U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Service
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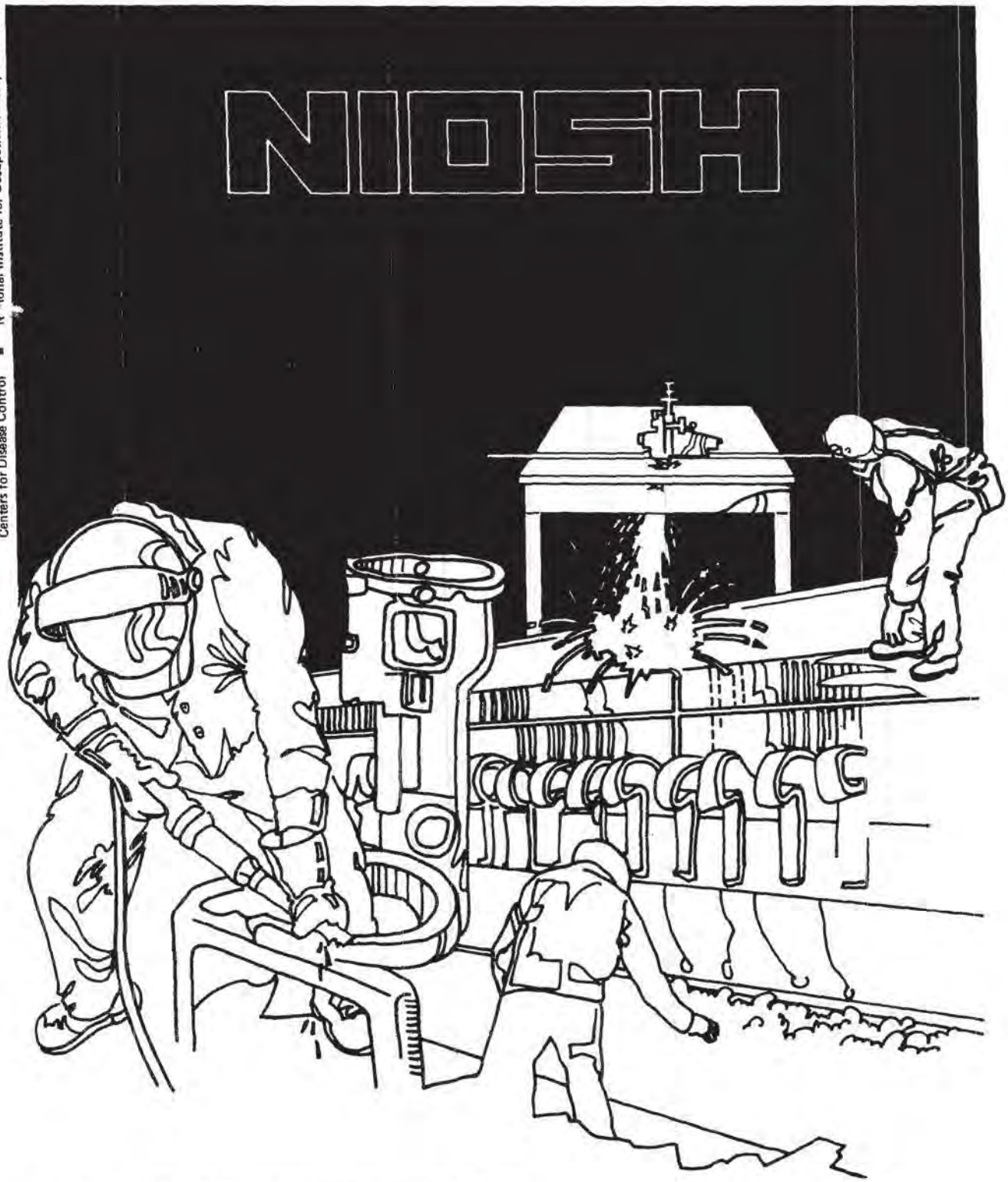

Health Hazard Evaluation Report

HHE 80-154-1027
BECHTEL POWER CORPORATION
BERWICK, PENNSYLVANIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HHE 80-154-1027
December 1981
Bechtel Power Corporation
Berwick, Pennsylvania

NIOSH Investigators:
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I. SUMMARY

On May 27, 1980, NIOSH received a request from the International Brotherhood of Painters and Allied Trades Local No. 41 to evaluate the toxicity of solvents and epoxy coating used by Bechtel Power Corporation at the Susquehanna Steam and Power Station, Berwick, Pennsylvania. Whereas previously only oil based paints were used, these coatings are being replaced with epoxy types and the union was concerned about the adverse health effects these types of coatings may produce.

On June 25, 1980, a NIOSH industrial hygienist conducted an initial walk-through survey during which the operations and controls were observed and an inventory of the paints and solvents was made. Five bulk samples of the solvents were collected for laboratory analysis. Chemical substances found in these solvents were methylene chloride, toluene, isopropanol, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), xylene, butyl cellosolve, molecular weight 120 aromatics, and diacetone alcohol.

