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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-28-212

WESTINGHOUSE AIR BRAKE COMPANY
WILMERDING, PENNSYLVANIA
JULY 1975

I. TOXICITY DETERMINATION

The West Product Shop of the Westinghouse Air Brake Company, Wilmerding, Pennsylvania was the subject of a combined environmental-medical evaluation during the period of August 13-15, 1974. Following a walk-through survey by the investigators, certain operations were selected on the basis of the utilization of agents with known, well defined toxic potentials for environmental and work practices evaluations. The methods used for evaluating worker exposure were environmental sampling, medical histories, and cutaneous examination of workers. Environmental sampling results for airborne levels of organic solvents (including perchloroethylene, toluene, xylene, trichloroethylene, and mineral spirits) in the degreasing, cadmium plating, spray printing, and Rustban® application areas were found to be less than half of the individual and combined Federal Standards for exposed workers in these areas. No symptoms suggesting excessive exposure to organic solvents were elicited from any employee. Environmental monitoring for airborne levels of cadmium, chromium, cyanides, and nitric acid were 10% or less of the applicable Federal Standards in the Alodine plating, Cadmium plating, and Teflon® painting areas. Based on the lack of significant medical findings and on the measurement of low levels of atmospheric exposure to organic solvents, cadmium, chromium, cyanides, and nitric acid, these substances were judged to not present a health hazard to the exposed workers, under the conditions prevailing at the time of the evaluation.

From the data collected during the medical evaluation it can be additionally concluded that a moderate number of workers (12%) examined had definite, although generally mild, cases of dermatitis. Most of the cases were due to primary irritation to various chemicals, primarily lubricants. With the exception of Union A.T.F. Dexron Fluid which was apparently associated with several cases in a delimited plant area, no other causal specific lubrication products were readily identifiable. However, a typical chrome sore was noted on the leg of one worker. Recommendations for improved work practices, protective measures, and medical monitoring of certain employees have been made in the body of the report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Westinghouse Air Brake Company, Wilmerding, Pennsylvania
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region III
d) NIOSH - Region III

For the purposes of informing the approximately 400 "affected employees" the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. 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 of employees to various substances in the West Product Shop, Westinghouse Air Brake Company, Wilmerding, Pennsylvania. The request also alleged that approximately 50 employees in the shop suffer from skin rashes in varying intensity.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

Essentially, all activities within the West Product Shop are concerned with the ultimate production of railroad air brake and emergency braking systems. For largely administrative purposes this large shop is divided into four departments, i.e., 63, 22, 43 and 62. Multiple operations are carried out in each department and rarely are more than four or five men per shift engaged in a particular operation. Frequently, only a single individual carries out a particular manufacturing step. Some typical operations by department are: area 63: degreasing, anodizing aluminum castings, machine threading, epoxy sealing and dry milling; area 22: machining of castings, cadmium plating, rubber hose assembly, hose assembly and testing and painting; area 43: degreasing, pickling, punch pressing, welding, shearing, rolling, air reservoir assembly and testing and area 62: beam machining and painting. All these various operations are carried out in relatively close proximity to similar or differing operations within a single, large, unpartitioned facility. The only major exception to this description is a sealed clean room utilized for the assembly and testing of very small brake components, the area being known as the green room. As previously mentioned a very large number of different lubricants and other chemicals are utilized. From a medical and environmental standpoint, the evaluation of every operation agent, or even separate

evaluations of each department were deemed clearly unnecessary and impractical. However, following a walk-through survey, certain operations were selected for environmental and work practices evaluations on the basis of the utilization of agents with known, well defined toxic potentials, such as the epoxy, painting and plating areas.

B. Evaluation Design

Based upon the observations of the investigators during the walk-through survey, areas selected for detailed evaluation by industrial hygiene sampling were:

Area 63 - Alodine plating - The operation consists of a detergent wash bath, two rinses in water, a dip in a nitric acid-chromate bath, and finally two water rinses. The two operators working in this area were selected for evaluation of their exposure to airborne chromium. An area sample was obtained to estimate exposure to airborne nitric acid and cyanides.

Area 62 - Painting - Two paint operations involving organic solvents were observed in the plant: spray application of a gray primer to brake assemblies and a dip application of a final black coat to the brake beams. Each of the painters could be exposed to solvents contained in the paints which were composed of mineral spirits, toluene, xylene, and diacetone alcohol. Exposure of these two painters was evaluated with personal samples.

