on our best medical judgement.

1. There is a significant hazard to the health and well-being of the workers employed in the Reinforced Plastic Operations of this establishment.

2. These hazards may be quantified as outlined in this report and a list of these hazards ensues:

A. Exposure to excessively high levels of dust which is primarily fibrous glass. This exposure has led to damage to the skin, nasal and pharyngeal mucosa, as well as causing conjunctival irritation. Furthermore, the respirable fraction of this dust may present an unknown potential danger to pulmonary structures.

B. Exposure to excessively high levels of various organic vapors has led to subjective symptoms of headache, nausea, vomiting, dizziness, generalized weakness and possibly chronic fatigue in certain workers. Some of these vapors may cause serious acute effects if inhaled for prolonged periods at high concentrations.

C. Potential exposure to unknown chemical combinations and possible potentiation of toxic effects of certain chemicals.

D. A setting of inadequate ventilation serves to potentiate the aforementioned hazards.

E. Exposure to harsh chemicals without adequate skin protection has led to the frequent occurence of irritant cutaneous eruptions.

3. The health capabilities of this facility are insufficient for the number of workers employed and the types of hazards that are found in the work place.

D. CONCLUSIONS

The results of an endeavor by Officers of the National Institute for Occupational Safety and Health (NIOSH) to "....determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found," have indicated that there is a significant hazard to the health and well-being of the workers employed in the Reinforced Plastic Operations at North American Rockwell, Ashtabula, Ohio.

A colation of the Environmental and Medical conclusions of the Hazard Evaluation and the basis for these conclusions, in the best judgement of the authors, ensues:

1. Exposures to airborne dust in many areas of the plant are far in excess of ACGIH recommended standards, as well as, OSHA promulgated standards. An appreciable fraction of airborne dust in this plant has been demonstrated to be of respirable character. These exposures have caused damage to the skin, nasal and pharyngeal mucosa, as well as having caused conjunctival irritation in workers at this facility. Furthermore, the respirable fraction of this dust may present an unknown potential danger to the pulmonary structures of these workers.

2. Many chemical vapors are simultaneously present in several of the plant work areas and have been documented to reach transient, high concentrations. Acetone, cellosolve acetate, isobutyl alcohol, isopropyl alcohol, methyl cellosolve, MIBK, methylene chloride, methyl ethyl ketone, normal butyl acetate, styrene, toluene, and xylene have all been found in the plant

4. The exposure to harsh chemicals without adequate skin protection has led to the frequent occurence of irritant cutaneous eruptions.

5. Appropriate warning labels for the materials used in this plant are virtually unknown. In general, the employee population exhibited little knowledge concerning the toxic properties of the materials in their workplace.

6. There is no program in this facility to educate workers about the use and maintenance of personal protective equipment. Furthermore, the management and workers displayed a distinct lack of knowledge regarding the need for such equipment.

7. The health capabilities of this facility are insufficient for the number of workers employed and the types of hazards that are found in the workplace.

V. RECOMMENDATIONS

The following recommendations are suggested to alleviate hazardous in-plant conditions as outlined in this report:

1. Ventilation. There is a demonstrated need for an indepth study of the plant ventilation systems. This study should be conducted without delay. (Many ventilation problem areas have already been outlined in Sec. IV, part B.) It is suggested that a reputable ventilation and industrial hygiene firm be retained to do this work. If NAR has qualified ventilation and industrial hygiene personnel available at the corporate level, they may be able to provide this service. Once the study and design work are complete, new construction and modifications of existing equipment should proceed at once.

2. Respirators. In general, respirators should be used only when it is not feasible or possible to hold contaminants to an acceptable level by engineering controls. It is urged that such controls be provided whenever possible. Until such controls can be provided, there are a number of areas in which workers should be required to wear respirators (eg. sanding operations). Even after controls are provided, there may still be areas in which respirators will be required (eg. paint spray booths).

A respiratory protective program should be established and maintained which includes the general requirements described in American National Standard Z88.2-1969, "Practices for Respiratory Protection". A minimal acceptable program would include:

(A) Written standard operating procedures governing selection and use of respirators.

(B) Appropriate selection of respirators based on the hazard to which the worker is exposed.

(C) Instruction and training in the proper use of respirators and their limitations.

(D) Facility for regular cleaning and disinfection of respirators.

(E) Clean and convenient storage area.

(F) Routine respirator inspection and maintenance program for respirator wear and deterioration.

(G) Appropriate surveillance of work area conditions and degree of employee exposure.

3. Protective Clothing. Appropriate protective clothing should be provided in areas where harsh chemicals are used. The proper types of gloves and aprons if necessary should be made available to employees. The purchase and wearing of safety shoes should be encouraged. Certain types of head gear should be worn in sanding and paint spray areas to prevent dust from being deposited in the hair and ears of workers. Cloth muffs or soft cotton (applied to the ears before the shift) may provide adequate protection. Cloth caps or hats may adequately protect the hair.

4. Eye Protection. Safety glasses should be required in all work areas of the plant. Where added protection is necessary, chemical goggles or face shields should be provided.

5. Warning Labels. Appropriate warning labels should be affixed to all materials used in the plant. These labels should appraise the workers of potential hazards and provide directions for emergency action in the event of accidental over exposure via inhalation, ingestion, etc.

6. There is a demonstrated need for an improvement in the health capabilities of this facility. Recommended Guidelines for the design of an Occupational Health Program may be found in Appendix C.

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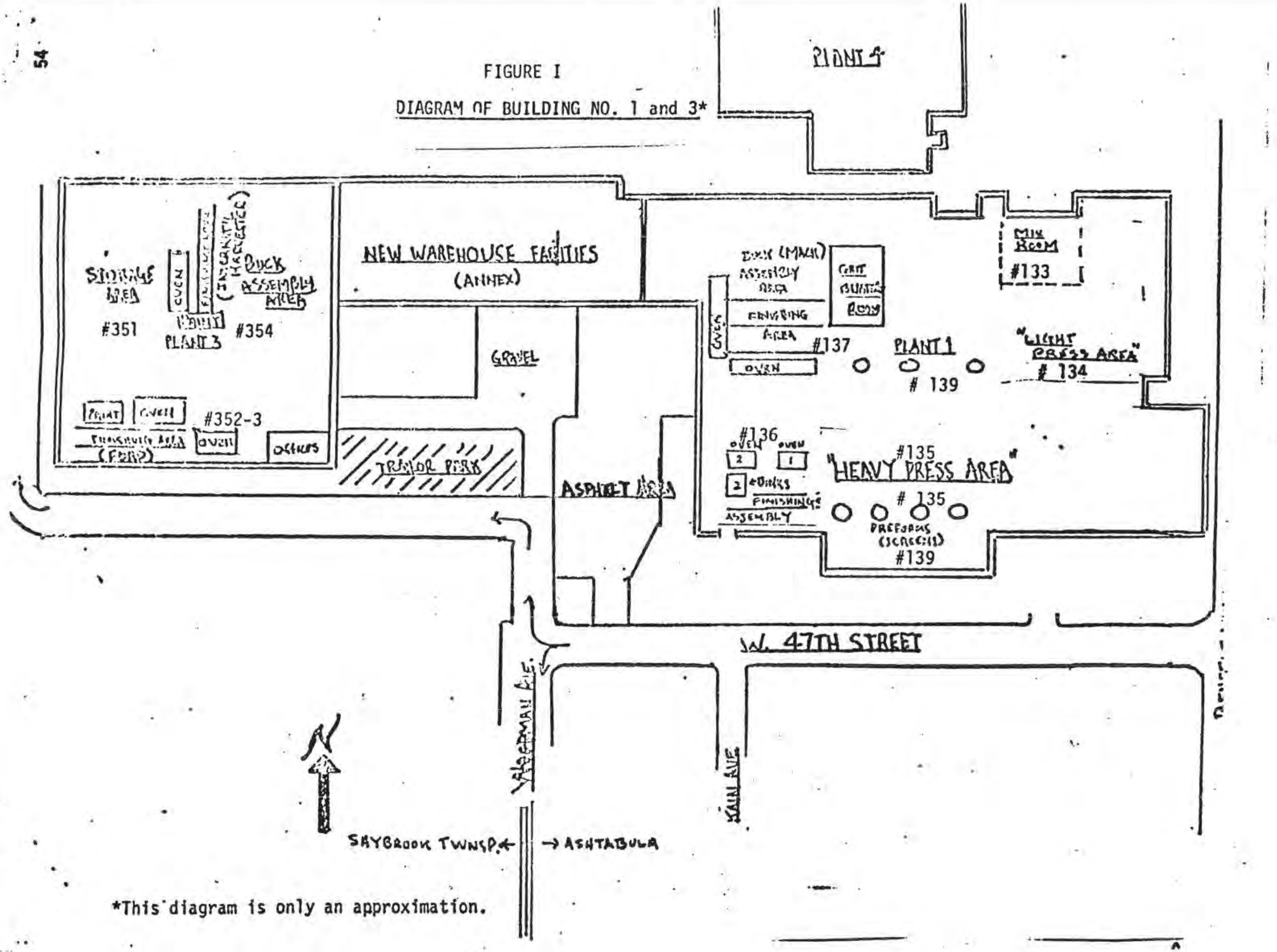
VII FIGURES, TABLES AND PHOTOGRAPHS*

FIGURE I

DIAGRAM OF BUILDING NO. 1 and 3*



*This diagram is only an approximation.