Environmental air sampling was conducted and non-directed medical questionnaires were administered to nine of the forty painters on September 23-24, 1980 and May 19, 1981. Samples were taken in the operators' breathing zone and in the work area. The following time weighted average air concentrations were found; isopropanol (7.9-216 milligrams per cubic meter of air sampled (mg/M^3)), toluene (less than 0.01-55.5 mg/M3), benzyl alcohol (less than 0.01 mg/M^3), perchloroethylene (less than 0.01-0.46 mg/M^3), furfuryl alcohol (less than 0.01-7.84 mg/M^3), bisphenyl A and diglycidal ethers of bisphenyl A (less than 0.5 to 5.4 micrograms per cubic meter of air). The above results were recalculated using the formula for mixture to determine if their combined value exceeded unity. The calculated values for mixtures using OSHA standards ranged from 0.01 to 0.29 and using NIOSH recommended criteria they ranged from 0.01 to 0.70.

On September 23, 1980, medical investigators from the Center for Occupational and Environmental Health Johns Hopkins University and the U.S. Public Health Service Hospital Baltimore, Maryland interviewed seven employees. The employees complained primarily of acute reversible central nervous system symptoms and skin problems.

On the basis of the results obtained from the environmental air sampling performed during this investigation, the painters were not overexposed to organic solvents; however, from the interviews it appears that acute reversible central nervous system symptoms may be experienced, especially when painting in confined spaces. Environmental and medical recommendations are incorporated in this report.

Keywords: SIC 1629 (electric light and power plant construction) Freon 112, toluene, xylene, methylene chloride, 1,1,1 trichloroethane, perchloroethylene, furfuryl alcohol, isopropanol, benzyl alcohol, bisphenol A, diglycidal ethers of bisphenol A, central nervous system, skin, taste in mouth, skin problems, headaches, heartburn.

II Introduction

Under the Occupational Safety and Health Act of 1970, NIOSH investigates the toxic effects of substances found in the workplace. On May 27, 1980, a request was received from the International Brotherhood of Painters and Allied Trades Local No. 41. The Union was concerned about the toxicity of the solvents and coatings used by Bechtel Corporation at the Susquehanna Steam and Power Station in Berwick, Pennsylvania. Interim reports were mailed to concerned parties August 1980 and March 1981.

III Background

The Bechtel Power Corporation is the general contractor for the Pennsylvania Power and Light Company and the Allegheny Electric Cooperative, Inc., for the construction of a nuclear-powered electric generating plant at Berwick, Pennsylvania, designated the Susquehanna Steam Electric Station. Construction at this site began in 1973 and is scheduled to end in July 1981 for Unit 1, and in the summer of 1983 for Unit 2.

The plant is situated on a site of over 100 acres and will encompass two-to-three million square feet per unit. Bechtel has approximately 3200 employees currently on site; the peak work force to-date at this site has been 4800 employees.

There were approximately 50 painters on the site. These painters also work as sandblasters, both in the preparation for painting of walls, ceilings, floors, small beams and other metal parts. Sandblasters use air supplied hoods, NIOSH approved disposable respirators and ear plugs.

Paints applied may be latex, anti-rust or epoxy. Application is done by roller coating, airless spray and trowling. The use of epoxy coatings is specified by the Nuclear Regulatory Commission; and is the most common coating used.

The epoxy coating consists of a primer, second coat and finish coat. All coatings have different formulations. Each of the three coats is a separate two-part epoxy system which is poured by hand and mixed with an electric mixer just prior to use. Rubber gloves are used during the paint mixing process. The primer coat is generally rolled on by hand while the other two coats are generally sprayed on with an airless spray gun.

Painting takes place in various locations throughout the generating plant, occasionally in small rooms and in closed spaces. The painters are completely covered with protective gear, viz. disposable white paper coveralls and boots nonpermeable to organic solvents and rubber gloves. Paper hoods, googles and NIOSH approved respirator are used during painting. Replacement filters are available should the employee sense a vapor breakthrough.

On June 25, 1980, the NIOSH Regional Industrial Hygienist met with representatives of the company and of the employees for the opening and closing conferences and walk-through survey. An interim report on this visit was sent to plant management and

and representative of the employees in August 1980.

The majority of the complaints during the visit of June 25, 1980 concerned the ill effects experienced by the painters when applying the primer and second epoxy coating.

Analysis of the 5 bulk solvent samples used for thinning the epoxy paint showed that the predominant components were methylene chloride, toluene, isopropanol, methyl ethyl ketone, xylene, butyl cellosolve, diacetone alcohol and molecular weight 120 aromatics.

On September 23 and 24,1980 environmental air sampling was conducted during the roller coating of the primary epoxy paint and the mixing, airless spraying, and trowelling of the second coat of epoxy paint. Analysis of the bulk sample taken of the second coat epoxy paint showed that charcoal would not absorb certain contaminants. An interim report explaining these problems was sent to management and union, February 1981.

Additional air sampling was conducted on May 19, 1981, utilizing charcoal, silica gel and porous polymer tubes to collect all the air contaminants.

