

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 75-168 -309

WATER WELL DRILLING COMPANIES
WESTERN TENNESSEE

JULY 1976

I. TOXICITY DETERMINATION

It has been determined on the basis of medical and environmental data collected during the period of April 26-30, 1976 that the use of PVC cement by the Water Well Drillers in Western Tennessee does not constitute a health hazard under the present conditions of use. Environmental samples show only low levels of tetrahydrofuran and no detectable levels of cyclohexanone. Responses to medical questionnaires indicated no symptomatology believed to be occupationally related and physical examinations revealed no health disorders associated with exposure to the chemicals involved.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

- a) Clyde Ragsdale, Trenton, Tennessee
- b) Robert W. Wilson, Whiteville, Tennessee
- c) Jack Carrington, Jackson, Tennessee
- d) Billy Watkins, Pinson, Tennessee
- e) Eugene McCarver, Medina, Tennessee
- f) G. H. Mize, Covington, Tennessee
- g) Webber and Jones, Trenton, Tennessee
- h) Buhl Water Service, Williamsburg, Kentucky
- i) U.S. Department of Labor - Region IV
- j) NIOSH - Region IV

For the purpose of informing the approximately 20 "affected workers" the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place near where exposed employees work.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an individual well driller regarding well drillers' exposure to polyvinyl chloride (PVC) plastic cement. The driller had experienced a series of illnesses which were questioned by his physicians as possibly being related to contact with some type of toxic material. The individual's only known source of exposure to such materials was PVC cement used on the pipes in wells. The request was submitted in an effort to determine if exposure to PVC cement could be linked to the reported illnesses and also because of concern for other drillers with similar occupational exposure.

IV. HEALTH HAZARD EVALUATION

A. Conditions of Use

The alleged health hazard deals with the use of (PVC) cement. The cement is used for joining both PVC casing and PVC pipe. Upon completion of drilling, a PVC casing (typically four inches in diameter) is inserted into the hole. Twenty foot sections of the casing are joined using PVC cement until the necessary depth is reached. The cement is applied to the casing by means of a small paint brush. The time required for installing the casing varies depending on well depth but usually requires approximately 20 minutes to complete. Exposure is not continuous during this time as it is necessary to wait for the cement applied to each section to dry before the casing is lowered and the next section is cemented. The actual exposure time to the cement is approximately 5 minutes.

The installation of the pipe involves a similar procedure. The pipe is usually one inch in diameter and because of the smaller size, the cement is often applied by means of a small round lid applicator rather than a paint brush.

Of the companies involved in the study, it was reported that PVC cement has been used for a period of 10-15 years. The quantity of cement used and the amount of exposure varies greatly from company to company. The installation of casing or pipe requires approximately one-half pint of cement but the number of times this is performed varies from a maximum of twice per day to a minimum of once per week or once every two weeks.

The companies involved in the study all used ABCO® PVC cement. This cement is composed of tetrahydrofuran (THF), cyclohexanone, and PVC resin. (The major constituent is THF.)

B. Evaluation Design

Upon receipt of the Health Hazard Evaluation request, letters were sent to 44 licensed well drillers in Western Tennessee explaining the alleged hazard associated with the use of PVC plastic cement and requesting their participation in conducting an investigation. Only eight drillers responded to the letter, resulting in a cohort of twenty people. An initial survey was conducted April 26-30, 1976 with those companies indicating a willingness to participate. This survey included observation of work practices, administration of employee medical interviews and brief medical examinations and the collection of environmental samples.

C. Environmental and Medical Evaluation Methods

1. Environmental

Exposures to THF and cyclohexanone were determined by collecting personal breathing zone samples on charcoal tubes. The samples were analyzed by gas chromatography.

2. Medical

A NIOSH physician administered a non-direct and direct medical questionnaire and performed a brief physical examination emphasizing vital signs and neurological functions.

D. Evaluation Criteria

Tetrahydrofuran (THF) is a colorless highly flammable liquid with an ether-like odor. Over exposure may result in nausea, dizziness and headache. Symptoms disappear rapidly on access to fresh air. Skin exposure tests have shown no sensitization or irritation of the skin by liquid THF aside from the defatting action common to most organic solvents. The current Occupational Safety and Health Administration (OSHA) standard and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for THF is 200 ppm.

Cyclohexanone is capable of causing narcosis and death at high concentrations. However, it is only slightly volatile and high concentrations are not likely to occur unless it is being used at an elevated temperature. Cyclohexanone does produce throat irritation at higher concentration. Occasional skin contact should cause no irritation but prolonged or frequent skin contact may result in defatting of the skin. The current OSHA standard and TLV is 50 ppm.

E. Evaluation Results and Discussion

The well drillers exposure to THF and cyclohexanone was determined by collecting four breathing zone samples on charcoal tubes. One sample showed a level of 20 ppm for THF. This concentration was for a 20-minute period of time and represented the days exposure. Therefore, the time-weighted concentration for an 8-hour day was less than 1 ppm. (The sample was collected on a worker applying cement to the casing.) The remainder

of the samples had no detectable levels of THF. No levels of cyclohexanone were detected. Although only a limited number of samples were collected, the samples were judged to be representative in respect to application technique and duration and represent typical exposures.

A total of twenty workers constituted the group evaluated. The age of the cohort (which were all male) varied from 24 to 64 with an average age of 40 years (39.95). Seventy percent of the cohort were White and thirty percent were Black and no other race was represented. The average time the cohort worked as well drillers ranged from one and one-half to thirty years with a mean of eleven years (10.93). All but two workers smoked an average of a pack of cigarettes a day (1.28) and have done so from 2 to 38 years for an average of 18.35.