Area 22 - Teflon® - A Teflon® coating containing a chromium based pigment was applied to ball valves by spraying. The painter's exposure to chromium was evaluated with a personal sample.

Rustban Application - Small parts are dipped into each of three tanks containing mineral spirits, liquid wax, and a rust inhibitor to prevent deterioration due to rusting. One operator's mineral spirits exposure was evaluated with a personal sample.

Cadmium plating - This operation could expose the operator to cadmium, chromium, nitric acid, and cyanides from the chemicals used in the plating dip tanks. A degreasing tank located just prior to the plating operation may expose this operator to perchloroethylene vapors. Personal samples were collected to evaluate the worker's exposure to cadmium, chromium, and perchloroethylene. Area samples were used to estimate worker exposure to cyanides and nitric acid.

C. Evaluation Methods

1. Environmental

Employee exposures to organic substances were measured using personal air sampling equipment. Vapor concentrations were determined by adsorbing the organic vapors onto charcoal air sampling tubes and analyzing the tubes by the gas chromatographic method of White et al.[1]

Employee exposures to metals were also determined with personal samples. Substances were collected on cellulose membrane filters contained in a closed-face cassette using a flowrate of 1.5 liters per minute. Metals were analyzed using an atomic absorption spectrometry method.[2]

Area samples were collected using midget impingers containing 15 milliliters of 0.1N sodium hydroxide. These samples were analyzed for cyanides[3] and nitric acid.[4]

2. Medical

In view of the large employee population and very diverse nature of the manufacturing processes carried out in the West Product Shop, it was felt that interviewing only persons known to be experiencing dermatitis problems would bias our impressions and the survey result. Therefore, it was decided to interview and perform limited cutaneous examinations on a random basis among as many workers as was practical within the study period time constraints.

D. Evaluation Criteria

1. Brief Discussion of Known Pathologic Effects of Suspected Agents

a. Metalworking lubricants, coolants, and greases.

Approximately forty percent of industrial dermatitis is attributable to cutting oils and other petroleum products. In addition to mineral and other oils, these products contain an almost innumerable variety of ingredients including soaps, emulsifiers, detergents, waxes, resins, water conditioners, corrosion inhibitors, deodorants, anti-foaming agents, dyes and biocides to retard spoilage and rancidity. The oil components are often sulfurized, chlorinated or phosphorized to provide special characteristics such as pressure resistance.

Two major types of dermatitis result from exposure to these products, i.e., primary irritant contact dermatitis and oil folliculitis (oil acne). Chloracne was once a major problem since chlorinated biphenols or naphthalenes were once common pressure resistant additives. Such additives are now rare. Oil folliculitis is seen commonly in machinists who utilize insoluble oils and results from a direct mechanical blockage of the hair canal. This results in blackhead formation, papule formation, and eventually cystic lesions. These may be few or extensive in number. Usually the exposed hairy skin surfaces are involved, i.e., backs of the fingers, hands and forearms. When clothing is contaminated, the thighs and abdomen are frequent sites. Workmen commonly, but mistakenly, believe that bacteria in the fluid are responsible. While cutting oils may contain large numbers of bacteria, these are nearly always of species incapable of causing infection. Persons with facial acne are frequently aggravated by exposure to insoluble oils.

Primary irritant contact dermatitis is now more common than oil folliculitis since recent years have seen more and more use of soluble cutting oils which are oil in water emulsions. These fluids are often

quite alkaline and lead to defatting of the skin with dryness, redness scaling and cracking. In addition to the alkaline nature of most such coolants they often contain many additives which may contribute to the irritation. The hands are the usual site of involvement. It should be noted that many straight or insoluble oils may have similar additives and also cause primary irritation.

Allergic contact dermatitis is rare from lubricants, although known sensitizers are encountered occasionally in these products. Such cases are usually of a severity which precludes continuation on that particular job.