On September 23, 1980, NIOSH medical contract personnel from the Center for Occupational and Environmental Health of the Johns Hopkins University and the U.S. Public Health Service Hospital, Baltimore, Maryland, conducted a walk-through evaluation. During this visit, operations were observed. Informal interviews were conducted with seven of the painters and sandblasters concerning their health and possible work-related effects. The medical program for painters and sandblasters was discussed with the plant physician who conducts regular medical examinations of the employees.

IV Evaluation Design and Methods.

A. Environmental

1. Organic Solvents.

On June 25, 1980, five bulk samples of the most commonly used solvents were collected. These samples were analyzed by gas chromatograph/mass spectrograph. The major peaks identified were methylene chloride, toluene isopropanol, methyl ketone, xylene, butyl cellosolve, diacetone alcohol and molecular weight 120 aromatics.

On September 23 and 24, 1980, two bulk air samples and ten painter personal breathing zone air samples, were collected. Two bulk samples of the paint applied were also collected. The bulk epoxy paints were analyzed by gas chromatography (FID) or GC/MS. The primer epoxy showed that the major components were isopropanol, toluene, benzyl alcohol and phenol. The second coat epoxy components were furfuryl alcohol, aniline and p,p,l methylene dianiline.

On September 23 and 24, thirteen airborne breathing zone samples for organic solvents were collected on charcoal tubes using personal sampling pumps. These samples were analyzed by NIOSH Method P&CAM 127(1) for Freon 113, toluene, xylene, methylene chloride, isopropanol and benzyl chloride. The limit of detection was 0.01 milligram per sample (mg/s).

2. Bisphenol A and Diglycidyl Ether of Bisphenol A

Five personal air samples were collected. These samples were analyzed for bisphenol A and the diglycidyl ether of bisphenyl A by NIOSH Method P&CAM 333(1). The limit of detection for this analysis was 0.5 micrograms per sample (ug/s) for both analytes.

3. Epichlorohydrin

Two personal breathing zone air samples were collected. These samples were analyzed for epichlorohydrin by NIOSH method P&CAM S-118(1). The limit of detection was 0.01 mg/s.

Due to the fact that all the air contaminants could not be absorbed with charcoal tubes viz aniline, methylene dianiline and furfuryl alcohol, a reevaluation was conducted on May 19, 1981 when the second coat was being applied.

4. Aniline, Methylene Dianiline

Six personal breathing zone air samples were collected on silica gel tubes with personal air sampling pumps. These samples were analyzed by NIOSH Method P&CAM 168(1). The limit of detection was 0.01 mg/s.

5. Furfuryl Alcohol

Six personal breathing zone air samples were collected on porous polymer tubes. These samples were analyzed by NIOSH Method P&CAM S-365(1). The limit of detection was 0.01 mg/s.

The diluents in the paints are mixtures of organic solvents. Atmospheric samples that were collected were analyzed for the individual components of the air contaminant.

In order to determine if there were overexposures to mixtures of organic solvents, the following formula was used: (2)

$$E_m - (\frac{C_1}{L_1} + \frac{C_2}{L_2}) + \ldots (\frac{C_n}{L_n})$$

where E_m is the equivalent exposure for the mixture C_1 is the observed atmospheric concentration and L_1 is the corresponding threshold limit value. If the sum of the fractions exceeds unity (1), then the threshold limit of the mixture should be considered as being exceeded. The formula is only used when the chief effects are in fact additive, which they were is this case.

V. Evaluation Criteria

Substance	NIOSH(TWA)	OSHA(TWA)(2)
Isopropanol(3)	980*	980
Toluene(4)	375(skin)**	750
Benzyl alcohol	--	--
1,1.2-Trichloro 1,2,2-Trifluoroethane	--	5600
Xylene(5)	435	435
Methylene Chloride(6)	270	1800
Epichlorohydrin(7)	2**	19**
1,1,1-Trichloroethane(8)	1900(15min)***	1900
Perchloroethylene(9)	335	670
Cyclohexane(11)	--	1,050
Furfuryl alcohol(10)	200(skin)	200

There are no established standards or criteria for bisphenol A(BA) or diglycidyl ether of bisphenol A(DGEBA). At present there is insufficient data available to suggest a standard for these compounds.

*Denotes milligrams of contaminant per cubic meter of air sampled.
** Potential contribution to the overall exposure by the cutaneous route including the mucous membrane and eye.
*** Ceiling concentration as determined by a 15 minute sample.

VI Toxicity

A. Isopropyl Alcohol (3, 11)

The vapors are mildly irritating to the conjuctiva and mucous membranes of the upper respiratory tract and is potentially narcotic in high concentration.

B. Toluene (4, 11)

Toluene may cause irritation of the eyes, respiratory tract, and skin. Repeated or prolonged contact with liquid may cause removal of natural lipids from the skin, resulting in dry, fissured dermatitis. The liquid splashed in the eyes may cause irritation and reversible damage.

Acute exposure to toluene predominantly results in central nervous system depression. Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness, incoordination with staggering gait, skin paresthesians, collapse and coma.

