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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-65-230

GENERAL ELECTRIC COMPANY
ROCKFORD, ILLINOIS

NOVEMBER 1975

I. TOXICITY DETERMINATION

It has been determined that airborne concentrations of solvent vapors from toluene, xylene, n-butyl alcohol, isobutyl acetate, and of benzene, used as paint solvents in the spray paint area, third floor, Building 1, are not toxic in the conditions as used or found. This determination is based upon environmental measurements taken, medical interviews with affected employees, and chemical data supplied by the manufacturer. A recommendation regarding booth modification is included in this report.

II. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, Fifth and Walnut streets, Cincinnati, Ohio 45202.

Copies have been sent to:

A. General Electric Company, Rockford, Illinois.

B. Authorized representative of employees.

C. U.S. Department of Labor, Region V.

D. NIOSH, Region V.

For the purpose of informing the 2 "affected employees," the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 CFR, 669(a)(6) authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized repre-

sentative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees of the General Electric Company, regarding exposure to various paint solvents used as thinners in the spray paint operation.

The request was prompted by employee concern over the lack of effective ventilation at the spray painting operation, which allegedly did not properly remove paint mist, allowing mist to accumulate in the air and on clothing and body of the sprayer.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

The General Electric Company, Rockford, Illinois manufactures television cabinets. The installation of picture tubes and other components is done at another General Electric plant in a different area of the country. Approximately 300 people are employed in the making of the television cabinets.

One of the operations involved in the fabrication of the cabinets is the spray painting of side panels, which is done in 2 large spray booths, both located on the third floor of Building 1, but in different rooms. Two employees are involved in the spray painting of the side panels. In this operation, panels are brought into the booth hooked to an overhead conveyor system, sprayed with a paint/solvent mixture, and carried out of the booth. The conveyor line is automated. A spray is made approximately every 30 seconds, with each spray lasting about 20 seconds.

Each spray booth measures approximately 200 inches across by 68 inches high. Each booth is partitioned in the middle, making it effectively 2 spray booths. Each "half" of the spray booth has a filter media inserted and is mechanically exhausted to the outside. Each booth has side enclosures.

Depending upon work load, spray painting of the panels is conducted at 1 or both spray booths.

B. Work Site Evaluation.

1. Initial Survey

On June 13, 1974, a NIOSH representative conducted an observational survey of the spray paint areas, third floor, Building 1. Pertinent information was obtained from the employer regarding plant processes, affected employees were interviewed and work procedures observed.

Detector tube measurements for aromatic hydrocarbons were made near the employees' breathing zone--at each of the 2 spray booths, since, at the time of the evaluation, the general "nature" of the solvent was unknown. These detector tubes, as noted by the manufacturer, are designed to measure contaminant levels between 5 to 800 ppm, depending upon the aromatic hydrocarbon being measured.

Although, in spray booth 1 and spray booth 2, measurements for "aromatic hydrocarbons" did show some type of contaminant present, it is not possible to quantify the readings, in that interference from aliphatic and alicyclic hydrocarbon structures were present. The presence of aliphatic hydrocarbons as noted by the detector tube manufacturer can cause erroneous readings.

Smoke tube tests taken at each booth to evaluate exhaust ventilation efficiency showed the exhaust system to be functioning adequately. Spray booth filters are changed approximately once every 3 days.

A bulk sample of the solvent used with spray-paint operation was obtained and sent to the NIOSH Cincinnati laboratory for analysis.

Interviews were conducted in a nondirected manner with 2 affected employees regarding health effects they believed were due to employment. Both employees interviewed stated that they had coughing spells during the day, and they believed it was brought about by inhalation of solvent vapors. One of the 2 employees interviewed noted coughing spells particularly after a new filter had been installed in the spray paint booth.

a. Initial Survey Results

Laboratory analysis of the bulk sample obtained indicated the possible presence of benzene. For this reason, a follow-up environmental evaluation was performed to ascertain the presence or absence of benzene as used in the spray painting operation.

2. Follow-Up Evaluation

On October 23, 1974, a follow-up environmental-medical evaluation was performed. Discussion with management indicated that 4 employees came into contact with the solvents in question--either by inhalation, skin

contact, or both. Personal samples were collected in the breathing zone of the 2 spray painters and of 2 solvent supply workers. Medical interviews were conducted with the above 4 employees by a NIOSH physician, and biological samples were taken from each.

C. Evaluation Methods

1. Air Sampling In Spray-Paint Operation and Paint Mix Room

Employee exposure to paint solvent vapors were evaluated by collecting air samples in tubes containing activated charcoal. All charcoal tube samples were collected using Sipin air pumps, battery-powered, running at approximately 100 cc/min.

At the time of the follow-up evaluation, both spray painters were spray painting at only 1 of the 2 booths. In that both spray-paint booths were of identical construction and size and the smoke tube measurements indicated by visual observation similar flow characteristics, it was felt that the collection of samples at 1 booth would be adequate in assessing employee exposure.

