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HAZARDOUS CONDITIONS AND PRECAUTIONARY MEASURES WHEN WORKING WITH EPOXY RESINS AND SOLVENTS

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Epoxy resin systems are composed of two or more reactive components: uncured resin, and a curing agent generally referred to as the "hardener."

Uncured liquid resins have a consistency of heavy syrup and in this form have limited use; however, when mixed with a hardener, a chemical reaction takes place which converts it to a hard, mechanically strong material with excellent adhesion, cohesion, chemical, and electrical resistance properties. Other additives to the mix may include liquids or solids to produce desired physical properties.

Epoxy resin applications include potting of electrical components, re-inforced plastic and metal laminates, foundry patterns, forming tools and dies, adhesives for metal and plastic bonding, appliance finishes, floor and surface coatings.

Let us look at the hazards problems.

In the December, 1959, issue of the American Medical Association's *Archives of Industrial Health*, the following statement was made: "Epoxy resins are causing more occupational dermatitis than any other new chemical material within the past 10 years!"

The first users of epoxy resins did not appreciate the delayed irritating effect resins and hardeners could have on the skin. Workers got the material on their hands and arms during mixing, pouring, and spreading operations. Since the irritant has a delayed rather than an immediate effect on most people, a few days to several weeks elapsed before severe cases of skin irritation developed.

Recent developments of new hardening agents of low toxicity and minimum irritant potential have somewhat reduced the dermatitis hazard. However, the use of these new hardeners does not eliminate the need for following prescribed precautions to avoid contact with the material. Good housekeep-

ing, personal cleanliness, and ventilation are still essential.

Basic resins, reactive curing agents, reactive diluents, and modifiers are mild to strong primary skin irritants, and some have sensitizing properties.

The volatile materials given off during compounding, handling, and curing operations can cause irritation of the eyes, upper respiratory tract, and lungs if the concentration of the vapors is excessive. No systemic intoxication of any significance has been associated with exposure to epoxy resins.

Contact dermatitis is the common type of skin irritation produced by epoxy resins. The irritation appears at the point of contact and may vary from slight reddening with mild itching to a rash or small eruptions with intense itching. In severe cases there may be open or weeping sores with or without swelling.

If an employee contracting a mild case of contact dermatitis is removed from the exposure and receives the necessary medical care, the irritation will usually clear up in a few days and the employee may return to the job without ill effects; that is, if he is careful to avoid further contact with the irritant. In severe cases the employee may become temporarily disabled and may or may not be returned to the job.

Sensitization dermatitis is the less common type of dermatitis. The term is used to describe an allergic type of reaction from a sensitizing agent. The sensitizing agent may not affect the individual on first contact, but after continued exposure for an extended period a dermatitis suddenly develops. After sensitization occurs, the slightest exposure to the sensitizing agent may precipitate a severe reaction. Irritation may spread from the point of contact to other parts of the body and be accompanied by swelling and other systemic reactions.

Once sensitized, the skin tolerance is so reduced that the individual develops dermatitis from much lower concentrations than would have affected him before sensitization.

Sensitization dermatitis is generally considered to be the most serious of the two types. Sensitized individuals can seldom return to work with the sensitizing agent, and may be more susceptible to other irritants.

Exposure Causing Dermatitis.

The most severe exposure comes from direct contact with the hardener and with the uncured resin-hardener mix. Exposure can result from contact with the volatile materials which are given off during the compounding, handling, and curing of these resins. The volatile materials given off during oven curing can be very irritating.

Cured resins are not always inert. If an excess of hardener is used or if the curing action is incomplete, there may be appreciable unreacted hardener left in the finished part.

Dust from finishing operations such as grinding, filing, sanding, etc. on such parts may contain sufficient uncombined hardener to irritate the skin of some individuals.

It is obvious that the best way to control epoxy dermatitis is to prevent skin contact with the hardener and uncured resins. No contact — no dermatitis!

Fillers.

Fillers used in epoxy mixes can also present problems. Asbestos, mica, silica, flour, and fiber glass, if inhaled, can cause irritation of the respiratory passages. Silica and asbestos are recognized toxic dusts having harmful effects on lung tissues. Local exhaust ventilation may be necessary if operations require extended exposure. For exposures of short duration a dust type respirator will provide the needed protection.

Fiber glass tends to fragment into small spicules; these may be caught in the ridges and folds of the skin. If they work their way into the skin they produce severe itching and sometimes foreign body reactions. Secondary infections may result from rubbing or scratching the affected area.

Grinding, filing, sanding, drilling, and similar operations on resins using these fillers can also produce dusts that can cause mechanical skin irritation. Washing the hands

and arms frequently with "scrubber" type granular soap to remove these particles before they work their way into the skin has been found to be a good protective measure.

Experience has shown that the incidence of dermatitis from epoxy resins can be satisfactorily controlled by:

1. Good engineering
2. Education of supervisor and worker
3. Good housekeeping
4. Protective clothing
5. Job placement and medical service

Good Engineering.

Select hardeners, modifiers, and fillers having the least irritating and toxic effect.

Arrange epoxy operations to minimize traffic through the work area.

Provide adequate exhaust hoods for compounding, mixing, dipping, laminating, curing, etc., where large quantities or continuous operations are involved.

Provide properly ventilated ovens exhausted outside the building when curing is done at elevated temperatures.

Provide well ventilated areas for curing at room temperature.

Provide hand washing facilities in close proximity to work area.

Employee Education.

The irritating and toxic effects of the resin and hardener should be explained to the employee. The necessity of keeping the hardener and uncured resin from the skin must be stressed.

Handling procedures should be established and demonstrated showing how direct contact can be avoided.