C. Benzyl Alcohol (14)

Benzyl alcohol can cause local irritation of the skin and mucous membranes. In addition it can cause headaches, vertigo, nausea, vomiting and diahrea.

D. 1,1,2-Trichloro-1,2,2 Trifluoroethane (Fluorocarbons) (11)

Typically, fluorocarbons have very low levels of toxicity. These compounds may produce mild irritation to the upper respiratory tract. Dermatitis occurs only rarely. Mild central nervous system depression may occur in cases of exposure to very high concentration of fluorocarbons.

E. Xylene (5-11)

Xylene vapor may cause irritation of the eyes, nose, and throat. Repeated or prolonged skin contact with xylene may cause drying and defatting of the skin which may lead to dermatitis. Liquid xylene is irritating to the eyes and mucous membranes, and aspiration of few milliliters may cause chemical Pneumonitis, pulmonary edema, and hemorrhage. Repeated exposure of the eyes to high concentrations of xylene vapor may cause reversible eye damage.

Acute exposure to xylene vapor may cause central nervous system depression and minor reversible effects upon liver and kidneys. At high concentrations xylene vapor may cause dizziness, staggering, drowsiness, and unconsciousness. Also at very high concentrations, breathing xylene vapors may cause pulmonary edema, anorexia, nausea, vomiting, and abdominal pain.

F. Methylene Chloride (6, 11)

Repeated contact with methylene chloride may cause a dry, scaly, fissured dermatitis. The liquid and vapor are irritating to the eyes and upper respiratory tract at higher concentrations. If the liquid is held in contact with the skin, it may cause skin burns.

Methylene chloride is a mild narcotic. Effects from intoxication include headache, giddiness, stupor, irritability, numbness, and tingling in the limbs. Irritation to the eyes and upper respiratory passages occurs at higher dosages. In severe cases, observers have noted toxic encephalopathy with hallucinations, pulmonary edema, coma, and death. Cardiac arrythmias have been produced in animals but have not been common in human experiences. Exposure to this agent may cause elevated carboxyhemoglobin levels which may be significant in smokers or workers with anemia or heat disease, and those exposed to CO.

G. Epichlorohydrin (7, 15)

Epichlorohydrin is highly irritating to eyes, skin, and respiratory tract. Skin contact may result in delayed blistering and deep-seated pain. Allergic eczematous contact dermatitis occurs occasionally.

The earliest symptoms of intoxication may be referable to the gastrointestinal tract (nausea, vomiting, abdominal discomfort) or pain in the region of the liver. Labored breathing, cough, and cyanoses may be evident and the onset of chemical pneumonititis may occur several hours after exposure.

NIOSH recommends that as a prudent measure, epichlorohydrin be handled in the workplace as if it were a human carcinogen. This recommendation is based primarily on two recent studies; a long term epidemiologic study showing a significant increase in respiratory cancer deaths of exposed workers, and an inhalation study showing an increased in nasal carcinomas in rats. In addition, cytogenetic studies of human peripheral lymphocytes have shown a highly significant increase in chromogenic potential, NIOSH believes it would be prudent to minimize occupation exposure to epichlorohydrin.

H. 1,1,1-Trichloroethane (8, 11, 17)

Liquid and vapor are irritating to eyes on contact. This effect is usually noted first in acute exposure cases. Mild conjuctivitis may develop but recovery is usually rapid. Repeated skin contact may produce a dry, scaly and fissured dermatitis due to the solvent's defatting properties.

1,1,1-trichloroethane acts as a narcotic and depresses the central nervous system. Acute exposure symptoms include dizziness, incoordination, drowsiness, increased reaction time, unconsciousness, and death.

NIOSH recommends that 1,1,1-trichloroethane be treated with caution because of its relationship with other chloroethanes shown to be carcinogenic in laboratory animals.

I. Perchloroethylene (9, 11, 18)

Repeated contact may cause a dry, scaly, and fissured dermatitis. High concentrations may produce eye and nose irritation.

Acute exposure to perchloroethylene may cause central nervous system depression, hepatic injury, and anesthetic death. Cardiac arrhythmias and renal injury have been produced in animal experiments. Signs and symptoms of overexposure include malaise, dizziness, headache, increased perspiration, fatigue, staggering gait, and slowing of mental ability. These usually subside quickly upon removal into the open air.

NIOSH recommends that it is prudent to handle perchloroethylene in the workplace as if it were a human carcinogen. The recommendation is based on a recent study which shows that perchloroethylene causes liver cancer in laboratory mice.

J. Cyclohexane (11)

Repeated and prolonged contact with liquid may cause defatting of the skin and a dry, scaly, fissured dermatitis. Mild conjunctivitis may result from acute vapor exposure.

Alicyclic hydrocarbons are central nervous system depressants, although their acute toxicity is low. Symptoms of acute exposure are excitement, loss of equilibrium, stupor, coma, and rarely death as a result of respiratory failure.

K. Furfuryl Alcohol (12)

Furfuryl alcohol can be assimilated into the body by inhalation or skin absorption. At high concentrations, furfuryl alcohol causes narcosis in animals, and it is expected that severe exposure will cause the same.