TABLE I

KEY TO WORK AREAS AT NAR-RPO

Area Number*	Department
111	Inspection
114	Materials
115	Maintenance
132	Mat
133	Mix Room
134	Small Press Area
135	Large(Heavy) Press Area
136	Finishing Area(Includes Dodge Engine Cover, FMC Window Panel, Binks Paint Spray)
137	Mack Area(Assembly, Finishing, Paint Spray)
139	Pre-Forms
350	General Shipping
351	Shipping
352-353	Ford Motor Company(Assembly, Finishing, Paint Spray)
354	International Harvester Company(Assembly, Finishing Paint Spray)
459	Resin Plant

* The first number of the area code designates the building(eg. Area 111 would be in Building no. 1).

TABLE II

REVIEW OF ALL CASES INVOLVING "GASING INCIDENTS" AT NAR-RPO

Date	Number of Employees Effected By Work Area															
1972	Area 111	114	115	133	134	135	136	137	139	351	352-3	354	459	U	Total	Workers Hospital*
5-22		1					2	4	1	5	10	10	1	2	36	33
6-22												6		4	10	6
8-16							9		1					14	24	10
9-9														3	3	0
9-11							2			1	1	1			5	0
9-13														1	1	1
9-14							1	2				2		2	7	0
9-16										1		2			3	3
9-20								1							1	0
9-21												1			1	0
9-22											2				2	0
9-26												14			14	2
9-27												1			1	1
10-2							3								3	1
10-4												1			1	0
10-5							8								8	0
10-16									1						1	0
10-17							2					1			3	0
10-21												5			5	0
10-24						1									1	0
10-26							1								1	0
10-30							2								2	0
10-31	1						2	4							7	0
11-1								1							1	0
11-13							12								12	1
11-14							3					1			4	1
11-15				1				2	2	1		16			22	3
Totals	1			1		1	47	14	5	8	13	61	1	26	179	62

*Abbreviations: Hospital - Hospitalized; U - Unknown (Work Area)

<u>TABLE III - "HOSPITAL RECORDS OF WAR WORKERS</u>

WORKER	AREA	ADMISSION DATES 5/22	6/22	8/16	9/16	SYMPTOMS	PHYS. EXAM	VITAL SIGNS P	B.P.	RR	T	CHEST X-RAY	CBC HCT	HGB	DIFF	WBC	U/A*	SMA-12**	COHB***
B.A.	#139			X		"overcome"	bland face mono-syllabic speech	70	N.D.	12	100	Sl. elev. of L. hemidiaphragm (WNL)	43	14.5	WNL	6400	WNL	WNL	WNL
B.A.	#139	X				"overcome"	DATA NOT LOCATED												
V.A.	#137	X				"overcome"	WNL	80	124/86	20	99	WNL	45	14.5	WNL	5900	WNL	N.D.	WNL
H.A.	#353	X				"Overcome"	Conj. irr.	88	112/30	20	98	WNL	39	13.0	WNL	7900	WNL	N.D.	WNL
H.A.	#353		X			S, weakness, SOB, face burns, P-lips	Conj. irr.	ND	110/60	ND	ND	WNL	43	14.1	WNL	8300	WNL	N.D.	WNL
A.B.	#354	X				"inhalation"	WNL	80	138/100	20	98	WNL	54	17.7	WNL	6000	WNL		WNL
M.B.	#351	X					DATA NOT LOCATED												
M.B.	#352	X				"Inhalation"	WNL	85	156/102	20	99	WNL	48	16.3	WNL	6800	WNL	N.D.	WNL
R.C.	#352	X				N, abd. pain, H, D	Epig. tend.	96	180/80	20	99	WNL	52	16.3	WNL	5900	WNL	Sl. elev. A.P.; LDH	WNL
R.C.	#352			X		N, V, D, chills	Epig. tend. tremor	84	122/80	25	99	WNL	46	15.8	WNL	5700	WNL	WNL	
F.C.	#351	X				N, V, eye irr., abd. pain	Epig. tend.	80	120/80	25	98	WNL	40	13	WNL	6800	WNL	N.D.	WNL
D.C.	#351	X				"inhalation"	WNL	136	184/90	25	99	WNL	43	14.1	WNL	7600	WNL	N.D.	WNL

*U/A - Urinalysis consists of specific color, charaltar, gravity, microscopic, qualitative screen for glucose, acetone, bilirubin and blood.
**SMA-12 - Analysis consists of calcium, phosphorus, glucose, bun, uric acid, cholesterol, total protein, albumin, total bilirubin, alkaline phosphatase (A.P.), Lactic Dehydrogenase (LDH), serum gluthamic oxalacetic transaminase (SGOT).
***COHB - Carboxy hemoglobin - qualitative colorometric determination; insensitive for 20% saturation.

ABBREVIATIONS: WNL - within normal limits; N.D. - not done; N - nausea; V - vomiting; H - headache; SOB - short of breath; D - dizziness, virtigo; P - (paresthesias) tingling, numbness; S - sleepy, sommolence; Conj. irr. - conjunctival irritation; Eye irr. - eye irritation; Epig. tend. - Epigastric tenderness; P - pulse; B.P. - blood pressure; RR - respiratory rate; T - temperature; HCT - hemotcrit; HGB - hemoglobin; DIFF - differential white count; WBC - white blood count; Prob. - probable; Prox. - proximal.

TABLE III - HOSPITAL RECORDS OF NAR WORKERS

WORKER	AREA	ADMISSION DATES 5/22	6/22	8/16	9/16	SYMPTOMS	PHYS. EXAM	VITAL SIGNS P	B.P.	RR	T	CHEST X-RAY	CBC HCT	HGB	DIFF	WBC	U/A*	SMA-12**	COHB***
T.M.	#354	X						DATA NOT LOCATED											
E.M.	#114	X						DATA NOT LOCATED											
M.M.	#354	X						DATA NOT LOCATED											
W.M.	#353	X				N	WNL	76	130/80	20	98	prominence bilat-chron.	34	10.8	WNL	5200	WNL	N.D.	WNL
W.M.	#353		X			coarse cough, (present before admiss) P,S,SOB	few chest rales which persisted	80	130/90	20	99	prominence bilat-chron.	33	11.1	WNL	6400	WNL	N.D.	WNL
D.M.	#353	X				discomfort with breathing	WNL	100	88/60	18	98	WNL	44	14	WNL	5000	WNL	N.D.	WNL
J.M.	#351	X				"overcome"	WNL	80	110/80	16	99	WNL	37	12.2	WNL	7400	WNL	N.D.	WNL
V.M.	#354	X				H, P-feet & hands, cough	Basilar bilat. rales	90	146/90	20	99	WNL	41	13.4	WNL	7600	WNL	N.D.	WNL
J.M.	#136	X				H, N, epig. distress	some epig. tend.	65	130/80	30	98	WNL	37	11.8	WNL	8600	WNL	WNL	WNL
R.P.	#352	X				prob. sunburn, D P-arms &legs, pink face, N	some epig. tend.	90	148/90	20	99	bilat. prominence of lung marking chron. bronc	48	16.3	WNL	7500	WNL	N.D.	WNL
R.S.	#352	X				H, P-feet & hands	WNL	88	160/80	30	98	WNL	50	16.3	WNL	5000	WNL	N.D.	WNL
S.S.	#137	X				"overcome"	WNL	98	154/100	20	98	WNL	41	13.4	WNL	6500	WNL	N.D.	WNL
S.S.	#351	X				burning eyes burning with deep breathing	sl. cong.	80	118/76	20	98	WNL	51	16.7	WNL	8000	WNL	N.D.	WNL

TABLE III - HOSPITAL RECORDS OF NAR WORKERS

WORKER	AREA	ADMISSION DATES 5/22	6/22	8/16	9/16	SYMPTOMS	PHYS. EXAM	VITAL SIGNS P	B.P.	RR	T	CHEST X-RAY	CBC HCT	HGB	DIFF	WBC	U/A*	SMA-12**	COHB***
D.C.	#351		X			felt hot, face burned, S, Legs ache	Conj. irr.	96	120/88	20	99	WNL	44	14.5	WNL	7700	WNL	N.D.	N.D.
C.C.	#136	X				H,D,N, abd.pain & distress, D, muscle pains	Nervous WNL	120	110/70	23	98	WNL	39	11.5	WNL	6500	WNL	WNL	WNL
P.D.	#354	X				DATA NOT LOCATED													
L.D.	#354	X				D,H	WNL	88	120/70	20	98	WNL	44	15.8	WNL	11000	WNL	N.D.	WNL
H.D.	#354	X				H, P-feet & hands	WNL	104	134/80	20	98	WNL	38	12.5	WNL	7300	WNL	WNL	WNL
E.G.	#354	X				"Overcome"	WNL	104	144/82	25	97	mild diffuse chronic dis.	47	15.8	WNL	5000	WNL	N.D.	WNL
M.H.	#354	X				Exposed to fumes nervousness	WNL	100	158/78	24	99	WNL	45	15.4	WNL	9500	WNL	N.D.	WNL
M.H.	#354		X			DATA NOT LOCATED													
M.H.	#354				X	N,weakness, H, chest pain,cold sweat, cough, wheezing, P-toe prox. weakness	Bowel sounds	80	114/70	24	98	WNL	36	13	WNL	6800	WNL	N.D.	WNL
R.H.	#352	X				"overcome"	WNL	76	122/80	25	98	WNL	49	15.8	WNL	6600	WNL	N.D.	WNL
E.J.	#459	X				N,H, malaise	apprehensive epig. tend.	85	120/80	20	98	WNL	48	16.3	WNL	7300	WNL	N.D.	WNL
H.J.	#352	X				Nervousness	WNL	72	138/78	18	98	sl. incr. lung markings chronic	48	15.8	WNL	4800	WNL	N.D.	WNL
W.L.	#354	X				Burning eyes, N, weakness	B.P.,excited	100	198/108	17	99	early emphysema	50	16.7	WNL	6600	WNL	N.D.	WNL