Employees should be cautioned to avoid careless handling that will result in the contamination of tools, fixtures, equipment, and work surfaces by hardeners or uncured resins.

Personal protective equipment such as protective creams, rubber finger cots, rubber or cloth gloves, sleeves, aprons, face shields, safety glasses, etc., must be worn and kept in good condition.

Good personal cleanliness is the best preventative measure for eliminating skin irritation. The hands should be washed with mild soap before and after work and before

going to the toilet. If hardening or liquid resin should contact the skin it should be wiped off and the affected area washed with soap and water immediately.

The use of solvents should be reduced to the absolute minimum. Suitable rubber gloves should be worn for all cleaning work in which solvents are used. The wearing of rubber gloves does not obviate the need for absolute cleanliness. Contaminated solvent should be disposed of at once in a suitable safety container. Contaminated solvent must not be used to clean tools or equipment.

Employees should be warned against touching their face or other skin areas with hands or gloves which may be contaminated.

Smoking or eating on the job should not be permitted, to eliminate the possibility of contaminating the face and lips with irritants.

Housekeeping.

Meticulous housekeeping standards should be established and enforced.

Bench tops, work surfaces and, in some instances, certain floor areas should be covered with disposable paper, changed at least each shift of operation.

An adequate supply of paper towels should be available so that small splashes or drips of hardener or uncured resin can be wiped up immediately. These should be disposed of in a special closed container specifically provided for this purpose. Similarly, paper cups used for mixing or holding resin should be disposed of as soon as empty to prevent contamination of the work area.

Protective Equipment and Clothing.

Personal protective equipment items and clothing must never be considered an adequate substitute for good engineering, good housekeeping, and a careful, informed worker. However, if used intelligently and maintained in good condition, personal protective equipment can be very effective in minimizing exposure to irritants and toxic vapors.

The personal protective equipment needed for safe operation will vary widely depending on the process and exposure. The need for such equipment should be determined by a careful study of the operation as well as a review of injury experience data.

Lanolin and silicon base protective creams applied to the hands and arms before start-

ing work provide some degree of protection against skin irritation. They leave an oily surface to which the resin will not firmly adhere and facilitate removal when washing with soap and water.

Plastic coated fabric and disposable paper sleeves have been found to give good arm protection against minor splashes and spills.

For light exposures such as potting or cementing of small electrical components where finger dexterity is essential, rubber finger cots or tight fitting fabric gloves may be adequate if reasonable skill and care is used. Fabric gloves should be removed and discarded just as soon as there is visual contamination of their outer surface. After removing the gloves, the employee should wash his hands and arms, re-apply protective cream, and put on new gloves before resuming work.

Hand mixing and dispensing of resins usually require the wearing of rubber gloves. Particular care must be taken in putting on and taking off gloves and sleeves to assure the irritant material is not transferred to their inner surface where it will be in direct contact with the skin.

Coated fabric or disposable paper aprons are generally provided, not only for body protection against occasional minor splashes or spills but also to prevent permanent damage to the employee's personal work clothing.

For operations such as laminating, casting, and surface coating where the nature of the work is such that an employee cannot avoid body contact with the uncured resin, suitable outer work garments are generally provided and maintained by the employer.

When a large volume of epoxy must be handled in poorly ventilated or confined areas, a chemical type respirator or air supplied breathing apparatus may be required to protect the worker from the inhalation of hazardous vapors.

Face and eye protection in the form of face shields or safety glasses may be required for compounding, mixing, and dispensing operations where pressure systems are used or where there is a splashing hazard. Hardeners and uncured resins are extremely damaging to the eye. If the eye is affected, it should be flushed promptly with plenty of water for at least 15 minutes and medical attention obtained for it at once.

Job Placement and Medical Service.

Employees should be screened before they are placed on epoxy resin work to exclude those who are known to have sensitivity or allergy to irritants as well as those who are prone to acne or eczema.

Whenever dermatitis develops due to epoxy resin exposure, the employee should be sent immediately to the nurse or plant physician with a note to indicate there has been exposure to epoxy resin. The decision regarding whether the employee should be placed on temporary or permanent restriction away from epoxy should be left to the physician.

To summarize, basic resins, reactive curing agents, diluents, and modifiers are mild to strong summary skin irritants. Some have sensitizing properties.

Volatile materials given off during compounding, handling, and curing operations irritate the eyes, nasal passage and lungs, if excessive.

Certain fillers used in epoxy mixers are skin irritants and may have harmful effects on the lungs if the exposure is excessive.

Experience has shown that the incidence of dermatitis and systematic injury can be satisfactorily controlled through (1) good engineering, (2) education of the supervisor and worker, (3) good housekeeping, (4) protective equipment and clothing, and (5) job placement and medical service.

Hazards Associated With the Use of Organic Solvents.

Twenty-five years ago there were only a few dozen organic solvents commonly used in industry.

Today, hundreds of different solvents and solvent blends are in use not only in industrial plants but in commercial establishments, laboratories, offices, and the home. Typical applications include degreasing metal parts; extraction of fats, oils, and waxes; dry cleaning; formulation of paints, varnishes, and lacquers; paint removers; adhesives, and manufacture of synthetic fabrics, insecticides and cosmetics.

The use of organic solvents presents three potential hazards:

- 1) Health
- 2) Skin Irritation (Dermatitis)
- 3) Fire and Explosion

Health Hazards.

The extent of the health hazard depends on several factors: relative toxicity of the material, how it is to be used, how the worker is exposed and vapor concentration.

Toxicity refers to the harmful systemic effects resulting from the inhalation of vapors or from absorption through the skin. These include effects on the upper respiratory passages, lungs, and the nervous and digestive systems.