Bulk samples of the solvents used in the paint spray operation were obtained and analyzed at the NIOSH Cincinnati laboratory.

2. Medical Evaluation

Two spray painters and 2 solvent supply workers were interviewed and examined. Blood samples for hemoglobin, hematocrit, red blood cell indices, differential white blood counts, reticulocyte count, quantitative platelet estimation, and total and direct bilirubin concentrations were obtained from each individual and were analyzed at the Swedish-American Hospital in Rockford, Illinois. Urine was collected at the end of the day to ascertain total phenol excretion.

D. Evaluation Criteria

Criteria considered in this report for the basis of toxicity are the Threshold Limit Values (TLV) as issued by the document "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment - 1974."

For reference, federal occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Title 29, Chapter XVII, Subpart G) are also presented.

The above criteria are listed below:

Substances	TLV ppm	Federal Standard ppm
Benzene (skin)[2]	10[1]	10
Toluene (skin)[2]	100	200
Xylene (skin)[2]	100	100
N-Butyl Alcohol	50[1]	100
Isobutyl Acetate	150	250

ppm = Parts of vapor or gas per million parts of contaminated air by volume at 25° C and 760 mm. Hg pressure.

1 = This value is proposed in the ACGIH TLV List - 1974.

2 = Indicates potential contribution to the overall exposure by the cutaneous route, including mucous membranes and eye, either by airborne, or more particularly, by direct contact with the substance.

Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect.

All paints used by the company in conjunction with the various solvents in question are of the same basic composition, with the pigment changing depending upon production requirements. The pigments utilized are red iron oxide or titanium dioxide, both solids. When mixed with other paint constituents, these chemicals would not present an exposure via the inhalation route.

Benzene:

The inhalation of high concentrations of benzene may cause exhiliration followed by drowsiness, fatigue, vertigo, nausea, or headache. High concentrations of benzene are also irritating to the mucous membranes of the nose and respiratory tract and to the eyes. Liquid benzene is irritating to the skin, and direct contact of liquid benzene with the lung may cause severe pulmonary edema and hemorrhage which may be fatal.[1]

The outstanding aspect of chronic poisoning resulting from exposure to benzene vapor over prolonged periods of time is its effect on the blood-forming organs. Originally, the most important sign of benzene poisoning was thought to be a change in the white blood cell (WBC) count. Greenburg,

in his study of benzene poisoning in the rotogravure printing industry in New York City in 1939, found that in early cases the most frequent changes were a decrease in the red blood cell (RBC) count (72% of cases) and in macrocytosis (increase MCV) (58%), whereas the WBC count alone was abnormal in only 40% of cases. The data from this study suggested that the MCV and RBC determinations would reveal 93% of suspected cases and MCV, RBC, WBC and platelet determinations would reveal 97% of cases of benzene poisoning. However, there is little correlation between clinical severity and intensity of the exposure.[2]

Small amounts of benzene are absorbed through the skin whenever the liquid comes into contact with the skin. However, it is not probable that systemic poisoning can arise from immersing the hands in benzene.

Some benzene is eliminated unchanged in the urine. Some is oxidized in the body to phenols and diphenols, which conjugate in the liver with sulfate ions. This conjugate is then excreted in the urine.[3]

Toluene:

Employee exposure to toluene at a concentration of 200 parts per million (ppm) for an 8-hour period produces mild fatigue, weakness, confusion and numbness of the skin. Exposure to 50 and 100 ppm failed to present any distinct symptoms. Toluene does cause skin irritation, and vapors are irritating to the respiratory tract.[4]

Xylene:

A solvent mixture of 3 isomers, xylene resembles benzene in many physical and chemical properties, but does not produce chronic blood disease characteristic of benzene absorption into the body. It exhibits a narcotic action at concentrations of 200 ppm. Repeated skin contact may cause dermititis.[5]

N-Butyl Alcohol:

Exposure of humans to vapors of this alcohol can result in irritation of the nose, throat, and eyes; headache, vertigo, and drowsiness. Contact dermititis may also occur.[6]

Isobutyl Acetate:

Physiologic effect of exposure to high concentrations consist of signs: irritation of eyes, nose and throat, followed by a relatively slow and gradual onset of narcosis with slow recovery after exposure ceases.[7]

E. Evaluation Results

1. Environmental Air Sampling

The results of environmental measurements made are summarized in Table I. A close review of the data shows employee exposure to all solvent vapors measured are well below established levels of toxicity. In particular, no detectable levels of benzene were found in the spray paint area.

2. Medical Evaluation

Two spray painters and 2 solvent supply workers who worked in the solvent supply area were interviewed and examined. Since the initial survey evaluation indicated the possible presence of benzene, the midical evaluation centered around symtomatology associated with benzene.

None of the individuals interviewed gave a history of medical illness that they specifically related to their job. One individual, D.J., is an insulin-dependent diabetic since 1970 and notes, on occasion, hypoglycemic symptoms (headache and drowsiness) that are promptly relieved by sugar.