The control of this form of dermatitis requires a dedicated effort by both employees and management. It is frequently associated with poor work practices and inadequate hygiene. Sporadic cases become almost inevitable if sufficient skin contact occurs. The following measures will minimize the problem: (1) As much protective clothing as is consistent with job safety should be worn. (2) When gloves cannot be worn some protection is conveyed by the frequent and proper application of barrier creams. (3) Proper removal of oils is very important and waterless hand cleansers are particularly valuable in this regard. (4) Workers must be urged to report early signs of dermatitis. This allows prompt medical attention and a review of work habits often permitting rapid healing with little lost time. Once the chronic stage of irritant dermatitis is reached transfer is frequently the only solution.

b. Epoxy Resins

Repeated skin contact with most liquid industrial grade epoxy resins frequently results in allergic contact dermatitis. Before utilization of these resins they must be mixed with a hardener or catalyst, usually an organic amine. These compounds may also cause allergic or irritant dermatitis although in practice it is usually the epoxy moiety which is responsible in most cases. Patch testing properly carried out by an interested physician is required to absolutely establish the diagnosis. Automatic mixers and dispensers help control the problem and protective gloves and clothing are absolute essentials. Sensitized persons can usually continue to work with epoxies if they strictly adhere to all control measures and if accidential skin contamination is removed immediately with liberal amounts of soap and water.

c. Perchloroethylene is a commonly employed industrial solvent. Major usage is in dry cleaning and degreasing. In high concentrations it causes lightheadedness, dizziness, and loss of consciousness (anesthetic effects). It also may cause irritation of the eyes, nose and throat. Chronic excessive overexposures may result in liver disease. It is believed that airborne concentrations maintained below 100 ppm will prevent serious narcotic effects or liver involvement.

d. Cadmium

This metal is commonly used in industrial plating. Cadmium compounds are generally regarded as being quite toxic. Most serious industrial cases of cadmium poisoning have arisen where metals containing cadmium have been heated. The early symptoms of acute intoxication include coughing, constrictive sensations in the chest, shivering, headache, nausea and vomiting. A few days later pneumonia occurs with chest pain, shortness of breath and prostration. In nonfatal cases recovery usually occurs within two weeks. Chronic poisoning results in emphysema and/or renal injury characterized by the presence of a unique protein in the urine. The emphysema commonly does not develop until 10 or more years of exposure have occurred. Unfortunately, this form of emphysema tends to become progressive even when no further exposure occurs.

e. Xylene

Xylene is a commonly employed fuel and solvent for some gum, resin, rubber, oil and paint systems. Very large amounts are used industrially. Since Xylene defats the skin, dermatitis commonly results from frequent skin contact. Drowsiness, giddiness, excessive fatigue, headache, sensation of "drunkenness," and other narcotic effects have been noted in cases of excessive exposure. Nausea and vomiting may accompany these symptoms. Cases of bone marrow depression and anemia once attributed to xylene are now thought to have been due to benzene contamination. Such contamination now occurs rarely due to improved refining methods.

f. Chromium

Hexavalent chromium salts and chromic acid produce characteristic injuries in the form of skin ulcers (chrome holes or sores) and ulceration with subsequent perforation of the nasal septum. Ulcers may also occur within the mouth. Dermatitis is also not uncommon. Workers handling chromate ore as in the refining of the basic metal have long been known to have an increased incidence of lung cancer. However, this effect has not been found among chrome platers.

g. Trichloroethylene

Trichloroethylene is commonly used in industry as a solvent particularly in degreasing metal parts. It has narcotic effects in high concentrations and was fairly widely used as a surgical anesthetic in the past. Today this application has largely disappeared except in obstetrics where it is still occasionally utilized. Chronic exposure has been reported to cause abnormal fatigue, increased need for sleep, irritability, headache, and decreased tolerance to alcohol. Ventricular fibrillation resulting in death has been related to trichloroethylene exposure in several reports. Adverse kidney and liver effects were noted in the older literature but are thought to be due to other chlorinated hydrocarbons present as contaminants. It is felt that the present standard of 100 p.p.m. is adequate to protect workers against adverse effects.

h. Mineral Spirits

Mineral spirits are a mixture of paraffin hydrocarbons consisting primarily of heptane, octane, and nonane with a boiling point range of 150-210°C. Because these hydrocarbons have relatively low vapor pressures, inhalation toxicity is unlikely under ordinary conditions of use. Vertigo, hilarity, and incoordination have been reported from very high level exposures to heptane (5000 p.p.m.).

2. Environmental Criteria

A number of sources recommend airborne levels of substances below which toxic effects would not be expected to occur in most workers. Such airborne levels are referred to as standards or threshold limit values, although such recommendations consider only the effect of the individual substances. Simultaneous exposure to two or more substances could result in additive or synergistic effects. Several such sources were consulted during the conduct of this study including the Federal Standards, American Conference of Governmental Industrial Hygienists threshold limit values, and NIOSH Criteria Documents.