TABLE III - HOSPITAL RECORDS OF NAR WORKERS

WORKER	AREA	ADMISSION DATES 5/22	6/22	8/16	9/16	SYMPTOMS	PHYS. EXAM	VITAL SIGNS P	B.P.	RR	T	CHEST X-RAY	CBC HCT	HGB	DIFF	WBC	U/A*	SMA-12**	COHB***
S.S.	#351				X	Inflated abd., D cough, pink sputum or emitus, N H, malaise, sternal pain	Midpoint rales both lung fields	60	134/80	12	97	WNL	40	14.1	WNL	4700	WNL	N.D.	WNL
D.T.	#137	X				stinging eyes, choking, N, epig. pain	mild epig. tend.	76	84/50	20	99	WNL	42	13.8	WNL	7100	WNL	N.D.	WNL
R.W.	#352	X				stinging eyes, choking, N, epig. pain	mild epig. tend.	76	146/92	20	99	WNL	50	17.2	WNL	13900	WNL	N.D.	WNL
L.W.	#354	X				DATA NOT LOCATED													
Q.W.	#354		X			DATA NOT LOCATED													
D.L.				X		H, burning eyes swelling feet	DATA NOT LOCATED												
M.M.				X		Lassitude, inability to move	eye rolling, squeezing eyelids	90	120/80	20	99	WNL	49	16.7	WNL	9600	WNL	WNL	WNL
I.H.				X		H, N, malaise	WNL	70	128/80	15	98	WNL	42	14.5	WNL	5300	WNL	WNL	WNL
L.K.				X			DATA NOT LOCATED												
V.T.				X		N, H	WNL	80	132/80	20	98	WNL	41	14.1	WNL	7900	WNL	WNL	WNL
W.M.				X		H, chest pain	WNL	85		20	98	WNL	41	14	WNL	9500	WNL	WNL	WNL
C.P.				X		Inhaled fumes minimal symptoms	some perceordial pain	85	130/74	20	98	WNL	40	13.8	WNL	6000	WNL	WNL	WNL

Photo. 7. This is a water wall type spray booth. Suspended truck parts cannot be manually rotated. The worker must spray away from the water wall 50 per cent of the time, as demonstrated above.

Photo. 8. This photo demonstrates the striking Tyndal Beam reflection under the light fixtures. This is due to heavy dust concentrations in the plant atmosphere.

TABLE III - HOSPITAL RECORDS OF NAR WORKERS

WORKER	AREA	ADMISSION DATES 5/22	6/22	8/16	9/16	SYMPTOMS	PHYS. EXAM	VITAL SIGNS P	B.P.	RR	T	CHEST X-RAY	CBC HCT	HGB	DIFF	WBC	U/A*	SMA-12**	COHB***
N.J.				X		H,N,D,malaise	WNL	75	96/66	20	98	WNL	42	14.5	WNL	6100	WNL	WNL	WNL
M.W.				X		N,V,H,D	WNL	70	130/90	20	98	chronic adhesions on R base as before	4[illegible]	13.8	WNL	9300	WNL	WNL	WNL
G.C.					X	N,H,weakness	WNL	80	114/80	18	98		43	14.5	WNL	9000	WNL		

TABLE IV - SUMMARY OF QUESTIONNAIRE
AS RELATED TO SYMPTOMATIC PATIENTS (WORKERS)

TOTAL EMPLOYEE COUNT	AREA	SHIFT (Symptomatic/non-symptomatic)		
		1st	2nd	Misc.
14	133	6/11	3/3	
28	134	10/24	NO DATA/4	
61	135	7/38	8/23	
88	136	33/56	9/32	
68	137	12/63	NO DATA/5	
21	139	8/13	6/8	
99	352-3	19/52	13/47	
22	354	11/11	2/11	
13	459	5/10	NO DATA/3	
70	111,114,115 132,350			22/70
484		112/277	41/13	22/70

GRAND TOTAL: 175 symptomatic/484 non-symptomatic (36.2%)

TABLE V: Personal Breathing Zone Dust Concentrations

(Samples collected September 14 and 15, 1972)

Sample No.	Location	Job	Total Time (Min)	Total Dust Conc (mg / m^3
11	133 Mixing Room	Mixer, All Formulas	99	10.5
29	133 Mixing Room	Mixer, All Formulas	96	7.9
7	133 Mixing Room	Binder Mixer	93	4.8
27	133 Mixing Room	Mixer BMC	97	2.8
42	133 Mixing Room	Bond Mixer	96	10.4
10	133 Mixing Room	Mix Room Service	97	1.9
26	133 Mixing Room	Mix Room Service	88	3.8
32	133 Mixing Room	Mix Room Service	91	3.0
49	134 Press 26	Trim. & Press Oper.	88	3.2
44	134 Press 11	Light Trimmer	88	5.1
37	134 Press 5	Trim. & Press Oper.	84	4.1
3	134 Press 2	Trim. & Press Oper.	84	3.2
36	135 Press 49	Press Operator	85	2.1
47	135 Press 48	Heavy Trimmer	85	4.1
41	135 Press 46	Press Operator	87	2.6
48	135 Press 42	Heavy Trimmer	81	10.9
21	135 Press 39	Press Operator	80	2.6
13	137 Mack Dry Line	Disk Sander	83	86
4	137 Mack Dry Line	Disk Sander	82	62
14	137 Mack Dry Line	Sander, Hvy. & Lt.	81	20.3
19	137 Mack Dry Line	Jitterbug Sander	81	29.1
2	137 Mack Dry Line	Jitterbug Sander	80	154
1	137 Mack Dry Line	Final Finishing	78	6.7
25	137 Mack Wet Line	Final Finishing	77	33.1
17	137 Mack Wet Line	Wet Disk Sanding	74	37.[illegible]
18	137 B. Bond	B. Bond	65	158
9	137 B. Bond	B. Bond	63	40.
6	137 Grit Blast Cab	Grit Blast	82	83

TABLE V: Continued

Sample No.	Location	Job	Total Time (Min)	Total Dust Conc. (mg / m^3)
68	137 Shipping	Finisher	47	23.9
56	137 Shipping	Finisher	46	32.4
20	139 Preform 12	Hvy. Preform Oper.	69	4.4
43	139 Preform 10	Hvy. Preform Oper.	66	4.5
24	352 Assembly	103 Fender Sub Asbly.	80	6.1
16	352 Assembly	103 Fender Sub Asbly.	75	25.8
40	352 Assembly	103 Hood Sub Asbly.	72	7.4
12	352 Assembly	103 Sub Assembly	69	33.0
8	352 Assembly	U90 Ford Sub Asbly.	67	5.4
30	352 Assembly	U90 Assembly	65	23.1
39	352 Assembly	Sub Assembly	63	7.7
5	352 Assembly	Assembly	64	9.6
82	352 Assembly	Sander	44	310
90	352 Assembly	Sander	42	148
100	352 Assembly	Sander	31	129
77	352 Grit Blast	Material Handler	30	32.8
52	352 B. Bond	Sander	74	4.1
76	352 Finishing	Finisher	73	7.5
51	352 B. Bond	Hvy. Disk Sander	66	19.8
61	352 B. Bond	Sander	64	129
57	352 Undersize	Sander	68	105
65	352 Undersize	Sander	62	34.6
74	353 Ford Dry Line	Disk Sander	64	98
75	353 Ford Dry Line	Disk Sander	63	36.9
63	353 Ford Dry Line	Sander	63	75.1
66	353 Ford Dry Line	Sander	61	100
60	353 Ford Dry Line	Sander	58	95
54	353 Ford Dry Line	Grinding	3	320
69	353 Ford Dry Line	Finisher	58	19.0
71	353 Ford Dry Line	Disk Sander	56	33.1

TABLE V: Continued

Sample No.	Location	Job	Total Time (Min)	Total Dust Conc. (mg / m^3)
72	353 Wet Line Hvy. Fin.	Sander	53	21.2
62	353 Wet Line Hvy. Fin.	Sander	52	15.6
70	353 Butterfly	Assembly	51	12.8
58	354 IHC Finishing	Sander	66	12.8
73	354 IHC Finishing	Sander	66	14.9
59	354 IHC	Sander	65	20.3