All organic solvents are potentially injurious to the health of workers unless used with proper and adequate controls.

"Threshold limit values" recommended by the American Conference of Governmental Industrial Hygienists are the generally accepted guide to toxicity. The threshold limit value for a particular solvent indicates the maximum vapor in air concentration to which most workers can be repeatedly exposed day after day without ill effects.

Following are threshold limits for some commonly used solvents:

Solvent	Parts Per Million
Acetone-Ethyl alcohol	1000
Petroleum naphtha-Stoddard	
Solvent	500
Methyl chloroform	350
Coal tar naphtha-Methyl	
alcohol-Toluene	200
Trichlorethylene-Perchloroethyl-	
ene-Turpentine	100
Carbon disulfide	20
Carbon tetrachloride	10

Since threshold limit values may be based on various effects including discomfort, respiratory irritation, narcosis, as well as acute poisoning, they should not be used for a direct comparison of toxicity.

Short exposure to some solvent vapors can produce eye and respiratory irritation, drowsiness, dizziness, nausea, headache, and lack of muscular coordination, but cause no lasting and harmful systemic effects.

Others, such as carbon tetrachloride and benzol, may seriously affect or damage the blood, lungs, liver, kidneys, and gastro-intestinal tract and may cause permanent damage.

Acute solvent poisoning results from breathing high concentrations of solvent vapors for a short period of time. Such exposures may result from accidental spil-

lage, overflow of tanks, or cleaning operations in confined, poorly ventilated areas of tanks.

Chronic poisoning results from repeated daily exposure over an extended period.

To evaluate the health hazard from solvent exposure one must know: composition and toxicity of the solvent, vapor concentration in the work area, and duration of employee exposure.

Instruments and analytical methods are available for sampling the air and determining the vapor concentration. Such determinations can best be made by an industrial hygienist or a qualified chemist.

The results of such determinations can be compared with the recommended threshold limit values for the solvent in question. If the vapor concentration in the work area exceeds the recommended value corrective action is indicated.

Corrective action necessary to assure safe operation might include: a change to a solvent of lower toxicity, a suitable enclosure and local exhaust, better general room ventilation, or providing employee with approved respirator or air-supplied mask.

The chlorinated solvents — methyl chloroform, trichlorethylene, perchlorethylene and carbon tetrachloride—because of their non-flammable and high solvent properties, have been used for some time in industry.

It is obvious that carbon tetrachloride, because of its very low (10 parts per million) threshold limit value and accumulative harmful effects on the body, should only be used with adequate exhaust ventilation and carefully controlled handling procedures.

Trichlorethylene, with a threshold limit of 100 parts per million, is being used extensively in vapor degreasers for cleaning metal parts. These machines, if properly designed, operated, and maintained, do an excellent job with little solvent vapor hazard. However, if improperly operated and maintained they can quickly release large amounts of trichlorethylene vapors in the work area and present a serious health hazard. The vapors have a narcotic effect similar to chloroform and in high concentrations can cause serious injury and death.

Leaking pumps or valves, failure of the water supply to the cooling coils, overloading, or too fast a cleaning cycle, cleaning

cup shaped parts or parts with blind holes, tightly packed parts which prevent good drainage are a few of the conditions which can liberate harmful solvent vapor concentrations in the work area.

It is essential that the parts be dry when they come out of the degreasers.

Trichlorethylene vapors in the presence of an open flame break down into very toxic vapors. Welding and similar torch operations should not be performed in close proximity to vapor degreasers.

Under no circumstances should an employee be allowed to enter a degreaser that has not been drained, cooled, sludge removed, and then aerated. An employee working inside such a degreaser should always be under constant observation by another person on the outside.

The use of trichlorethylene for removing oils or waxes from floors, benches, etc., should not be condoned.

Methyl chloroform, with a threshold limit of 300 parts per million, can generally be used safely for occasional and intermittent small cleaning operations provided the work is done in well ventilated areas.

Repeated or prolonged exposure may result in mild irritation from its defatting action on the skin. Solvent resistant gloves should be provided.

Dermatitis.

Solvents cause contact dermatitis because they dissolve and remove the natural oils and fat needed to keep the outer layer of skin soft, flexible, and healthy.

With continued exposure to fat solvents, the skin becomes dry and scaly. Cracks and fissures develop which allow the solvent to penetrate and irritate the sensitive underlying tissue.

Fire and Explosion Hazards.

Many solvents present a fire and explosion hazard. In dealing with this hazard one must keep in mind that it is the solvent vapor-air mixture that burns, not the liquid solvent!

Flash Point.

The relative fire hazard rating of a solvent is based on the solvent's *flash point*. The flash point is the lowest temperature at which vapor is given off in sufficient quantities to mix with air and catch fire from a

source of ignition. The lower the flash point, the greater the fire hazard.

We are concerned particularly with the hazards of solvents having flash points under 140°F. Those with flash points at or below 100°F are rated *extremely flammable* because flammable vapor-air mixtures can be present at most room temperatures. Typical are acetone, alcohol, petroleum naphtha, and turpentine.

Solvents with flash points above 100°F but below 140°F carry a flammable rating but do not form flammable vapor-air mixtures at ordinary room temperatures. They do form flammable vapor-air mixtures when heated to over 100°F. Kerosene, petroleum spirits, and Stoddard solvent fall in this group.

Explosive Limits.

When combustible vapor is mixed with air in proper proportions, ignition will cause an explosion.

For each flammable liquid there is both a minimum and maximum vapor in air concentration which propagate a flame and cause an explosion on contact with a source of ignition. The minimum concentration is known as the lower flammable or explosive limit and the maximum, the upper explosive limit. The upper and lower explosive limits for most solvents and solvent mixtures can be obtained from the supplier or insurance underwriters.