L. Glycidyl Ethers (12, 16)

Glycidyl ethers are synthetic compounds and find their major use as components of epoxy resin systems. The "diglycidyl ether of bisphenol A" has been a traditional basic active ingredient of epoxy resins; other glycidyl ethers are frequently incorporated into epoxy resin systems as reactive diluents. The epoxy group of the glycidyl ethers reacts during the curing process and glycidyl ethers

are therefore generally no longer present in completely cured products. Epoxy resins containing glycidyl ethers are used in a variety of applications including protective coatings, reinforced plastics, as well as bonding materials and adhesives.

Much occupational exposure to glycidyl ethers results from the use of proprietary or trade name products which do not disclose the presence of toxic agents in their formulations; This complicates efforts to take appropriate precautionary measures for the prevention of occupational disease. For example, unrecognized hazardous situations can occur where protective coatings containing epoxy resins are sprayed, thereby facilitating the inhalation of even non-volatile materials, and where there is skin contact with epoxy resins containing glycidyl ethers.

Reports from different laboratories present a pattern of findings indicating that some of the glycidyl ethers may be capable of producing testicular atrophy and hemopoietic abnormalities in various species of laboratory animals. While none of the individual research reports are conclusive, some of the changes observed may act as predisposing factors to systemic problems. NIOSH is not aware of any studies investigating the possible occurrence of testicular astrophy or hemopoietic abnormalities in humans exposed to glycidyl ethers. The possibility of these effects occurring in humans is reason for concern. Therefore, the occupational health community is advised of the possibility of these effects appearing in workers exposed to glycidyl ethers.

Aromatic epoxy resins have been shown to be mutagenic in bacteria and may represent a cancer risk in humans. They contain additives (catalysts, curing agents, etc.) other than BA and DGEBA which were not covered in this evaluation due to inadequate information and/or lack of necessary or sufficiently sensitive analytical procedures for their detection. Although such additives represent a very small percentage of the overall formulation, they may contribute significantly to the overall toxicology considerations of the total resin system. The glycidyl ethers are highly reactive both chemically and biologically. Cytotoxic effects and mutagenicity in bacteria and other test systems has been demonstrated. It is recommended (NIOSH) criteria document, Occupational Exposure to Glycidyl Ethers (3) that because of the evidence that some "glycidyl ethers have the potential to produce tumorigenic, mutagenic, or reproductive effects, and because few have been adequately tested for such effects, occupational exposure to glycidyl ethers is defined (in this document) as work in any area where these substances are manufactured, stored, used or handled". (p.11) It is further recommended that "work practices appropriate for handling glycidyl ethers should be adhered to in processes involving an uncured epoxy resin system". (p. 27)

VII Results and Discussion

A. Environmental

The breathing zone samples of the epoxy paints sprayers, rollers and trowlers were collected to determine their potential exposures to organic solvents. The analysis of the samples during the primer applications showed the components to be isopropanol, toluene, and benzyl alcohol. Analysis of the samples during the application of the second coat showed the components to be xylene, toluene,

Methylene chloride, epichlorohydrin, 1,1,1 trichloroethane, perchloroethylene, Freon 113, cyclohexane and furfuryl alcohol. The formula $\frac{C_1}{L_1}+\frac{C_2}{L_2}..\frac{C_n}{L_n}$ was used to determine if the additive effects exceed unity. Using the values utilizing both NIOSH recommended criteria and OSHA standards it was determined the unity was not exceeded.

a) Organic Vapor

Using NIOSH recommended criteria, four breathing zone exposures during the primer application September 23, 1980 ranged from 0.01-0.27, while when using OSHA standards they ranged 0.01-0.29.

During the second coat application on September 24, 1980, NIOSH recommended criteria for mixtures ranged from 0.05-0.64 while using OSHA standards ranged from 0.01-0.16 for five breathing zone samples.

Due to the fact that certain components of the second coat of paint were not absorbed on charcoal, viz. aniline, methylene dianiline and furfuryl alcohol, additional environmental air sampling was performed using in addition to charcoal, silica gel and porous polymer tubes. This evaluation was performed on May 19, 1981. The results of six breathing zone samples showed that using NIOSH criteria the concentrations ranged from 0.10 to 0.20.

The results of all atmospheric air sampling collected during the airless spraying, roller coating and trowling did not exceed unity.

Six environmental air samples collected for aniline and methylene dianiline were less than the lower limit of detection of 0.01 mg/Sample.

Three environmental air samples were collected for bisphenol A and diglycidal ether of bisphenol A. Breathing zone air concentrations for bisphenol A ranged from less than the lower limit of detection of 0.04 microgram/Sample (ug/S) to 4.49 micrograms per cubic meter of air samples (ug/M3). Airborne breathing zone samples of diglycidal concentrations ranged from 8.99-9.74 ug/M3.

B. Medical

During the walk-through investigation, seven workers were interviewed concerning their activities and the nature of any health effects they may have experienced. These workers are exposed to epoxy paints during the pouring and mixing of the two-part epoxy systems prior to painting, and during the application of these paints.

