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. 78-53-510

YARTER-TEK CORPORATION
DENVER, COLORADO

JULY 1978

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Yarter-Tek Corporation in Denver, Colorado, on May 3 and 12, 1978. At the time of this evaluation breathing zone and general room air samples were taken for silver and cyanide. Concentrations of cyanide were all below laboratory detection limits. One out of three silver samples taken exceeded the most recent evaluation criteria. All workers were interviewed. None of these workers had complaints related to their work. The silver sample that exceeded the evaluation criteria was a general room sample that was taken very near the electroplating solution containing silver. It was impossible to get breathing zone samples, since people did not work in the room where the electroplating solution was kept. The remaining two samples taken in different parts of the work place were below the laboratory limits of detection. Based on this information, a health hazard did not appear to exist at the time of this evaluation.

II. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Yarter-Tek Corporation
2. U.S. Department of Labor/OSHA - Region VIII
3. NIOSH - Region VIII

For the purpose of informing six affected workers, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

III. INTRODUCTION

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

NIOSH received such a request from the owner of Yarter-Tek Corporation in Denver, Colorado, to evaluate potential exposures associated with the preparation and operation of a silver cyanide electroplating solution.

IV. HEALTH HAZARD EVALUATION

A. Processes Evaluated

The Yarter-Tek Corporation produces a silver electroplating solution composed of a mixture of potassium cyanide, calcium carbonate, and silver cyanide. This solution is sold to dentists along with a small electroplating tank. This apparatus is used by the dentist to electroplate dental bridges, inlays, and so forth. During the preparation and operation of the electroplating solution, it is possible for the generation of airborne levels of silver and cyanide that could be harmful to the dentist and the person preparing the solution. These areas were all monitored during this evaluation.

B. Evaluation Design and Methods

There was a total of six workers involved in this evaluation. Breathing zone and general room air samples to determine the concentrations of silver and cyanide were taken during the preparation and operation of the electroplating apparatus. Silver samples were taken on 37 millimeter filters using pumps operated at 1.5 liters per minute. Silver samples were analyzed by atomic absorption spectroscopy. Cyanide samples were taken using impingers filled with 0.1 normal sodium hydroxide using pumps operated at 1.5 liters per minute. Cyanide samples were analyzed according to Physical & Chemical Analysis Method #116. All workers were interviewed.

C. Criteria for Assessing Workroom Concentrations of Air Contaminants

Three sources of criteria generally used to assess workroom concentrations of air contaminants are: (1) NIOSH criteria for recommended standards; (2) recommended threshold limit values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1977; and

(3) Occupational Safety and Health Administration (OSHA) standards (29 CFR 2920), January 1976. NIOSH criteria and ACGIH TLVs represent the most recent and relevant recommendations and are given prominence in this evaluation.

	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M3)		
Substances	NIOSH Criteria for Recommended Standard	TLV	Current OSHA Standard
Silver	----	0.01	0.01
Cyanide.	5.0 "C"	5.0	5.0

mg/M3 = milligrams of substance per cubic meter of air

"C" = ceiling concentration and should never be exceeded

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

D. Toxicology

Silver--all forms of silver are extremely cumulative ones that enter body tissues, and very little is excreted. Generalized argyria develops when silver oxide or salts are inhaled or ingested by workmen who handle compounds of silver. This condition may lead to permanent pigmentation of the skin and eyes. The worker's face, forehead, neck, hands, and forearms develop a dark slate gray color. The dust of silver salts may cause local irritation of the skin, burns of the conjunctiva, and blindness (reference 1).

Cyanide--all forms of cyanide are extremely toxic. The route of entry may either be by inhalation, ingestion, or absorption. It produces cytotoxic anoxia by inhibition of cytochrome oxidase and other enzyme systems. Acute signs of cyanide exposure are headache, dizziness, rapid pulse, nausea, vomiting, unconsciousness, convulsions, and death. Halogenated forms of cyanide produce irritation of eyes and respiratory tract. Chronic exposures to cyanide produce headaches, anorexia, nausea, dizziness, palpatation of the heart, weakness, and dermatitis. There may be damage to the central nervous system from prolonged anoxia (references 2, 3).

E. Conclusions

Only general room samples were taken during the silver electroplating procedure, since workers were not occupying the laboratory where the electroplating solution was in operation. Cyanide concentrations were below the laboratory detection limit of 0.001 milligrams per sample. Breathing zone and general room air samples were taken for silver during an entire normal procedure of weighing and preparing the solution. Two general room samples were below the laboratory limit of detection of 0.002 milligrams per sample. One silver breathing zone air sample was 0.04 milligrams per cubic meter, which exceeds the evaluation criteria of 0.01 milligrams per cubic meter.

V. RECOMMENDATIONS

1. The electroplating solution should be kept free of organic debris such as unclean dentures, inlays, and so forth.

2. All workers should be informed of the hazards of working with cyanide and silver.

3. No one should be using the electroplating solution unless familiar with its operation.

VI. REFERENCES

1. Department of Health, Education, and Welfare, NIOSH 77-181. Occupational Diseases - A Guide to Their REcognition, revised edition 1977, p. 391-393.

2. Plunkett, E. R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, p. 120-121.

3. NIOSH criteria for a recommended standard...occupational exposure to cyanide and cyanide salts. NIOSH #77-108, October 1976.

VII. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF
SILVER

YARTER-TEK CORPORATION

May 12, 1978

Sample Number	Location	Time of Sample	Silver (mg/M3)	Type of Sample
10	Dental Laboratory	11:00 AM - 2:05 PM	0.04	Breathing Zone
1	" "	" "	*	General Room
15	" "	" "	*	General Room
		EVALUATION CRITERIA	0.01	
		LABORATORY LIMIT OF DETECTION	0.002 mg/sample	

* = below laboratory limit of detection

TABLE II

ATMOSPHERIC CONCENTRATIONS OF
CYANIDE

YARTER-TEK CORPORATION

May 12, 1978

Sample Number	Location	Job Classification	Time of Sample	Cyanide (mg/M3)
1	Silver Cyanide Weighing Station	Engineer	9:00 AM-11:00 AM	*
2	"	General Room	" "	*
3	"	" "	" "	*
5	"	" "	" "	*
6	"	" "	" "	*
		EVALUATION CRITERIA		5.0
		LABORATORY LIMIT OF DETECTION		0.001 mg/sample

* = below laboratory limit of detection