The acute symptoms of benzene toxicity that were sought included: drowsiness, fatigue, vertigo, nausea and headache. The chronic symptoms that were sought included: fatigue, headache, anorexia, irritability, epistaxis, or other hemorrhagic complaints. There were no signs or symptoms suggesting anemia. In no instance did the individuals give a history that was suggestive of acute or chronic systemic benzene toxicity. On occasion both spray painters noted irritation of the mucous membranes of eye, nose and throat. On the day of our visit which they deemed was a usual work day, none of the subjects noted such irritation.

A limited physical examination that included a cutaneous examination and an examination of the mucous membranes of the eyes, nose and throat was conducted. There were no petecchiae, ecchymosis or other evidence of acute or chronic dermatitis. Jaundice of the sclera and hard palate were absent. The mucous membranes were not injected.

A urine specimen was taken from each of the above employees, and total phenol content of the urine determined by the sulfuric acid-steam distillation method. Phenol is well recognized to be the chief metabolite of benzene in the urine. All total, phenol determinations were corrected to a specific gravity of 1.024. All determinations were found to be entirely within normal limits.

A blood specimen was also taken from each of the above employees. The

results of the complete blood counts were entirely within normal limits with the exception of 1 individual (M.P.). In this case the abnormality consisted of mild leukopenia with an absolute netropenia, and an absolute lymphocytosis and monocytosis. There was no evidence of anemia, thrombocytopenia or abnormality of red blood cell indices and the reticulocyte count was normal. Such a blood picture is rather nonspecific and may be caused by many disease processes. The most common cause for such blood picture is recovery from an acute or inapparent viral infection. In this individual the negative history and physical examination and the normal total phenol content in the urine do not suggest systemic benzene toxicity.

F. Conclusions

In summary, the history, physical examinations and laboratory data do not suggest that the individuals in the cabinet spray painting area on the third floor of Building I have experienced systemic benzene toxicity. Environmental measurements obtained indicate no detectable exposure of benzene to employees. Employee exposure to other substances identified in this evaluation are well below established levels of toxicity. Medical findings support the above environmental findings.

G. Recommendations and Discussion

It is recommended that (1) a visible gauge or indicating device be installed "across" the filter to indicate the pressure differential. An increased pressure drop indicates the filter to be clogging resulting in a decreased air flow through the filter (thus, the spray-paint booth).

The original request expressed employee concern over inadequacy of ventillation to effectively remove paint mist near the employee, resulting in deposition of paint mist on the clothing of the employee. By maintaining the maximum possible air flow through the spray booth, paint mist deposition on the workers resulting from overspray can be kept to a minimum.

It is also recommended that (2) a panel be installed at the lower front edge of the spry booth. Such a panel would decrease the flow area, and for a given flow rate, increase the air velocity resulting in a more effective capture of air contaminants.

V. REFERENCES

1. Patty, Frank A., INDUSTRIAL HYGIENE AND TOXICOLOGY, Vol. II, John Wiley & Sons, N.Y., 1963, P. 1221.

2. Greenburg, L., et al., Benzent (benzol)"Poisoning in the Rotogravure

Industry in New York," J. Ind. Hyg. Toxicol., 21:395 (1939).

3. Patty, P. 1224.

4. Patty, P. 1226.

5. Olishifski, J.B., P.E., McElroy, Frank E., P.E., FUNDAMENTALS OF INDUSTRIAL HYGIENE, National Safety Council, Chicago, P. 822.

6. Patty, P. 144.

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TABLE I

Summary of Solvent Vapor Concentration (ppm)
October 23, 1974

Job	Sample Period	Sample Type	Benzene	Toluene	Xylene	N-Butyl Alcohol	Isobutyl Alcohol
Spray Painter	10:07AM-11:31 AM	Personal [1]	N.D.	1.49	.33	1.46	.17
Spray Painter	10:12AM-11:30AM	Personal [2]	N.D.	.67	.13	.66	.12
Solvent Mixer	10:28AM-11:24AM	Personal	N.D.	3.68	.13	2.01	.71
Solvent Mixer	10:33AM-11:27AM	Personal	N.D.	17.09	.55	7.91	2.33
Solvent Mixer	11:03AM-12:42PM	Area*	N.D.	14.42	.33	6.06	2.81
Spray Painter	12:03PM-3:20PM	Personal	N.D.	2.23	.11	1.65	.48
Spray Painter	12:03PM-3:21PM	Personal	N.D.	2.37	.09	1.40	.35
Solvent Mixer	12:37PM-3:09PM	Personal	N.D.	10.49	.23	3.32	1.79
Solvent Mixer	12:40PM-3:09PM	Personal	N.D.	8.42	.13	2.40	1.64
Solvent Mixer	12:45PM-3:11PM	Area**	N.D.	18.63	.35	5.78	3.00

[1]Approximately 15 minutes of the sample, employee was talking with medical personnel.

[2]Approximately 15 minutes of this sample, employee was talking with medical personnel.

*Paint Pump Room - Center of room.

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