TABLE VI: Personal Breathing Zone Vapor Concentrations (Samples collected 9/14-15/72)

Sample No.	Location	Job	Methyl Ethyl Ketone ppm	Isopropyl Alcohol ppm	Methylene Chloride ppm	Toluene ppm	Styrene ppm
66	133 Mixing Room	Mix Room Oper.	*N.D.	5.6	8.4	0.7	22.9
65	133 Mixing Room	Mix Room Oper.	N.D.	4.5	5.2	1.0	18.0
67	133 Mixing Room	Mix Room Oper.	N.D.	5.6	7.5	0.3	70.0
68	133 Mixing Room	Mix Room Oper.	N.D.	5.C	7.5	8.0	68.1
64	134 Press Area	Press Operator	N.D.	2.1	6.2	1.3	21.4
63	134 Press Area	Press Operator	N.D.	2.1	10.0	0.9	34.5
71	134 Press Area	Press Operator	1.9	4.9	5.3	2.3	15.0
4	136 Ford Fender	Assembler	N.D.	1.6	N.D.	0.8	2.4
5	136 Ford Fender	Hvy. Finisher	N.D.	1.4	N.D.	0.3	3.2
6	136 Ford Fender	Sander	N.D.	0.7	N.D.	0.3	1.3
13	136 Assembly	LS Fender Ford	N.D.	2.4	N.D.	1.8	4.5
14	136 Assembly	LS Fender Ford	N.D.	6.6	4.4	1.2	2.4
15	136 Binks No. 2	Painter	2.3	N.D.	N.D.	0.6	0.5
17	136 Finishing	Finisher	N.D.	0.9	0.4	0.8	1.0
18	136 Finishing	Finisher	0.7	2.5	N.D.	1.3	2.6
19	136 Finishing	Finisher	0.8	2.1	N.D.	0.9	2.6
20	136 Finishing	Finisher	0.4	2.7	0.7	2.0	4.2
22	136 Finishing	Painter's Help.	N.D.	19.8	N.D.	0.6	1.1
**24	136 Binks No. 1	Painter	3.4	3.8	2.9	0.9	7.5
27	136 Assembly	Assembler	N.D.	44.8	1.6	1.8	21.7

*N.D. means less than 0.1 ppm.
**Contained a trace of Methyl Cellosolve

Note: All Samples Contained Traces of Xylene.
Trace means less than 1.0 ppm.

TABLE VI: Continued

Sample No.	Location	Job	Methyl Ethyl Ketone ppm	Isopropyl Alcohol ppm	Methylene Chloride ppm	Toluene ppm	Styrene ppm
29	136 Finishing	Finisher	N.D.	18.6	0.3	0.8	2.9
30	136 Finishing	Finisher	N.D.	7.9	0.3	6.2	2.2
75	136 Foam	Finisher	0.5	11.5	2.9	1.5	6.8
3	137 Assembly	Assembler	N.D.	6.2	N.D.	0.4	3.6
8	137 Assembly	Assembler	N.D.	3.5	0.4	0.8	9.5
9	137 Assembly	Laborer	N.D.	14.0	N.D.	0.5	3.8
10	137 Assembly	Operator	N.D.	2.2	0.3	0.3	0.7
11	137 Assembly	Operator	N.D.	8.4	N.D.	1.1	10.5
12	137 Assembly	Operator	N.D.	3.1	N.D.	0.9	2.4
**23	137 Mack Booth	Painter	1.4	2.5	0.6	0.5	3.6
60	139 Preform	Preform Oper.	0.4	N.D.	0.3	0.3	13.8
61	139 Preform	Preform Oper.	N.D.	1.0	3.5	0.6	15.1
62	139 Preform	Preform Oper.	0.4	9.0	5.4	0.3	14.0
70	139 Preform	Preform Oper.	N.D.	0.8	10.4	2.7	26.8
32	352 Assembly	L-92 M-Buck	N.D.	N.D.	8.6	N.D.	2.4
**38	352 Assembly	L-92 M-Buck	N.D.	N.D.	2.9	N.D.	2.4
**34	352 Assembly	L-92 M-Buck	N.D.	N.D.	8.6	2.6	4.8
**39	352 Assembly	L-92 M-Buck	N.D.	N.D.	11.5	0.3	4.8
**36	352 Assembly	#2 LS Butterfly	N.D.	N.D.	8.6	0.3	4.8
35	352 Assembly	#2 LS Butterfly	N.D.	N.D.	8.6	N.D.	0.2
**31	352 Assembly	#2 LS Butterfly	N.D.	N.D.	8.6	0.3	2.4

TABLE VI: Continued

Sample No.	Location	Job	Methyl Ethyl Ketone ppm	Isopropyl Alcohol ppm	Methylene Chloride ppm	Toluene ppm	Styrene ppm
**37	352 Assembly	#2 LS Butterfly	N.D.	N.D.	8.6	0.3	4.8
76	352 Buck Area	Hvy. Assembler	N.D.	8.3	N.D.	0.6	9.5
78	352 Buck Area	Hvy. Assembler	N.D.	7.1	N.D.	0.8	7.1
79	352 Buck Area	Hvy. Assembler	N.D.	10.9	N.D.	1.3	7.1
1	353 Ford Hood	Spray Painter	N.D.	N.D.	N.D.	N.D.	1.1
2	354 IHC	Spray Painter	N.D.	1.6	N.D.	1.3	0.6

TABLE VII: Area Organic Vapor Concentrations (Samples collected 11/9/72)

Sample No.	Area	Methyl Ethyl Ketone ppm	Methylene Chloride ppm	Isopropyl Alcohol ppm	Toluene ppm	Styrene ppm
10	133 Mixing Room @ Operator's Desk	0.1	13.7	12.5	3.6	45.9
09	135 @ Heavy Press 42, near scale	0.2	8.6	6.0	0.6	30.0
14	135 Near Heavy Press 50	0.2	8.6	13.1	0.2	8.5
07	136 Bench Finishing	0.6	*N.D.	0.3	0.7	0.5
08	136 Paint Mixing Area	11.2	1.3	1.8	0.1	2.2
13	137 @ Start of Mack Line	N.D.	N.D.	0.4	0.2	0.8
12	138 MEK Work Table	0.8	0.1	N.D.	0.3	2.4
03	352 Undersize	0.1	N.D.	10.2	0.1	2.2
04	352 Main Assembly Buck Area	0.1	N.D.	13.6	0.1	2.3
02	353 Ford Dry Line	0.1	N.D.	0.4	0.1	1.2
01	354 @ No. 104 Buck	0.1	N.D.	10.2	0.1	2.2
05	354 IHC Finishing Line 1	0.2	N.D.	3.8	0.2	2.0
06	354 IHC Finishing Line 2, between spray booth and door to enclosed spray booth.	2.0	N.D.	3.0	0.2	1.1

*N.D. means less than 0.1 ppm.

Note: Sample 06 also contained a few ppm of xylene, methyl isobutyl ketone, normal butyl acetate, and isobutyl alcohol.

Sample 07 also contained a few ppm of xylene, methyl isobutyl ketone, normal butyl acetate, isobutyl alcohol, and acetone.

Sample 08 also contained a few ppm of xylene, methyl isobutyl ketone, normal butyl acetate, isobutyl alcohol, acetone, and cellosolve acetate.

TABLE VIII: Area Dust Concentrations

(Samples collected 11/9/72)

Sample Nos.	Location (Area Sample)	Total Time (MIN)	Respirable Dust Conc. (mg/m^3)	Total Dust Conc. (mg/m^3)	Percent Respirable
10 & 1	352 at Center of Undersize Area.	60	2.9	4.7	60
4 & 2	352 at Center of Main Assembly Buck Area.	78	0.7	3.9	20
14 & 20	353 at Center of Ford Dry Line.	78	0.7	10.6	10
6 & 16	354 IHC Finishing Line No. 1	86	1.5	5.2	30
19 & 3	354 IHC Finishing Line No. 2	82	0.1	4.4	2
8 & 11	354 at Buck 104	85	1.2	5.7	20

TABLE IX: Environmental Data from Envirolab, Inc.*

Sample No.	Date	Time	Location	Contaminant	Concentration ppm
1401-013A	08-23-72	----	At Press No. 42	Styrene	1,200
1401-013B	08-23-72	----	At Press No. 46	Styrene	600
32	09-05-72	0235	IHC Paint Booth	Xylene	685
37	09-06-72	1329	IHC Paint Booth	Xylene	340
38	09-06-72	1845	At IHC Oven Door	Xylene Toluene	300 350
39	09-06-72	2355	IHC Hood Flash-Off Area	Xylene	520
41	09-07-72	0005	IHC Hood Flash-Off Area	Xylene	1,400
42	09-07-72	0125	IHC Hood Flash-Off Area	Xylene	1,850
44	09-07-72	2040	IHC Sanding Line	Methylene Chloride	200
45	09-08-72	0450	IHC Sanding Line	Methylene Chloride	200
46	09-09-72	0042	IHC Sanding Line	Methylene Chloride	200
47	09-09-72	0312	IHC Sanding Line	Methylene Chloride	200+
55	09-11-72	1735	Econoline Booth	Xylene	500
59	09-13-72	1123	Binks No. 2	Xylene	360
68	09-14-72	1010	Bond Mach. Dept.	Methylene Chloride	300
78	09-19-72	2000	Engine Cover Assembly	Light Hydrocarbons (pentane, hexane, etc.)	1,000+
84	09-20-72	2155	White Engine Cover	Light Hydrocarbons (pentane, hexane, etc.)	480
85	09-20-72	2310	Dodge Engin Cover	Light Hydrocarbons (pentane, hexane, etc.)	1,200
95	09-26-72	0330	Preform Machine Dept.	Methylene Chloride	8,000
104	09-28-72	0625	Ford Paint Booth	Xylene	350

*Data acquired from reports prepared for North American Rockwell by Envirolab, Inc. (Analysis - Research - Testing) 946 Richmond Road Painesville, Ohio 44077. Copies of these reports were provided by NAR officials for review by NIOSH.