The workers were interviewed informally near their job sites in order to discover what kinds of possible work-related symptoms or illness, if any, they are experiencing. No attempt was made to select a statistically valid sample of workers, and therefore the information from these interviews gives no indication of the prevalence of symptoms or illness in this worker population. Five of the workers were selected for interviewing because they were actively engaged in the painting and sandblasting operations observed by the investigators from Johns Hopkins, and another two workers were chosen for interviewing by union and management.

The symptoms reported most frequently by the painters and sandblasters were related to the use of the primer coat. In spite of attempts at ventilation and the use of personal protective equipment, the odor of the paint can be detected even when the workers change their respirator cartridges as often as every half hour. Exposure to paint vapors for approximately one hour was reported to lead occasionally to dizziness, light headedness, an occasional headache, occasional heartburn and residual bad taste in the mouth for several hours. One painter reported that this residual bad taste can last as long as several days. Generally these symptoms are quickly reversible within several minutes of breathing fresh air, and no complaints of long term difficulties were elicited. There were no reports of peripheral neurologic effects such as numbness, tingling, weakness and paresthesias. Two workers stated that they were troubled with increasing irritability and insomnia, and one worker had occasional hand tremors. Another worker mentioned that he had reduced his drinking habits due to the presumed additive effect of ethanol with the odors that he was encountering, leading to problems of nausea and lightheadedness.

Health problems reported also included skin rashes. One worker had a rash which he related to exposure to a cleaning solvent for the coating system. Another worker had an erythematous papular rash on his forearem; this rash was presumably a heat rash due to the heavy overalls. One worker reported occasional skin and eye irritation which he related to exposure to metal abrasives. An anecdotal report was offered of a man who had put his hand and arm into a bucket of paint. Although he was wearing rubber gloves, he put his arm too far into the bucket and paint ran down inside his glove, resulting in a rash which was short lived and which resolved fully with cortisone treatment.

One worker, a sandblaster/painter, reported incipient kidney failure, presumably dating from an infection during childhood. He is currently being fitted with a venous shunt in preparation for dialysis.

Summary of Symptoms Reported by
Painters and Sandblasters
(7 Interviews)

Acute reversible central nervous system symptoms	5 workers
Eye irritation	1 worker
Skin problems	2 workers
(plus one anecdotal report)	
Persistent taste in mouth	2 workers
Headaches	1 worker
Heartburn	1 worker

VIII Control Measures in Place

A. Protective Equipment

The employees performing painting operations are supplied with coveralls, booties and hoods made of white paper which is impervious to organic vapors, rubber gloves and eye protection. NIOSH approved respirators for organic vapors are supplied. Should an employee experience an organic vapor breakthrough, replacement cartridge are available.

When painting is performed in a small or enclosed space, multiple fans are to circulate the air; however, it is occupationally difficult to vent exhaust air because of limited access to outside areas; sometimes even the "elephant ventilator", with a long air channel approximately 8" in diameter, is unable to reach an external area.

The painters attempt to apply the primer coat as rapidly as they can, and they will work for approximately one hour prior to taking a break. During this time, they change respirator cartridges periodically. The general consensus is that vapors can be smelled through the filter after approximately ten minutes in an area of high vapor concentration; the filters are changed at the discretion of the individual worker when he feels that the odor is becoming strong.

B. Medical

Bechtel Power Corporation at this location operates a dispensary staffed by a nurse. In addition, the plant physician visits the dispensary several times a week for one-to-two hours at a time. Workers may be either seen at the construction site or sent to the emergency room of Berwick Hospital where they are seen by the plant physician or his collegues.

The plant physician sees the employees (both painters and sandblasters) at his office for yearly examinations, which include a history of exposure, previous work history, medical history, physical examination, pulmonary function studies, chest x-ray, EKG, and laboratory studies (including blood lead, blood zinc and urinalysis). The physician also sees painters and sandblasters for interim examinations every three-to-six months, which include an interval history, physical exam and urinalysis.

IX Recommendations

In general, the personal protection, environmental control health care and medical surveillance programs already in effect for the painters and sandblasters at the Bechtel site are quite extensive. Recommended modifications are meant to focus the health care and monitor on the levels of specific exposures encountered by the workers, as determined by industrial hygiene measurements. Detailed medical monitoring procedures are described in the appropriate NIOSH Criteria Documents.

A. Environmental

1) Establish a program of periodic environmental air monitoring of employees performing painting operations. There are periodic modifications in formulations of paints. This program would determine if the paint formulation is consistent. This was brought out by the conversation with employees during the visit of May 19, 1981. During the visits of June 25, 1980 and September 23, 1980, there were no complaints concerning the application of the finish coat. There were some complaints on May 19, 1981 and laboratory analysis of the finish coat paint tentatively showed that it contains a cyclohexyl diamine isomer.

2) Where proper dilution ventilation cannot be supplied, supplied air respiratory protective equipment should be used.

3) Establish a quantitative faceseal fit test program for all employees who must wear respirators.