Test instruments known as "flammable vapor indicators" or explosimeters are available for checking vapor-air concentrations at the work place. These instruments are direct reading and the values contained are expressed as a percentage of the lower or upper flammable or explosive limit.

Toxicity Control Measures.

Education is one of the most important aspects of solvent exposure control. Supervisors must know the composition of the solvent, its toxicity, and precautions which must be taken to use it safely; this information must be passed on to the worker.

Toxicity data can be obtained from suppliers as well as from data sheets issued by the National Safety Council.

Proper labeling of all containers to meet Federal, state, and local requirements is essential. The label should include not only

the chemical or trade name of the solvent but also the nature of the health hazard, precautions to be observed, and, in the case of highly poisonous or toxic materials, first aid and emergency treatment.

Substitution of solvents with lower toxicity for a more hazardous one is always a possibility.

Enclosure of the process or equipment is one of the most effective means of minimizing the escape of solvent vapors into the workroom. When highly flammable or toxic solvents are involved, local exhaust ventilation may be required.

Local exhaust ventilation designed to remove solvent vapors at their source can be used to advantage for many operations as less exhaust capacity is required and result in low air handling and heating costs.

General room ventilation may be sufficient when comparatively small amounts of the less toxic solvents are vaporized. In general, ventilation sufficient to keep the vapor concentrations below the hazardous health level will automatically assure that the vapor concentration will be below the flammable or explosive limit.

Dermatitis Control Measures.

Personal protective equipment should be provided wherever it is impracticable to control exposure by other means. Goggles, face shields, respirators, solvent resistant gloves, sleeves, aprons, special shoes or clothing may provide the needed protection depending upon the exposure.

Set up operations involving solvents so as to minimize employee contact with liquid solvent and vapors.

Protective creams are of value in preventing solvents from removing natural oils of the skin. The protective cream selected should be resistant to the solvent being used.

Employees should be cautioned against washing their hands and arms in solvents. Waterless hand cleaners are generally quite effective in removing materials on which soap and water is ineffective.

Fire and Explosion Control Measures.

All solvent containers should be labeled to show contents, hazards, and precautions to be observed. Federal, state, and local labeling laws should be observed.

Highly flammable solvents should be transported and used in approved safety containers equipped with flash-back arrestors.

Dip and wash tanks should be equipped with fire screens or fusible link covers. Supply tanks and portable containers should be electrically connected and effectively grounded during filling operations. Use pumping systems rather than gravity flow for transferring solvents.

Arrange for safe and approved disposal of waste solvent. Solvents must not be dumped in to sewer or drainage systems; never in scrap or rubbish containers.

All sources of ignition should be eliminated from areas where flammables are stored or used. This should include open flames, static electricity, excessive heat, and sparks from electrical devices.

Good housekeeping is essential where solvents are stored, handled, and used. Spills should be cleaned up promptly by workers wearing necessary personal protective equipment. Solvent soaked rags or absorbent should be placed in closed metal containers and removed daily from the plant.

To summarize, the use of organic solvents present three potential hazards: health, skin irritation (dermatitis), and fire and explosion.

Acute or chronic systemic poisoning may result from breathing excessive vapors or from absorption through the skin.

Solvents cause contact dermatitis because they remove the natural oils from the skin and cause chemical irritation of the sensitive underlying tissues.

Flammable solvents present a potential fire and explosion hazard when used in close proximity to sources of ignition.

Potential health, dermatitis, and fire and explosion hazards can be controlled through:

1. *Educating* supervisors and workers so that they know the hazards associated with the handling and use of solvents, and the importance of following safe use procedures.
2. *Providing* safe equipment and processes with necessary enclosures and exhaust ventilation to assure safe operation.
3. *Supplying* the worker with any needed personal protective equipment or clothing to protect him from exposure to toxic vapors and minimize contact with the liquid solutions.

REFERENCES

For further information of the properties of solvents, health and fire hazards, evaluation and control of exposures:

Handbook of Organic Industrial Solvents, Technical Guide No. 6, National Association of Mutual Casualty Companies, 20 N. Wacker Drive, Chicago, Ill.

Hazardous Chemicals Data NFPA No. 49M, National Fire Protection Association, 6 Batterymarch, Boston, Mass.

Threshold Limit Values for 1966, American Conference of Governmental Industrial Hygienists, 1014 Broadway, Cincinnati, O.

National Safety Council Data Sheets, National Safety Council, 425 North Michigan Avenue, Chicago, Ill.

Flammable Liquid Trade Name Index, NFPA 325A, National Fire Protection Association, 60 Batterymarch Street, Boston, Mass.

self and his fellows, who uses his his knowledge, tools, and safety equipment to the best of his ability.

It may be however, that we are attacking symptoms rather than causes. We have, as I have said, begun to explore the nature and true cause of industrial accidents since it is apparent that legislation, regulations, and good intentions do not in themselves solve the dilemma of rising accidents. They do, however, provide us with a legal, and we hope precise, framework to operate within. With our study, we hope not only to define the industrial accident and the role of the chief participants, but to be able in some measure to anticipate the future and legislate, not only for this period, but in anticipation of the developments of the new industrial climate. I might say that we, as every prevention body, is, are working towards the day when we can no longer be employed. We are assured by many economic planners that the advent of sophisticated technology (automation, if you will), will relegate the industrial workers to pushing buttons and performing monitoring functions for three hours a day.

Our chief aim at the moment is to keep workers alive and kicking until that day arrives. However, I might note that since less than two per cent of our industry is fully automated, I feel no immediate need for a job re-training course.