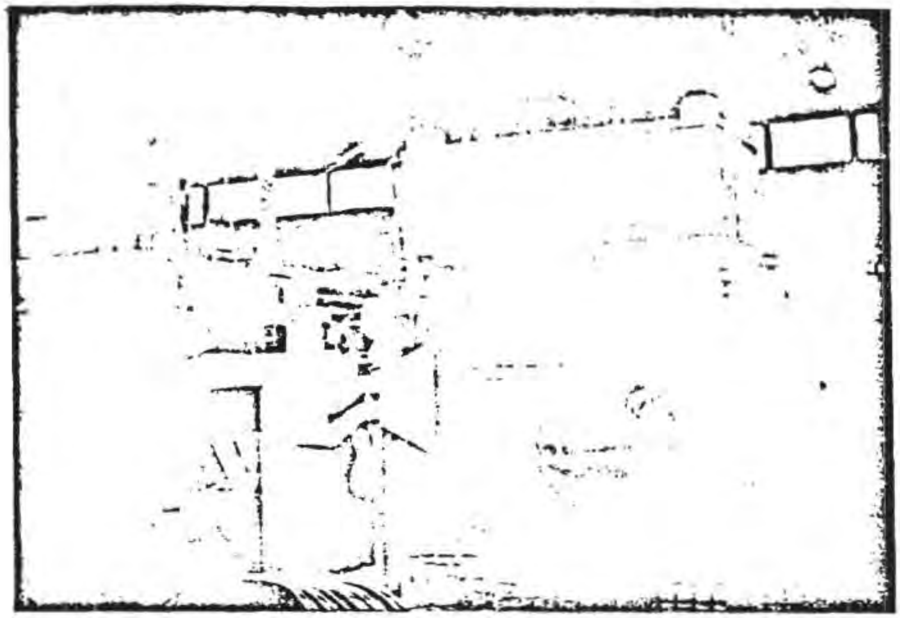


Photo. 1. Workman sanding a truck part in front of Heavy Press #42. This is an example of ineffective exhaust. Note the part is larger than the exhaust hood and the area fan destroys the capture of the hood.

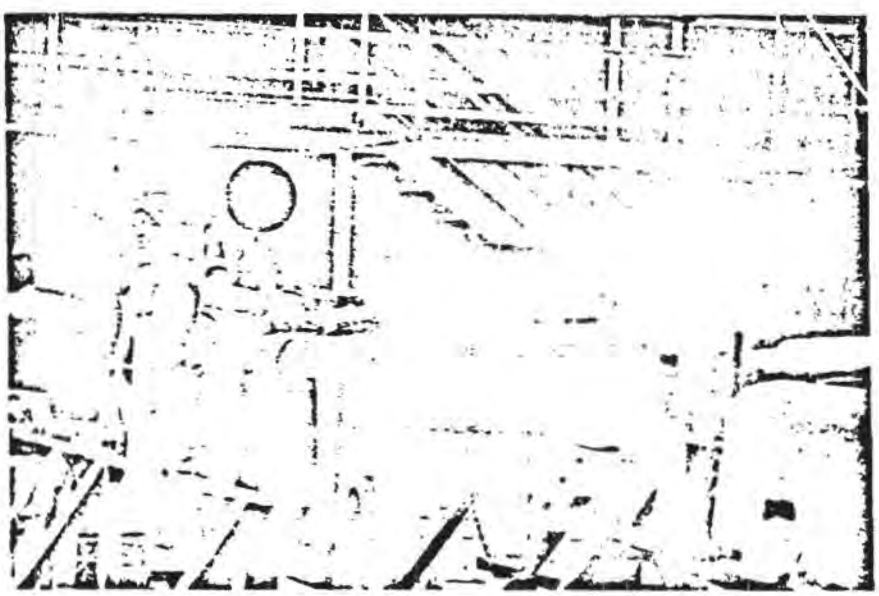


Photo. 2. Sanding operation in the FMC dry sanding area. Note the lack of personal protective equipment. The dust levels in this area are excessive.

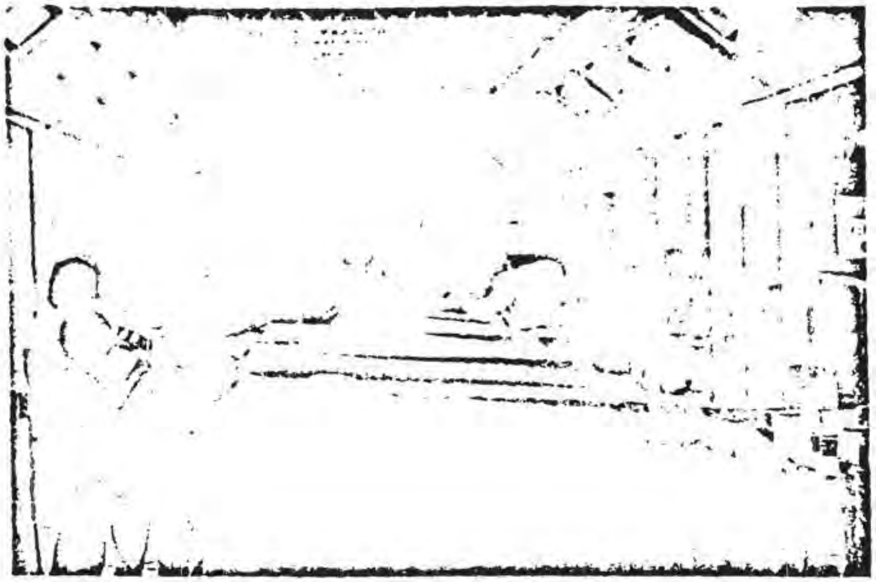


Photo. 3. Sanding operation in the FMC Finishing Line. Again, workers have no personal protective gear in this dusty environment. Observe proximity of ovens to the left of workers.

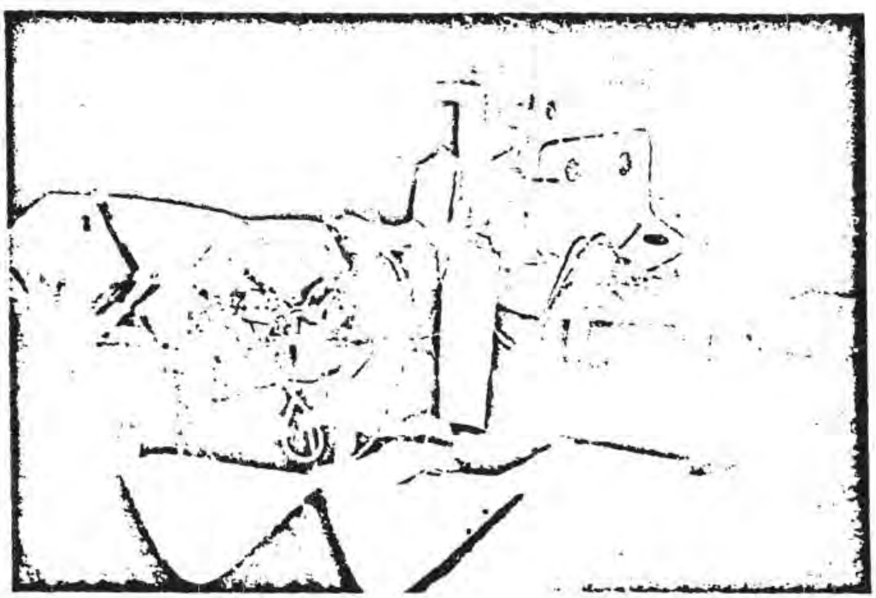


Photo. 4. This is an example of a worker who is attempting to gain respiratory protection from a [redacted] surgical-type face mask in the presence of excess dust.