Table I presents the symptomatology reported by the workers. None of the twenty workers interviewed and examined believed they had any occupationally caused symptomatology. The most common complaint included chest tightness and soreness with shortness of breath. Since these symptoms are attributed to obesity and hypertension, and in the absence of pertinent physical findings, no particular occupational significance is attributed to this information. Dry or sore throat was the next most common symptom and in each case it was thought to be related to cigarette smoking. Burning or itching of the eyes in both cases was considered to be due to seasonal allergies. The weight loss of two individuals was voluntary. The runny nose, wheezing or whistling in the chest was thought to be related to sinusitis and emphysema complicated by cigarette smoking. Tearing of the eyes, coughing and stuffy nose again were considered to be related to allergic responses, cigarette smoking and seasonal "colds." There were no reported cases of nausea, vomiting, or loss of consciousness or burning on urination. One worker complained of muscle weakness and headache. With the worker's permission the NIOSH medical officer contacted his personal physician. The problem is not believed related to his occupation.

The NIOSH medical officer questioned each worker about significant past medical illnesses. (Table II.) Six of the twenty workers (30%) reported diseases related to the kidneys, bladder or prostate. Three of the twenty workers (15%) reported gastrointestinal disorders including ulcers. One case of heat rash was reported; one case of psoriasis and one case of poison ivy. Reported chest problems included one case of tuberculosis, and one case of emphysema. Two cases of hypertension were also elicited through histories, both of which are presently under medical care and are progressing. An additional case of hypertension was found during the physical examinations. (Three cases of hypertension in twenty workers is not an unusual number.) None of the workers or their physicians felt these diseases were related to their occupation.

Table II further details that none of the workers had seen a physician ninety days prior to the study although four are on medication -- two for high blood pressure and two for ulcers.

Table III -- systolic and diastolic blood pressures and pulse rates are given as recorded. This was done rather than summaries so that independent investigators would have the actual data available to them. A summary appears on the bottom of Table III. None of the figures are decreased with the exception of No. 7 and this is deemed normal since the individual is athletically inclined and is in excellent condition.

Table IV presents a summary of the physical findings and indicates all 20 of the workers examined were determined to be physically normal with the exception of throat irritation. This was thought to be due to irritation of smoking cigarettes.

V. SUMMARY AND CONCLUSIONS

The cohort of 20 represents only a small portion of the well drillers using PVC cement. However, none of the 20 workers interviewed believed they had any occupationally caused symptomatology and none on examination had any physical disabilities related to exposure of THF or cyclohexanone. Observations of work practices indicated that the length of exposure to the PVC cement is limited and occurs only outdoors. Environmental samples showed only low concentrations of THF and no detectable levels of cyclohexanone. Therefore based on environmental samples, observations of work practices and medical interviews and examinations there appears to be no health hazard related to the use of PVC cement.

AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE I

Water Well Drilling Companies of Plastic Wells
General Area West Tennessee

RHE 75-168

Symptomatology Reported By Workers

	<u>Percent</u>	<u>Number</u>
Chest tightness, soreness, heaviness	20	(4)
Shortness of breath	20	(4)
Dry or sore throat	15	(3)
Burning or itching eyes	10	(2)
Weight loss	10	(2)
Runny nose	10	(2)
Wheezing or whistling in chest	10	(2)
Tearing of eyes	5	(1)
Coughing	5	(1)
Stuffy nose	5	(1)
Muscle weakness	5	(1)
Headache	5	(1)
Nausea/vomiting	0	(0)
Loss of consciousness	0	(0)
Burning on urination	0	(0)

(Totals more than 100% as some workers reported multiple symptoms.)

TABLE II

Water Well Drilling Companies of Plastic Wells
General Area West Tennessee

RHE 75-168

Previous Medical Diagnoses Not Work Related

	<u>%</u>	<u>No.</u>
Kidney or bladder problems including prostatitis	30	6
Gastrointestinal problems including ulcer	15	3
Skin rash including heat rash	15	3
Chest problems including tuberculosis	10	2
Heart problems including hypertension	10	2
Neurological problems including mental	5	1
Muscle problems	5	1
Arthritis	5	1

Some Workers Reported Multiple Previous Diagnoses

Medication at present	20	4
Seeing physician at present	0	0

TABLE III

Water Well Drilling Companies of Plastic Wells
General Area West Tennessee

RHE 75-168

No.	Systolic	Diastolic	Pulse
1	110	60	66
2	110	62	60
3	120	80	84
4	124	78	72
5	110	68	76
6	120	76	101
7	100	60	66
8	122	82	68
9	100	90	112
10	144	92	86
11	122	88	78
12	130	88	80
13	150	94	86
14	158	94	84
15	118	78	68
16	110	60	60
17	130	92	78
18	132	70	68
19	136	88	72
20	136	80	80
Mean	124.1	79.0	76.3
Range	100 - 158	60 - 94	60 - 112

TABLE IV

Water Well Drilling Companies of Plastic Wells
General Area West Tennessee

RHE 75-168

Physical Findings

<u>Positive Signs</u>	<u>Percent</u>	<u>(Number)</u>
Cardiac	0	(0)
Pulmonary	0	(0)
Dermatitis	0	(0)
Mucous Membrane		
Irritation (throat)	15	(3)
Neurological (physical)	0	(0)