B. Medical

Workers who are exposed to the solvent commonly found in paints, the medical monitoring program should include a history and physical exam, with special attention to the possibility of central and/or peripheral neurological effects related to chronic exposure and to the possibility of acute skin problems related to solvent spills.

An additional consideration in the dermatological history and physical exam would be the possibility of sensitization to glycidyl ethers and/or amine curing agents, with consequent allergic contact dermatitis. Monitoring would also include a respiratory history and pulmonary function tests with attention to the possibility of occupational asthma, due to amine curing agents or other potentially sensitizing substances.

For all workers, the choice of specific laboratory tests, such as blood lead and zinc, would be correlated with exposure as determined by industrial hygiene measurements.

C. Worker Education

Concern was voiced by the painters at the Bechtel site over the abundance of confusing - and sometimes conflicting - reports of chemical hazards relating to certain paint components and over the lack of information regarding other components. The painters said they would welcome assistance in interpreting these reports, and that they would also welcome new information relating to their work as it becomes available.

Regular worker education sessions organized through the union, through the company or as a collaborative efforts, would provide an opportunity to duscuss the nature of health hazards encountered in painting , the importance of control of exposure, and the role of personal protective equipment in this control.

X. Authorship and Acknowledgments

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Acknowledgements

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XI Distribution and Availability

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, OH 45226. After 90 days, this report will be available through the National Technical Information Service (NTIS), Springfield, VA. Information regarding its availability through NTIS can be obtained from NIOSH, Publication Office, at the Cincininati address.

Copies of this report have been sent to:

1. Bechtel Power Corporation
2. Employee Representative
3. NIOSH Region III
4. OSHA, Region III

For the purpose of informing the 50 employees of the results of the Bechtel Power Corporation survey, the employer shall promptly "post" for a period of 30 calendar days, the Determination Report in a prominant place(s) near where employees work.

XII References

1. U.S. Department of Labor, Occupational Safety and Health Administration, Federal Register, Volume 39, No. 125, June 27, 1974, (Revised No. 7, 1978).

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5. NIOSH Criteria for a Recommended Standard, Occupational Exposure to Xylene, Publication #75 168, 1975

6. NIOSH Criteria for a Recommended Standard Occupational Exposure to Methylene Chloride Publication #76 138, March 1976.

7. NIOSH Criteria for a Recommended Standard, Occupational Exposure to Epichlorohydrin, Publication #76 206, 1976.

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TABLE I

Bechtel Power Corporation
Berwick, Pennsylvania
HETA 80 154

September 23, 1980

Results of Sampling for Organic Vapors (NC-30)*

Operation	Time	Airborne Concentrations Isopropanol	Toluene	Benzyl Alcohol	Levels for Mixtures** OSHA	NIOSH
Roller	09:45-11:35	<0.01***	<0.01	<0.01		
Roller	12:47-14:03	50.2	22.7	0.01	0.01	0.01
		(6.9)****	(3.1)			
Roller	09:45-11:35	405.0	132.0	1.7		
Roller	13:00-14:05	615.4	140.0	2.8	0.25	0.31
		(176)	(49.2)	(0.8)		
Roller	10:00-11:35	536.3	134.0	6.7		
Roller	13:00-14:05	601.4	130.1	1.4	0.25	0.31
		(185.5)	(44.1)	(1.5)		
Roller	09:45-11:35	562.7	173.2	2.6		
Roller	13:55-14:30	495.0	93.9	1.0	0.29	0.37
		(241.5)	(65.1)	(0.76)		

*Denotes milligrams of contaminant per cubic meter of air sampled
**Denotes that if the sum of the following fractions: $\frac{C^1}{T^1} + \frac{C^2}{T^2} \ldots \frac{C_n}{T_n}$ exceeds unity, then the acceptable level of the mixture should be considered as being exceeded.
C^1= observed atmospheric concentration
T^1= threshold limit
*** < Denotes less than the lower limit of detection
**** ( ) Denotes 8-hour time weighted average TWA

TABLE II

Bechtel Power Corporation
Berwick, Pennsylvania

HETA 80-154

Results of Sampling for Organic Vapors (NC-30)

September 24, 1980

Operation	Time	Airborne Concentrations* Freon 113	Toluene	Xylene	Methylene Chloride	Levels for Mixtures** NIOSH	OSHA
Sprayers	09:57-14:45	22.3(13.4)****	0.91(0.55)	87.6(52.6)	232.5(139.5)	.64	.13
Trowler	09:53-14:32	1.9(1.1)	0.96(0.56)	89.6(52.1)	21.8(12.7)	.17	.13
Mixer	09:50-14:25	0.7(0.4)	<0.01(0.01)***	<0.01(<0.01)	6.2(3.8)	.05	.01
Ass't Mix.	09:50-14.25	16.6(10.2)	3.45(2.0)	34.5(19.8)	109.7(67.4)	.26	.05
Towler	09:55-13:53	8.8(4.4)	0.84(0.42)	113.5(56.2)	113.4(56.2)	.34	.16

*Denotes milligrams of contaminant per cubic meter of air sampled.
** Denotes that if the sum of the following fractions: $\frac{C^1}{T^1} \frac{C^2}{T^2} .. \frac{C_n}{T_n}$ exceeds unity, then the acceptable level of the mixture should be considered as being exceeded.
C^1=observed atmospheric concentration.
T^1=threshold limit.
***< Denotes less than the lower limit of detection.
**** ( ) Denotes 8-hour time weighted average TWA.