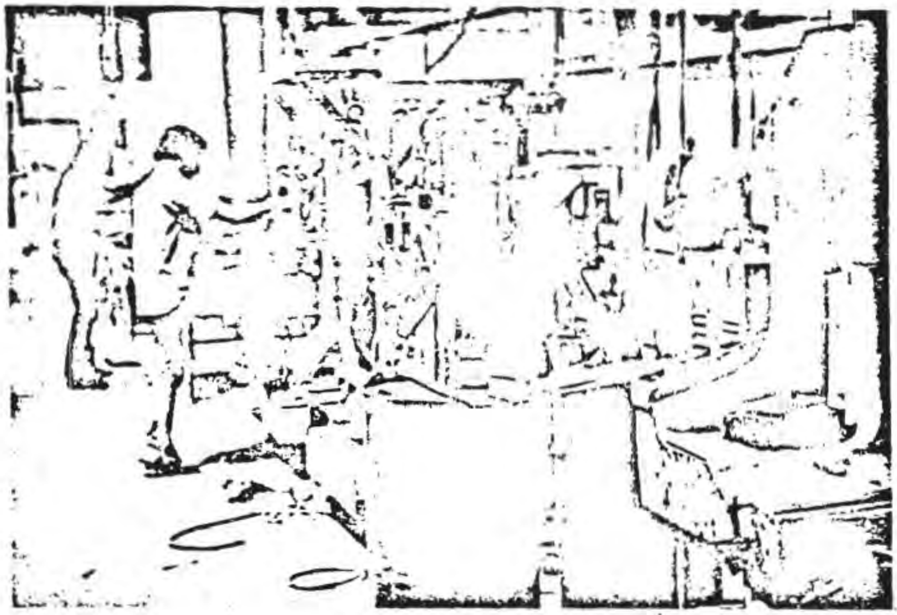


Photo. 5. Buck Assembly Operation in **Plant** No. 3. Note the yellow methylene **chloride** border on the hood in the **foreground**.

Photo. 6. Worker in Binks 2 Spray **Paint** Booth. This worker is observed **to be** spraying in the direction of **the** open entrance way and thus contrib**uting** to excessive overspray in this already malfunctioning booth.

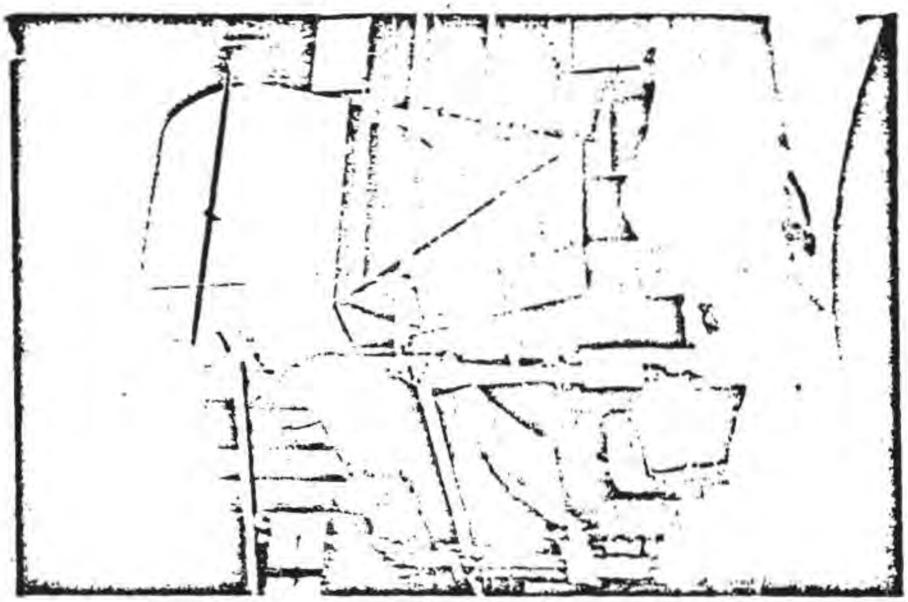


Photo. 9. This is the exhaust system surrounding Preform No. 9 (see text for details).

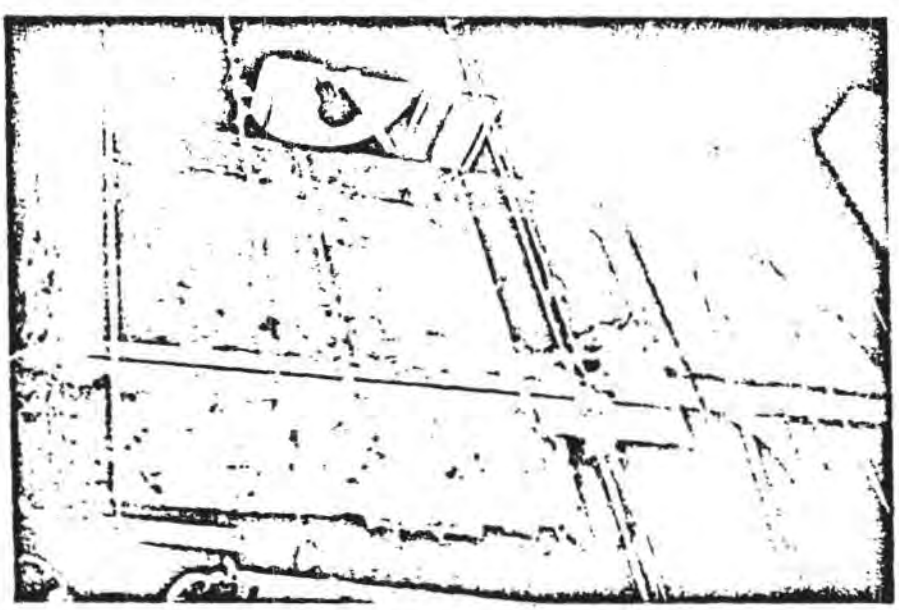


Photo. 10. Close-up projection of Preform No. 9 exhaust system. Note the axial fan in the roof which is intended to draw air from the large screened enclosure below (see text for details).

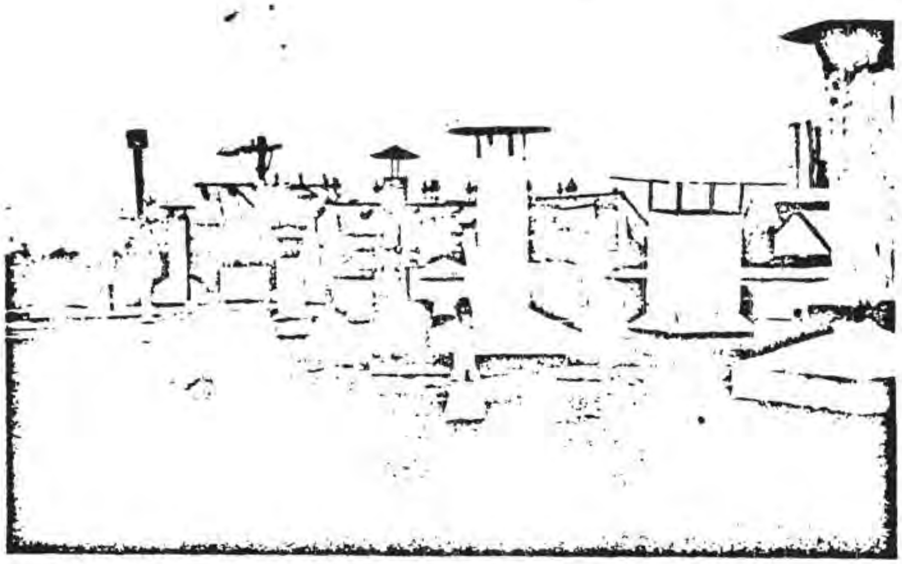


Photo. 11. Rooftop exhaust and intake structures on Building No. 3. Note the proximity of the structures.

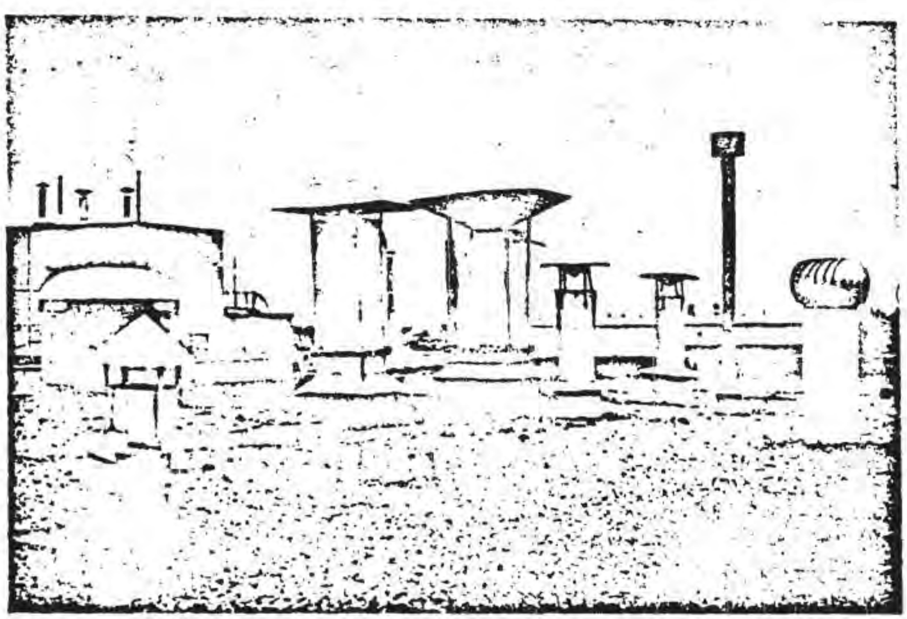


Photo. 12. Rooftop exhaust and intake structures on Building No. 1. Note the proximity of these structures. The central stack with deflector up is an exhaust flue and to its left is an intake duct with deflector down.