The range of the environmental recommendations for time-weighted average concentrations of the substances evaluated in this investigation are:

Substance	Range (mg/M^3)
Mineral Spirits	575[3] - 2950[2]
Perchloroethylene	670[2,3]
Toluene	375[1,3] - 750[2]
Trichloroethylene	535[1,2,3]
Xylene	435[2,3]
Cadmium (fume)	.05 Ceiling[3] - 0.1[2]
Chromic Acid	.05[1] - 0.1[2,3]
Cyanide	5[2,3]
Nitric Acid	5[2,3]

1. Environmental standard as contained in the NIOSH Criteria Document for this substance.

2. Federal Standard contained in CFR29, 1910.93, dated June 27, 1974.

3. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1974, ACGIH, Cincinnati, Ohio.

A Federal Standard or Threshold Limit value does not exist at the present time for mineral spirits. However, the boiling range and toxicological properties of mineral spirits are very similar to that of Stoddards Solvent. For these reasons the threshold limit value and Federal Standard for Stoddards Solvent are shown above for mineral spirits.

The following dermatologic conditions were observed:

Condition	Number Affected
Eczematous Hand Dermatitis	7
Oil Folliculitis	2
Fungal Infection	2
Vitiligo, hands	1
Chrome Sore	1

Of these, six out of the seven cases of hand dermatitis were quite mild with only one judged as being moderately severe. Of these cases, one appeared related to epoxy exposure and the remainder with contact to various lubricants, greases, and cutting fluids. Two of these cases were observed in green room workers who suspected two products known as Cosmolube 615 and A.T.F. Dexron Fluid (Union Oil Co.) as causal agents. Several other workers in this area also gave histories of recent dermatitis. Cosmolube contains dimethyl silicone, lithium hydroxystearate, ethyl hexyl sebacate, and a very small amount of antioxident. Patch testing of this product utilizing two NIOSH volunteers failed to demonstrate any potential for causing skin irritancy. The Safety Data Sheet for Dexron Fluid cautions that dermatitis may occur after extended exposure. Patch testing was not carried out since the investigators were unable to learn the composition. Both cases of oil folliculitis were mild. The single case of vitiligo predated employment in the West Product Shop. The chrome sore was an extensive lesion on the ankle of a plater. In addition, this workman was noted to have markedly injected nasal mucosa. The fungal cases were not considered as occupational in origin. In addition, eight individuals related histories of past episodes of hand dermatitis and one person described a past history compatible with oil folliculitis. In several instances the dermatitis was associated with epoxies and had cleared once transfer to other work assignments had been accomplished. It is entirely possible that the relatively small number of cases actually observed may have been due to the fact that the survey was conducted the week following the annual plant vacation period of two weeks. Several employees stated that they had healed during that interval.

As anticipated from the nondirected approach utilized, a large number of other complaints and symptoms of medical conditions were elicited. Eleven men specifically complained of hearing loss. While several work areas warrant noise monitoring to assure safe levels of exposure, our impression was that most of these men had formerly worked in high noise level areas (foundry operations) before transferring to this Shop. In addition, the median age of the employee is relatively high (54) and in many of these men the decline in auditory acuity may have been at least partially due to aging.

Ten men specifically mentioned that they felt the general ventilation was bad. Most related this to relatively high ambient temperatures experienced during the warm months. However, seven men related symptoms of irritation. Such irritation was stated to be sporadic in occurrence, ranging from several times weekly to monthly or less. Other complaints, symptoms, or medical conditions were distinctly rarer and included: hypertension, 2; past myocardial infarction, 3; occasional nausea, 2; headaches, 1; asthma, 1; and diabetes, 1. None of these latter conditions were felt to be in anyway excessive for a group of this composition. No symptoms suggesting excessive exposure to organic solvents were elicited from any employee.

One individual was observed (cadmium plating area) who gave a history of nausea and vomiting combined with a recent 16 pound weight loss. It is recommended that management institute a program of medical and biologic monitoring for persons at that particular job station.

3. Summary and Conclusions

Eighty-six workers were randomly selected for interview and cutaneous examination. Of these, ten were found to have various types of occupational dermatitis. In most instances this was mild and several workers were under physicians' care or using medications to control the problem. Since the plant had recently been closed for vacation, the true incidence under more normal prolonged working conditions would likely be somewhat higher. Several instances of non-occupational dermatitis were also encountered.