Our department has continual exchanges of ideas, statistics and operation descriptions with our other provinces and other countries. We have just recently completed the first of two ministers' safety conferences where representatives of trade unions management, and government have come together to re-examine ideas generated by individual research. We have, as well, been host and key participant at the recent International Labour Organization Manpower Conference, which discussed in some detail the international aspects of safety education and preventive techniques.

All of us then—government, management, and employees—share the responsibility for industrial safety. As government becomes more adept at defining it legislatively and management more adept in recognizing it as a method of enhancing the balance sheet and employees learn to use the safety mechanisms provided for their own protection, we may yet find formulas that work better than our current situation-by-situation approach. Frankly, I cannot give you omniscient answers, but I know that if we, together, carefully select our questions and behave honestly and with proper concern in the area of our responsibilities, we will arrive at solutions that lessen and may eventually stop industrial accident and death.

DISCUSSION PERIOD — WHAT'S BUGGING YOU?

Delegates who attended the labor sessions were asked to submit written questions concerning safety problems within their areas of operation, or questions that were generated by the safety sessions that they attended during the Congress week. These written questions were reviewed and answered by a panel of safety experts.

Presiding Officer: John R. Kumpel, Safety and Compensation Representative, United Rubber Workers, Akron, Ohio.

Moderator: Jacob Gold, Safety Engineer, Bureau of Labor Standards, U.S. Department of Labor, Washington, D. C.

Panel Members: Alan F. Burch, Director of Safety, International Union of Operating Engineers, Washington, D. C.; John L. Dowling, Director, Safety and Health Division, United Steel Workers of America (Canada), Toronto, Canada; Charles T. Greene, Director, Industrial Safety, District of Columbia Minimum Wage and Industrial Safety Board, Washington, D. C.; Floyd Van Atta, Ph.D., Deputy Director, Office of Occupational Safety, Bureau of Labor Standards, U.S. Department of Labor, Washington, D. C.; Victor E. Whitehouse, Safety Director, International Brotherhood of Electrical Workers, Washington, D. C.

Moderator: Are penalties provided for violation of safety codes in the various jurisdictions actually sufficient to act as a deterrent to the violation of codes?

Mr. Greene: I would say no; they are not sufficient. The amount a company has to pay for a safety code violation is not enough to act as a deterrent. However, publicity is more of a deterrent than any fine that could be imposed. Of course, the only way to have adequate publicity is to impose a fine that is out of the ordinary.

We had a contractor that was fined \$300 for a violation, which was the maximum fine that could be imposed. Later, the contractor indicated that the fine was nothing compared to the adverse publicity from the newspapers, and that he would have much rather paid a \$3,000 fine than experience the publicity.

Moderator: In the province of Ontario, where the circumstances constitute an offense against the Industrial Safety Act and this offense occurs consistently, every person or employer who fails to comply with the provisions of the regulation, or the directions of an inspector, or the conditions of an approval permit is subject to a fine of not more than \$1,000 for each day of the violation or to imprisonment for not more than 12 months for each day of infraction.

Dr. Van Atta: In school I was taught that it is not the nature of the penalty but the certainty that the penalty will be imposed that encourages compliance. Our main problem in this country is not the penalty but the fact that most of the people who are violating regulations will not be penalized regardless of what the law says. This is probably because we do not have enough inspectors to cover the areas.

Moderator: There are far too many accidents involving high voltages which cause burns, electrocutions, and falls from high places. These accidents occur to electricians, linemen, and other craftsmen above the age of 60 who do hazardous work. Few of these old timers will admit the weakening of their grip, failing eyesight, weak heart conditions, or a tendency to experience dizziness. I don't believe that a compulsory medical examination is the answer, but there must be some solution. Perhaps workers over 60 should be prohibited from working in high

places and assigned to other challenging work.

Mr. Whitehouse: A man 60 years old is not really the criterion. We in the International Brotherhood of Electrical Workers have many examples of men 25 to 30 years of age who have a heart condition, are epileptic, or suffer some other problem. It is true that some of the IBEW locals have agreements with the contracted company which require a man of 50 and over who shows evidence of gaining weight or suffering from some health problem be transferred to a less hazardous job. On the matter of physical examinations, the men within the local union can schedule periodical examinations with their own personal physicians.

Mr. Burch: I am opposed to pre-employment physical examinations as a condition of employment, but I am not against physical examinations. I think the point in this question is an important one and that is that we must be our brother's keeper. Most unions have negotiated health and welfare plans, and these should include at least annual physical examinations. Of course, there is nothing stopping an individual from seeking his own personal doctor periodically; in fact he will probably discuss his job more freely and the type of work that he performs with his doctor. After the personal doctor advises the individual about his physical ability in relation to performing his job, it is up to the worker to decide whether he will continue or not. In other words, we should inform ourselves about our own physical condition and how it applies to our job.

Mr. Greene: In this case, there is a question of one person being a hazard to other persons on the job. I know of two or three instances where physical condition of a worker caused injuries to others. In another instance, a chronic drunk was directly responsible for the severe injury of three other persons. Both management and labor knew of this man's illness, but neither related it to his responsible job. I am in agreement that compulsory examinations are not the answer, but there is a joint labor-management responsibility to get together and decide when a person may be a hazard to other workers because of his health.

Moderator: Do you think that unions and management should work together in writing or changing a safety rule book?

Mr. Whitthouse: For years I have been preaching for joint labor-management safety committees to do this very thing. They should sit down and work out the procedures that are to be followed so that it becomes the responsibility of both labor and management to see that they are enforced.