TABLE III

Bechtel Power Corporation
Berwick, Pennsylvania

HETA 80 154

Results of Sampling for Bisphenol A and Diglycidal Ether of Bisphenol A

September 23, 1980-May 19, 1981

Airborne* Concentrations

Operation	Time	Bisphenol A	Digylcidal Ethers of Bisphenol A
	Air Ejection Room	Turbine	Building 1
Roller	09:45-14:10	<0.5	8.3(3.2)
Roller	09:45-14:05	<0.5	5.0(1.8)
Roller	09:50-14:02	<0.5	2.8(1.1)
Roller	09:50-14:30	<0.5	<0.5(<0.5)
Roller	10:00-14:05	<0.5	4.8(1.7)
Mixer	09:50-14:25	<0.5	4.8(2.5)
Trowler	09:55-13:53	<0.5	9.6(4.8)
Ass't Mixer	09:50:14:25	<0.5	4.5(2.6)
Trowler	09:53-14:32	<0.5	8.9(5.2)
Sprayer	09:56-14:45	<0.5	15.6(9.4)
General Air	09:05-11:30	<0.04	9.0(2.7)
General Air	09:00-15:15	4.5(2.4)	9.4(5.0)
General Air	09:00-15:21	<0.4	9.7(5.4)

( ) Denotes 8-hour time weighted average (TWA)
* Denotes micrograms of contaminant per cubic meter of air sampled.
** Denotes the lower limit of detection.

TABLE IV

Bechtel Power Corporation
Berwick, Pennsylvania

HETA 80-154

Results of Sampling for Organic Vapors*

May 19, 1981

Operation	Time	Airborne Concentrations Xylene	Toluene	Methylene Chloride ****	Epichlorohydrin	1,1,1-Trichlorethane	Perchloroethylene	Freon 113	Cyclohexane	Furfuryl Alcohol	Levels for Mixtures** OSHA	NIOSH
Sprayer	9:05-11:30	68.97(20.83)	7.96(2.40)	73.39(22.17)	< 0.06***	<0.01	0.88(0.27)	7.96(2.40)	<0.01	18.59(5.62)	0.1	0.2
Trowler	9:00-11:30 13:28-15:12	25.47(13.48)	3.24(1.71)	42.61(22.55)	< 0.06	<0.01	<0.01	4.63(2.45)	<0.01	6.38(3.38)	0.1	0.2
Trowler	9:05-11:30 13:28=15:30	54.17(30.13)	7.08(3.94)	41.25(22.95)	< 0.06	<0.01	0.83(0.46)	5.00(2.78)	<0.01	4.50(2.50)	0.1	0.2
Ass't Spraying/Rolling	1:10=11:30 13:35-15:16	6.92(3.47)	<0.01	20.75(10.42)	< 0.06	<0.01	<0.01	2.77(1.39)	<0.01	10.38(5.21)	0.1	0.1
G.A Mixing	9:05=11:30 13:15-15:16	4.58(2.56)	0.01	41.19(23.43)	< 0.06	<0.01	<0.01	4.58(2.60)	<0.01	<0.01	< 0.1	0.1
G. Room	9:05-11:30 13:15-15:16	39.08(21.66)	4.60(2.55)	36.78(20.38)	< 0.06	<0.01	<0.01	4.60(2.55)	<0.01	14.14(7.84)	0.1	0.2

* Denotes milligrams of contaminant per cubic meter of air sampled.
** Denotes that if the sum of the following fractions: $\frac{C^1}{T^1} + \frac{C^2}{T^2} \ldots \frac{Cn}{Tn}$ exceeds unity, then the acceptable level of the mixture should be considered as being exceeded.
C^1= observed atmospheric concentration.
T^1= threshold limit
*** <Denotes less than the lower limit of detection.
**** ( ) Denotes 8-hour time weighted average TWA.

Table V

Bechtel Power Corporation
Berwick, Pennsylvania

HHE 80 154

Evaluation Criteria

Substance*	NIOSH (TWA)	OSHA (TWA)
Isopropanol	980*	980
Toluene	375 (skin)**	750
Benzyl Alcohol	--	--
1.2.2-Trichloro 1,2,2 Trifluoroethane (Refrigerant 113)	--	5600
Xylene	435	435
Methylene Chloride	270	1800
Epichlorohydrin	2**	19**
1,1,1-Trichloroethane	1900 (15 Minutes)***	1900
Perchloroethylene	335	670
Cyclohexane	--	1,050
Furfuryl Alcohol	200**	200

* Denotes milligrams of contaminant per cubic meter of air samples.

** Potential contribution to the overall exposure by the cutaneous route including the mucous membrane and eye.

*** Ceiling concentration as determined by a 15-minute sample

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