Photo. 13. These are modified exhaust stacks and intake ducts.

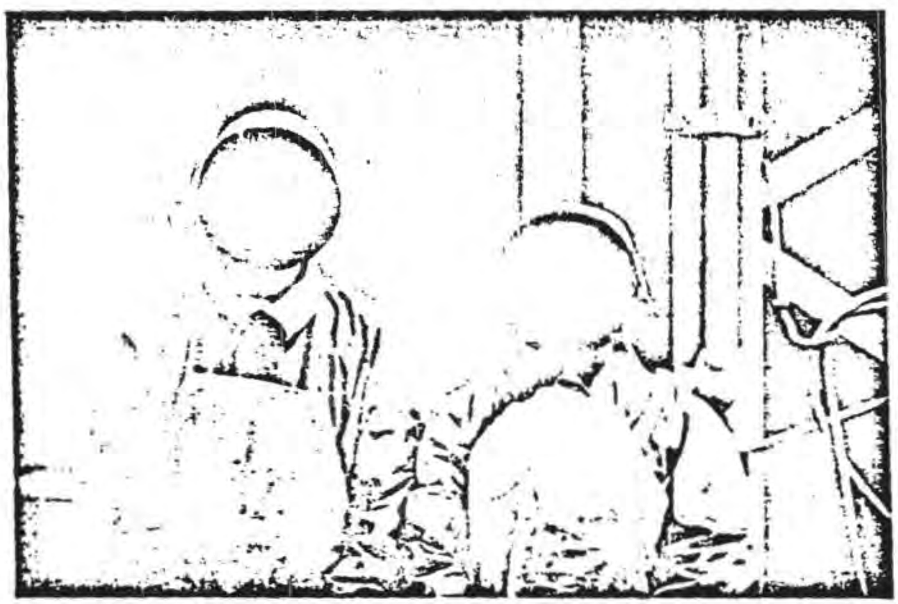


Photo. 14. Workers in the Mack Sanding Line. Facial skin off worker on right is markedly dust laden.

VIII. APPENDIX

A. Questionnaire

U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
518 POST OFFICE BUILDING
CINCINNATI, OHIO 45202

"REINFORCED PLASTIC" WORKERS STUDY
MEDICAL QUESTIONNAIRE

CONSENT

I hereby voluntarily agree to participate in a study of "reinforced plastic" workers to exposure to an unknown toxic substance. I agree to answer questions about my health which have a bearing in this study.

I agree to participate in necessary tests (to be described fully if deemed necessary) to determine whether I have had a significant exposure to this unknown substance. I am aware that medical information will be used for statistical purposes only unless I authorize otherwise. I am also aware that I may withdraw from the study at any time.

DATE SIGNATURE

AUTHORIZATION FOR RELEASE OF MEDICAL INFORMATION

I hereby request that the Public Health Service inform my personal physician

Dr.

Street City

and the company physician of

Company Name: City

of any significant medical findings from this study.

DATE SIGNATURE

Note: Strike out the words "and the company physician Company Name: ______ City _____", if the worker prefers that the significant medical findings from this study be sent only to his personal physician.

Information obtained in this study will be kept confidential in accordance with U.S. Public Health Service Regulation (42 DFR Part 1).

"REINFORCED PLASTIC" WORKERS STUDY
MEDICAL QUESTIONNAIRE

EMPLOYEE STUDY NUMBER:

NAME
Last First Middle

Social Security Number: / /

- - - - - - Month Day Year

USE THE ACTUAL WORDING OF EACH QUESTION. CIRCLE THE APPROPRIATE ANSWER AFTER EACH QUESTION. WHEN IN DOUBT RECORD "NO."

1. What is the nature of your work (i.e. heavy assembler, light painter, etc.)

2. Years in reinforced plastics _______

3. Years in present job _______

4. Please indicate all of the following which refer to working conditions:

Fumes & vapors	Wet and Damp
Dust	Noisy
Heat	Some other working condition not listed above
Cold	

5. Please indicate if your job has ever caused any of the following complaints and how often this occurs:

Headaches	Frequently	Occasionally	Rarely	Never
Double Vision	Frequently	Occasionally	Rarely	Never
Burning of Eyes	Frequently	Occasionally	Rarely	Never
Coughing	Frequently	Occasionally	Rarely	Never
Shortness of breath	Frequently	Occasionally	Rarely	Never
Nausea	Frequently	Occasionally	Rarely	Never
Vomiting	Frequently	Occasionally	Rarely	Never
Weakness	Frequently	Occasionally	Rarely	Never
Dizziness	Frequently	Occasionally	Rarely	Never
Fainting	Frequently	Occasionally	Rarely	Never
Skin Rashes	Frequently	Occasionally	Rarely	Never

6. If any (or all) of the above are present, is there a particular time of the day you are affected?

Morning Afternoon Night

Sporadically Continuously

7. Have you ever been hospitalized for any of the above complaints?

Yes No

Describe and give dates:

8. Do you feel better at the beginning or at the end of the work day?

Beginning End

9. Do you wear any of the following protective equipment?

Helmet
Goggles
Face Mask
Respirator Type ________
Gloves
Uniforms
Safety Shoes
Other ________

10. Are you seeing a physician regularly for any reason?

Yes No

Describe:

11. Have you ever been hospitalized for an illness or operation other than childbirth?

Yes No
If yes, please list below?

Year Reason

12. Have you been taking any medicines regularly during the last six months?

Yes No

If yes, describe each:

Started Stopped Name Purpose

13. Have you ever been rejected from a job because of your health?

Yes No

14. Have you ever worked where you were exposed to chemicals, dust particles, gases, fumes, loud noises, X-ray, poisons, sprays, lassers or other surroundings which might have affected your health?

Yes No

15. Have you ever been absent from work because of sickness?

Yes No

16. Have you had any of the following examinations in the last two years?

(Check All Appropriate Answers)

A complete physical examination

Blood pressure check

Chest X-ray

Blood tests

Pulmonary Function Tests - (Spirometry)

17. Do you often get skin infections or rashes?

Yes No

18. Do you have any allergy to soap, detergents, cosmetics, food, etc.

Yes No

B. CHRONOLOGICAL LISTING OF ALL AGENCIES THAT HAVE CONDUCTED INVESTIGATIONS REGARDING NAR "GASING" INCIDENTS*

Date	Name	Inspection	Results
11/23/71	Mr. Ken Clark Compliance Officer OSHA Cleveland, Ohio	Inspection & investigation	Suspected fumes from sewer in Mack area
12/7/71	Mr. S. Seferian Occupational Health Eng. Ohio Dept. Health	Tested for hydrocarbons	Insignificant concentrations were found
3/2/72	Mr. C. B. Myers P.E. Mr. D. Bergman Environment Control Corp. Painesville, Ohio	Conducted a gas & vapor sampling program on #4 reactor at N.A.R.'s request to determine whether incinerators or scrubbers should be considered	Gases emitted from the cyclone were found to contain hydro-carbons
5/22/72	Mr. Ken Clark Compliance Officer OSHA Cleveland, Ohio	Inspection & investigation	Nothing found to determine causes
5/22/72	Mr. C. B. Myers P.E. Investigator Environment Control Corp. Painesville, Ohio	Walk around inspection	Written report not received. It was their opinion it may have been due to faulty vents or inadequate removal of oven gases
	Report written 5/23/72 refers to the above visit and contains the following statement by Mr. Myers: "At no time did I experience any of the symptoms reported in plant #3." This statement refers to the incident 5/22/72 in plant #3.		
5/22/72	Mr. C. Hildebrecht Mr. C. B. Myers P.E. Painesville, Ohio	Walk around inspection	Their written report stated "It is the professional opinion of the investigators that the incident was brought about by faulty ventilation or inadequate removal of the oven gases. This was aggravated by winds and a temperature inversion producing back drafts in the ventilation systems of the ovens."

* This information was supplied to NIOSH by officials of the NAR Corporation.