In the past two years the IBEW and various managements have established over 800 joint labor-management safety committees. I am very strongly in favor of these committees establishing ground rules. This is a definite advantage for management. We have had cases in some of our locals where the union member was brought before the executive board and informed that the union agreed to these rules and regulations and he, as a member of the union, must comply.

Mr. Dowling: We deal with the Ontario Federation of Labor and favor its support of joint labor-management methods of rule and regulation writing, but I would like to add that once these rules and regulations are adopted they should be put into the working man's language. They should be developed in such a way that the working man knows what they are and he understands them clearly. In Canada, we print these rules and regulations in French for our French workers. The union also has an obligation to see that these rules are explained.

Moderator: A number of years ago Republic Steel Corporation wanted to communicate to all of its employees a better understanding of the economic problems of the company and how they affect the workers. They went to Brookings Institute for advice, then developed a play with 13 characters such as a farmer, business man, stock holder, manager, etc. The employees were assigned various parts and participated in the play at various locations all over the country. The principle idea was that participation would improve understanding and respect.

The company paid thousands of dollars for that idea, and it is believed that the same results can be obtained if the union is allowed to participate in developing safety rules. An example of such cooperation is the Carborundum Company's joint safety work with the Oil, Chemical, and Atomic Workers Union. This relationship is work-

ing extremely well and practically every one that I know of has worked very successfully.

Moderator: Do you think safety programs should be in the labor contract?

Dr. Van Atta: Certainly! A contract has to do with conditions of employment, and one of the major conditions of employment is your continued life. It seems to me that labor groups, in general, have been most remiss in that conditions of employment have not been included under safety. However, this is certainly no excuse for this to continue.

Mr. Greene: The contractors in the District of Columbia must comply with the regulations of our department. One of the problems with safety by reference is that most of the workers, and some of the management, do not have any idea of what these regulations are. They don't understand them. If safety is in the contract, the workers ought to have enough information so that they can know whether the regulations are being complied with or not. If they are not, the workers can act accordingly.

If their wages under the contract were not being paid, they would do something about it immediately. I believe that a union should act immediately if there is a hazardous situation that needs correcting in accordance with accepted codes and regulations. However, if people do not understand the regulations they do not know when the regulations are violated. The answer, of course, is training. Without training, the regulations will be unimplemented.

Dr. Van Atta: I have read a significant amount of contracts which were signed by people who thought they had negotiated safety into the contract. The standard phrase is "the company will continue to provide safe and healthful places in which to work." This is really just saying that the company will continue its existing bad practices. That is not negotiating safety. It is as worthless as a contract that says the company will continue to pay wages.

There is meaningful language which can be negotiated into union contracts and nearly all of the international unions can provide this type of language.

Mr. Burch: If the union has already sat down with management and worked out acceptable safety rules, the contract can contain meaningful language that is also simple.

For example, "both sides agree to adhere, at all times, to the safety rules agreed upon jointly." This keeps unnecessary words out of the contract and has the advantage that everybody knows what is being referred to. It also skirts the situation where the contract is filled with language aimed at everybody's particular grievance. The important thing is to get together and work out the rules and regulations by which you are going to live and then firm them up in a binding agreement so that everybody knows where they stand.

Actually the original question — should safety be negotiated into a union contract? — has been answered by the National Labor Relations Board. Not too long ago, there was a decision which was upheld after it was appealed, and it will probably be a landmark case in labor relations. The final ruling was that safety was a mandatory subject of collective bargaining.

Moderator: To what extent is voltage over 5,000 volts being worked on out of aerial baskets or insulated platforms with rubber gloves and sleeves?

Mr. Whitehouse: I would like to highlight two things. One, safety standards for the electrical industry recommend that any voltage over 5,000 be either de-energized, or grounded, or worked by hot stick. Two, aerial baskets are fundamentally a good tool because they place a man in a good position. However, these baskets should not be considered as an insulating or isolating device. The same rules apply when working voltages from a basket as when working from a pole. There has been a concerted effort on the part of management of many utility companies to go to 13,200 volts (and one wants to go up to 15,000 volts as a limit. A man can use rubber insulation for up to 20,000 volts; however, if his nose is still exposed, that is where he will make contact.

Edison Electric Institute made an analysis of accidents over the years and practically all of the contacts over 5,000 volts are not hand contacts. So, the rubber gloves are not enough, and it's not reasonable to expect a man to work completely enclosed in rubber. In the opinion of our organization, 5,000 volts is the limit for working energized lines except *via* hot stick.

Moderator: A major Chicago cab company has vehicles which have the fresh air

intake so placed that the exhaust fumes of the car immediately ahead are taken into the passenger compartment of the cab. This could constitute a serious health hazard and we are wondering what the National Safety Council can do about this situation.

Dr. Van Atta: Actually the Council cannot do anything about this sort of condition except publicize the hazard. It surprised me when I found that this cab company is still taking their fresh air into the passenger compartment through ducts that are located down low in back of the radiator. This is especially surprising when you realize that all other automobile manufacturers stopped this practice 6 or 7 years ago because of the number of deaths from carbon monoxide. I can't think of any conceivable excuse for this type of neglect in design which can cause serious injury. I would think that unfavorable publicity and perhaps one or two damage suits against the company for negligent design might have a most salubrious effect. These steps can be taken by the union and should be.

(Comment from the floor, by Joseph L. Algina, Safety Director, Seafarers International Union)—The local union that is involved with this cab company is meeting tonight and I will be present. I will recommend that this union take direct action to see that the condition is eliminated.

Moderator: How are safety and health problems handled under Canadian laws?