Since this facility is basically a machine and assembly shop, most of the observed cases correlated with exposures to lubricants, coolants and greases. Epoxies are also utilized and apparently caused significant past cutaneous morbidity. At present excellent work practices are utilized in the handling of these resins. Dermatitis from lubricants is notoriously difficult to completely eliminate in machinists, particularly where safety considerations prevent the use of gloves. Most such workers recognize the etiologic aspects of their dermatitis and mild cases are often regarded as a "badge of the trade." Management is often unaware of the extent of the problem and frequently only a minority of those affected have reported to the dispensary or sought to bring the matter to attention. In this regard, examination of OSHA Form 102 revealed only 13 cases of occupational dermatitis for the entire plant population of 2500 during the year 1973.

From the data collected it can be concluded that a moderate number of workers (12%) examined had definite, although generally mild, cases of dermatitis. Most of the cases are due to primary irritation to various chemicals, primarily lubricants. With the exception of Union A.T.F. Dexron Fluid which was apparently associated with several cases in a delimited plant area, no other causal specific lubrication products were readily identifiable. However, a typical chrome sore was noted on the leg of one worker. Medical and biologic monitoring for workmen doing cadmium plating was also judged advisable.

4. Recommendations:

a. That a feasibility study be carried out to see if Union A.T.F. Dexron Fluid could be successfully applied by means other than a spray mist. Application with a small brush or other applicator should eliminate much of the skin contact now occurring.

b. Waterless hand cleansers should be used exclusively in cleansing skin contaminated with lubricant products.

c. Where the use of gloves is not consistent with safety barrier creams such as Ply 5 (Milburn Company) or West #411 (West Chemical Products, Inc.) should be provided and their use strongly encouraged.

d. Personnel engaged in chrome plating should be urged to lightly coat the inner surfaces of the nostrils with petroleum jelly (Vasoline®) to protect against nasal irritation and/or perforation.

e. Cadmium platers should receive an annual physical examination and pulmonary function testing. Tests for anemia and to detect proteinuria should also be performed on a routine basis, preferably at six month intervals.

V. REFERENCES

1. White, W.D., Taylor, D.B., Mauer, P.A., and R.E. Kupel, A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere. Am. Ind. Hyg. Assoc. J., Vol. 31, March-April, 1970.

2. General Procedure for Metals, P&CAM173, PCAB, NIOSH, PHS, DHEW, January 15, 1974.

3. Cyanide in Air, P&CAM116, PCAB, NIOSH, PHS, DHEW, December 1, 1973.

4. Method 133B, Standard Methods for Examination of Water and Wastewater, American Public Health Assoc., Washington, D.C., 1971.

VI. AUTHORSHIP AND ACKNOWLEDGMENT

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TABLE I - PERSONAL AIR SAMPLING RESULTS FOR AIRBORNE LEVELS OF ORGANIC SOLVENTS - TIME-WEIGHTED AVERAGES

August 14, 1974

Job	Length of Sample (min)	Air Concentration (mg/M^3)					
		Perchloroethylene	Toluene	Trichloroethylene	Xylene	Mineral Spirits	Equivalent Exposure*
Degreaser Operator	334	110	<30	80	<30	n.d.	<0.42
Cadmium Plater Operator	274	110	<10	n.d.	<10	100	<0.23
Spray Painter (Primer)	247	20	10	n.d.	10	70	0.09
Painter (Beam)	236	10	40	n.d.	130	80	0.39
Rusthon Application Operator	260	<10	<10	n.d.	<10	90	<0.08
Environmental Guides	-	670	375-750	535	435	575-2950	1.0

n.d. - Result was less than the detection limit of the analytical method used.
* - Federal Standards were used to calculate equivalent exposures.

TABLE II - PERSONAL AND AREA SAMPLING RESULTS FOR AIRBORNE LEVELS OF INORGANIC SUBSTANCES - TIME-WEIGHTED AVERAGES
August 14, 1974

Sample Description	Length of Sample (min)	Concentration (mg/M^3)			
		Cadmium	Chromium	Cyanides	Nitric Acid
Alodine Plater Op 1	334	n.a.	<0.004	n.a.	n.a.
Alodine Plater Op 2	331	n.a.	<0.005	n.a.	n.a.
Cadmium Plater Operator	291	0.010	0.004	n.a.	n.a.
Alodine Plating Area	265	n.a.	n.a.	0.02	0.35
Cadmium Plating Area	259	n.a.	n.a.	0.04	0.24
Teflon Spray Op.	317	n.a.	<0.004	n.a.	n.a.
Federal Standard		.05C-0.1	.05-0.1	5	5

n.a. - Sampling media utilized does not permit analysis for this substance.