B. (CONT'D.)

Date	Name	Inspection	Results
5/22/72	Mr. Lafferty Weather Bureau Cleveland, Ohio	No plant inspection	Confirmed by phone the weather inversion condition, temperatures, wind velocities and wind direction
5/22/72	Mr. C. Barrett East Ohio Gas Co.	Tested for leaking natural gas and carbon monoxide	No significant findings were reported
5/22/72	Mr. Harry Scott East Ohio Gas Co.	Tested for malfunction of oven burners	All O.K.
5/22/72	Mr. D. R. Sage Sanitarian Board of Health Ashtabula, Ohio	Walked around	No results published
5/22/72	Dr. S. A. Burroughs Ashtabula, Ohio	Patient examination X-rays, blood tests, urinalysis	Nothing significant
5/23/72	Mr. Howard Scott District Engineer Air Pollution Control Ohio Dept. Health	Walked around	His opinion was that the trouble came from the weather inversion and the discharge from the stacks of the chemical factories north east of the city of Ashtabula
5/23/72	Mr. J. R. Bowen Industrial Commission Div. Safety & Hygiene Ohio	Walked around	No results published
5/23/72	Mr. W. Fedyk Compliance Officer OSHA Cleveland, Ohio	Walk around & assisted in investigation	No significant findings

B. (CONT'D)

Date	Name	Inspection	Results
5/23/72	Mr. E. Largent Industrial Hygienist OSHA Chicago, Illinois	Tested for carbon monoxide	Nothing significant
5/23/72	Dr. Harold Allen M.D. Ohio State Dept. Health Chief of Medical Unit	Walk around, patient interviews, medical consultations	No results
6/1-2/72	J. Barton P. Carlton G. D. Clayton & Assoc. Detroit	Fundamental industrial hygiene survey of the facility	No potential health hazards were found among the chemicals used frequently in the plant, same dust & ventilation problems were uncovered
6/8/72	Ching-tsen Bien G. B. Clayton & Assoc. Detroit	Noise level survey	Over exposure of air powered hand sanders and grinders and assembly rivetting.
6/22/72	R. Knarr W. Fedyk OSHA Officials Cleveland	Tested for hydrocarbons	Insignificant quantities were found
6/23/72	H. Scott J. Yee R. Wright Air Pollution Control Ohio Dept. Health	Tested for hydrocarbons	No measurable contaminant was fo
6/28/72	Mr. Howard Scott Mr. F. Long Mr. R. Wright	Hydrocarbon testing parking lot & North Morrison roof	No published results
8/22/72 to 9/22/72	Mr. Howard Scott Dist. Engineer Air Pollution Control [illegible]	A mobile hydrocarbon sampling unit was parked on W. 47th St. opposite Inland Container for a month	No published results yet

B.(CONT'D.)

Date	Name	Inspection	Results
9/25/72	Dr. S. Cohen Dr. Polocoff NIOSH M.D.'s Cincinnati, Ohio	Handed out questionnaires interviewed employees	No published reports yet
9/27/72	Dr. S. Cohen Dr. Polocoff Dr. K. Rupnick NIOSH M.D.'s	Did a records review of Ashtabula hospital, - interviewed hospital cases - held discussions with Dr. Burroughs & employees' family doctors	No published reports yet
9/27-28/72	Dr. S. Cohen M.D. NIOSH Cincinnati, Ohio	Further inspection of hospital records, employee interviews, and discussions with Ashtabula doctors.	No published reports yet

From 5/22/72 to 9/28/72 in a continuing progrm to find the cause of the incidents, 104 bottled samples of plant air have been taken and sent for analysis to Envirolab Inc., Painesville, Ohio. 75 analyses have been reported and with the exception of 2 isolated samples taken near presses #42 and #46 which showed styrene at concentrations of about 1200 ppm and 600 ppm respectively, all results have fallen within acceptable government safe human levels.

C. Recommended Guidelines For An Occupational Health Program*

Objective: To provide medical, administrative and engineering controls for the workers, with emphasis on those members of the labor force at risk with regards to the potentially toxic substances used in the fiberglass-plastic industry.

General Considerations:

The medical facilities (1) Should be located in a quiet area readily accessible to employees and to transportation; (2) Should be sufficiently spacious, well lighted, ventilated and heated; (3) Should include waiting, consultation, examining and treatment rooms, and toilet facilities, to insure adequate privacy and comfort; (4) Should have appropriate medical laboratory and other equipment; and (5) May include a rest or recovery room, dressing rooms and facilities for laboratory and radiological examinations.

The medical equipment (1) Should be supplied and maintained by the employer; (2) Should be adequate for the needs of the work force; (3) Should be of good quality and currently acceptable with regards to present day standards.

The medical staff (1) Should consist of an occupational health nurse (OHN) for each of the first and second shift operations; (2) Should maintain fully trained first aid personel (as set forth in the OSHA guidelines) for third shift operations; (3) Should provide an occupational health medical doctor (OHMD) on a part-time basis for a minimum of 3-4 hours daily, or 4 hours every other day. The OHMD should be on call 24 hours a day and is recommended to make frequent plant visits to observe the health stresses of the workers.

The Medical Program:

I. The Medical Examination - Pre-Employment: All employees in fiberglass-plastic operations should receive a pre-employment medical examination.

The following minimum examination is suggested: history, age, height, and general appearance; skin, eyes, ears, nose, teeth and mouth, chest (lungs and heart), lymph nodes, peripheral blood vessels, abdomen including hernia, anus, genitalia, and spine and extremities; blood pressure, pulse and temperature; a standard chest x-ray (14 x 17 inches, PA projection); urinalysis; visual and hearing acuity. Personality, temperament, and significant nervous or mental manifestations should be noted. Pulmonary function tests may also be included. Other specific biological studies may be employed to screen workers for potential or incipient exposures to toxic substances.

II. The Medical Examination - Periodic and Special: A periodic medical examination should be required. This may be similar to the pre-employment examination but should definitely emphasize those organ systems which are considered at risk (due to known toxic reactions). This type of examination should be performed on an annual basis. Special medical examinations may be performed upon retirement, resignation or termination of employment.

III. Health and Safety Education - It is recommended that (1) The OHN design a health education program. This program should be offered on a continuous basis throughout the year. Group instruction using lectures, pamphlets, films, etc. should provide the emphasis on personal hygiene, safe work habits, wearing and proper usage of personal protective devices; (2) A safety committee should be organized and hold meetings on a regular basis. This committee should be composed of an equal number of representatives from management and labor and provide a forum for the discussion of suspected hazards in the facility; (3) It is suggested that these committees establish a liason with community health agencies (eg. Tuberculosis, Cancer, Heart, etc.).

IV. Records - Preservation and Use - A system of recording medical information should be designed to meet the needs of the facility and all records should be kept in the Medical Department. Suitable filing equipment should be provided for the safekeeping and maintenance of these records. All medical records should be preserved for a period in accordance with Local or State regulations but where these do not exist, records should be kept for a period not less than 10 years following termination of employment. Furthermore, It is recommended that (1) All significant findings should be discussed with the worker using professional discretion. Good judgement should be used to prevent the raising of unnecessary fears, while emphasizing the importance of obtaining adequate personal medical care; (2) A transcript or pertinent data may be supplied to another physician or to health agencies, or as required for insurance purposes on request or consent of the employee; (3) The employer should be given a classification of fitness to facilitate placement. A form may be devised for this purpose; (4) The employer should be notified of potentially harmful work environments as detected through examination; (5) Authorized representatives of the Secretary of Labor and the Secretary of Health, Education and Welfare of the Government should be supplied with information on official order or when required by law. In all other respects the confidential character of health examinations records should be rigidly observed and access should be granted only on written consent of the worker, preferably after preliminary discussion with the examining physician.

V. Immunization - An employer may properly make immunization procedures available to his employees under the principles set forth in the "Guide for Industrial Immunization Programs"(JAMA, 171,2097 [1959]). The employer should provide a program of skin testing employees for tuberculosis and offer all employees immunization against tetanus and diphtheria.

VI. Diagnosis and Treatment - The following guidelines are recommended: (1) The diagnosis and treatment of occupational injury and disease cases should be prompt and should be directed toward rehabilitation;(2) Standard orders prepared and signed by the OHMD should be on file in the Medical Department with respect to the treatment and disposition of emergency problems. These orders should be updated on a regular basis; (3) The diagnosis and treatment in non-occupational injury and illness cases are not responsibilities of an occupational health program with certain exceptions, such as emergencies in which the employee may be subject to loss of life or limb or to relieve suffering until placed under the care of his personal physician. Also, The following minimum examination is suggested: history, age, height, and general appearance; skin, eyes, ears, nose, teeth and mouth, chest (lungs and heart), lymph nodes, peripheral blood vessels, abdomen including hernia, anus, genitalia, and spine and extremities; blood pressure, pulse and temperature; a standard chest x-ray (14 x 17 inches, PA projection); urinalysis; visual and hearing acuity. Personality, temperament, and significant nervous or mental manifestations should be noted. Pulmonary function tests may also be included. Other specific biological studies may be employed to screen workers for potential or incipient exposures to toxic substances.

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VII. Transportation - An adequate vehicle should be provided by the employer for the transport of ill workers for the purpose of a medical disposition. Trained personel should accompany ill workers to their point of destination if this disposition has been so ordered by the Medical Department.

VIII. Counseling Service - It is suggested that the OHN be available to the workers for consultation and advice to workers regarding emotional problems, alcoholism, drug abuse, weight reduction and other similar areas which may effect the health and consequent occupational efficiency of the worker.

Portions of this program were taken from American Medical Association (AMA) publications entitled "Guiding Principles of Medical Examinations in Industry" and "Scope, Objectives and Functions of Occupational Health Programs". This program, however, does not necessarily reflect AMA philosophy.

*This program was prepared in collaboration with Mrs. Jane Lee, OHN, NIOSH