Mr. Dowling: We have an arrangement with the Director and Chief Inspector, Industrial Safety Branch, Ontario Department of Labour, Toronto, whereby I meet in his office to discuss any problem that involves steel workers. If there is a violation of the Industrial Safety Act, the initial step rests with the official of the local union involved. The local should extend every effort to get the violation corrected. However, if no corrective measures are taken the report is sent to my office. I forward it to the Industrial Safety Branch and an inspector is sent to the plant to check into the condition. Subsequently, we get a report from the Director of the Industrial Safety Branch indicating whether the complaint was upheld or rejected.

The foundry section of our union has a somewhat more refined method of liaison. The government inspector for foundries

must contact the local union officials before he visits a plant and must take the local's appointed representative with him during his tour of the plant.

In addition, the factory inspectors in the Province of Ontario carry a warrant with them and, if they are opposed by the employer, the inspector uses the telephone to call the local magistrate. A policeman is dispatched to the plant to serve the warrant on the person obstructing the inspection and has the person removed from the premises until the inspection is completed.

Moderator: Is there a standard clearing house that records a complete list of radiation exposures to workers handling radioactive materials?

Dr. Van Atta: Not in the United States, unfortunately. There was a bill introduced in the last Congress, but Congress did not act on it. We have high hopes that it will be handled during the next Congress, although we understand that there is considerable opposition to this bill from management sources.

Moderator: How can we get management to correct unsafe conditions promptly?

Mr. Dowling: I can only give you an illustration of what happened in the city of Hamilton, Ontario. I was conducting seminars in Hamilton when one of the crane operators in the plant called me at my home. He informed me that the wheels on the crane had become so worn that the electric shoes that pick up the electricity had dropped to where they were striking stud bolts, causing them to fall to the floor below. I called the shop foreman and he admitted that the condition was unsafe.

I then phoned the Director of the Ontario Industrial Safety Branch and he sent an inspector within 35 minutes. The inspector was in the plant for 10 minutes. He shut down the entire plant. Management was then obligated to bring in a contractor to replace the crane wheels. The plant was shut down for two shifts.

Mr. Greene: We have a way of getting things done also; however, it is sometimes rather late. When we receive a complaint we send an inspector to the location. Usually the condition existed for some time before we receive the complaint. It has bothered the worker, and he has probably complained

to various people but he doesn't contact us until the condition gets serious.

Mr. Gold: I think it must be apparent that the answer to this question depends in a large measure on the geographic area in which the plant is located. Some states have fine laws which will take care of these things if you push them. However, other states are quite lax and backward.

Mr. Kumpel: If you believe you are working in a hazardous situation and feel morally certain that you are right in your belief, then you should refuse to work on such operations until they can be examined by proper and qualified authorities to determine if the conditions need correcting.

Mr. Burch: I endorse what John says, but I would like to add that union strength varies geographically. A lot will depend upon the knowledge and guts of the local business agents.

Moderator: What are the effects of asbestos dust?

Dr. Van Atta: Breathing excessive amounts of asbestos dust over a period of 25 to 35 years, depending upon the amount and the person, will result in shortness of breath, circulatory and heart problems, and the person will probably die of heart failure. In addition, you will probably get no assistance from workmen's compensation, if you are under most jurisdictions. That is the classical picture of asbestosis. But, in the last few years, we are discovering that asbestos is a rather prolific producer of a variety of cancers of the lung and surrounding tissues. Asbestos is a skinny little crystal, like a needle, and it works into the tissues and promotes cancers.

One variety is appearing in rather substantial numbers among asbestos workers—it has always been there, but now it is beginning to be diagnosed. This is a subject about which we don't know nearly as much as we thought we did 20 years ago. I might say that excessive amounts of asbestos dust is only enough to constitute a slight haze in the air. The situations in which asbestos is used are highly deserving of competent professional assessment.

Moderator: How can unions get such professional assessment in cases where they feel the plant hygienist or medical personnel are not competent?

Dr. Van Atta: There are several highly qualified physicians in the country who will act as consultants. Also, some state labor departments have personnel who can monitor asbestos operations and render opinions.

(Comment from the floor)—*Dr. Van Atta,* you mentioned you can't get compensation for asbestos disabilities in most jurisdictions.

The law has changed in most jurisdictions in the country during the last few years so that you may be able to sue the construction company, the architects, and engineers who built the plant without proper ventilation. This can be considered for full recovery for the wrongful death of a worker or for injuries. This is a very important new area of protection for workers, not only to get damages where there has been disability but to prevent the continuation of the condition in the future.

Moderator: What services or aid should be given or offered to local unions from the safety staff of an international union?

Mr. Burch: The safety director should develop training programs, or at least outlines, for use by local union safety personnel. He should supply materials (posters, decals, technical data, etc.) and act as a research consultant in safety and health matters. He should answer questions received via letter or telephone. He should gather statistics, which requires the cooperation of local unions.

The international union safety director should represent his union members and the trade union movement as a whole, on the various committees that write standards and codes which will effect the work of the union's members. The United States of America Standards Institute, the Society of Automotive Engineers, and the Society of Mechanical Engineers are examples of organizations that have these types of committees.

Previously, participation by union representatives has been minimal and we are doing our best to change this situation. This is one of the most important activities that safety personnel of international labor organizations can undertake. There are plenty of openings but labor hasn't sought representation. When labor does become a part of these committees, it has been my experience that labor representatives are welcome and offer valuable contributions.

Now we come to the really important role of the international union safety department and that is top management support. This is very important; however, it is also essential that the man on the job support the safety activities. Too many local unions still offer only lip service to accident prevention. Until local union leadership pushes accident prevention, the man on the job will continue to be unconcerned.

Mr. Whitehouse: Let us not overlook the fact that many international labor organizations do not have a safety director or safety department. For them, the first thing they can do is establish such a department and staff.

(Comment from the floor, by Joseph Leonard)—The Longshoremen's union installed accident prevention activities in the International Union office and made it mandatory that each local should have a safety program. That was four years ago. To this day, I have to carry a bat when I visit the various locals in order to get these fellows moving. I do not believe that the International Union office can do much until the local unions are willing to accept it and support it. In addition, the rank and file members must provide support to their local union officers.

Mr. Kumpf: Our International Union has conducted many safety and compensation clinics throughout the United States and Canada over the past 23 years. We have fairly good success in attracting local union people to attend these clinics for three or four days at a time.

Moderator: Does the District of Columbia have the right to make its own safety codes through its appointed commissioners, or are the safety rules of the District enacted by the Congress of the United States?

Mr. Greene: The District, through its Minimum Wage and Industrial Safety Board, has the right to make safety codes. They handle all of the investigations and conduct the hearings necessary to develop these codes. This privilege comes from Congressional legislation.

Moderator: How do we sell safety to our union members?

Mr. Gold: I believe that you must establish, within your members, a desire. You have to give them a chance to participate in the problems. Let them assist with first aid training and community action. The

worker must understand how accident prevention will benefit him, personally. You cannot sell just once in a while. Ads for new automobiles do not occur once in a while. They are published continuously. The same continuing sales pitch is necessary to keep a union safety program rolling. You have to work at it.

(Comment from Bob Wilkins)—I feel certain that the only way accident prevention can be effectively sold to union members and their families is through effective demonstrations. Demonstrative presentations stick in a person's mind much longer and are more effective in changing habits and attitudes. Films are one method of demonstrating what can be done to avoid accidents or reduce hazards. Of course, this requires more time in preparing safety presentations and oftentimes costs money.

I am sure that all of you will agree that Jake Gold does an outstanding job of teaching accident prevention to people from all walks of life and you will notice that he uses demonstrations wherever possible.

With reference to the continuing complaint that management cannot get the cooperation of the union or the men when they wish to initiate a certain type of accident prevention program, the primary reason for this difficulty is the fact that management feels that the safety program is not only their responsibility, but that it is their privilege to develop and enforce it as they see fit.

These types of procedures often run into difficulty because most people resist something that is forced upon them. However, most people are willing to cooperate with practically any project or program if they have some voice in the manner in which the project or program is developed.

As an example, if management wants to initiate a safety-spectacle program, it is extremely helpful if they will ask the union to appoint two or three representatives to sit with management and develop the program which will later become mandatory. When this cooperation is enjoyed from beginning to end, the program will always be a success because both parties feel that the program was developed properly, and both parties will cooperatively assist in seeing to it that the program is put into effect.

Regarding the question of what labor can

do about industrial hygiene problems, I believe that if the state labor department or other concerned organizations cannot provide industrial hygiene personnel to study situations believed to be hazardous by the union, then the union should have the opportunity to hire its own consulting industrial hygienist to study the situation and give an unbiased report. This should satisfy the desires of the union membership and should assist in avoiding hazardous situations which may be overlooked by management.

.(Comment from the floor by Mr. Philo)
—If you don't mind, I would like to say something in general about a problem we, as lawyers, have in representing injured people. I have been interested in one very important area of safety and I refer to suits against manufacturers of machinery or safety equipment that result in an injury to a worker. Our position is not aided by the existence of weak standards and weak positions by local and international unions.

In particular, I have during the past year presented cases of 37 workers who have lost hands in power presses. I have just spent some time in the Power Press and Forging Section sessions, listening to speakers on points of operation guarding. It is my opinion that about 50,000 presses in the United States are guarded by a trap instead of a safety device. These are the pull-back guards. I think it is predictable that a worker who operates a press equipped with these pull-back devices for 30 years is bound to lose a hand. I represent some clients who have lost both hands.

I don't believe that the National Safety Council is ever going to suggest that the pull-back devices are unsafe. This is probably because the Power Press and Forgings Section basically represents industry and management. However, the unions can and should do something about this situation. They ought to get these devices banned in every state in the country. The pull-back devices violate the two principles of power press safety. First, every device or guard must have a fail safe mechanism; second, the worker's hands should never be placed between the dies when the machine is running.

General Motors, Ford, and Chrysler will not use these pull-back devices on any of their thousands of presses. They recognize

they are a trap. It is the smaller shops which do not have effective accident prevention engineering in the plant, where these devices exist.

I recently talked to a corporate safety director who I thought, should know better. However, his company is being advertised as having pull-back type guards on power presses in several of its plants. The corporate safety director admitted this was true. He went on to say that this type of device was used in some plants because the local union insisted on the pull-back devices.

I believe that the local union safety personnel were undoubtedly good, conscientious safety people but were not safety sophisticated. This point of operation guarding is a complex problem.

Dr. Van Atta: What Mr. Philo says is perfectly true. Fail safe design is particularly important when you're talking about power presses. It is true that there is no failure of a pull-back device which is a

safe failure. Every conceivable failure is a hazardous failure.

(Comment from the floor)—I disagree with the idea of including industrial hygiene services in a union contract. I am with the State Labor Department of Iowa and am director of the industrial inspectors. We have one of the finest industrial hygiene laboratories in the United States. What we really need is support from the unions at the state level when it comes to budget time. The State Bureau of Labor doesn't receive the support from the unions when it comes time for requesting monies to provide adequate factory inspection and industrial hygiene survey work. The Manufacturers Association are there and they lobby against our budget continuously. Our Safety Commission is currently operating on a budget of \$16,000. We asked for \$39,000. The point is that the state has the facilities in adequate equipment and laboratories. But we need more support from labor.