U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45225

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-13-316

CARGILL ELEVATOR - TERMINAL 4
PORTLAND, OREGON

JULY 1976

I. TOXICITY DETERMINATION

The National Institute for Occupational Safety and Health conducted a health hazard evaluation of grain handling activities at the Cargill Elevator in Portland, Oregon on March 22-24, 1976. Based upon the results of these environmental and medical investigations the following determinations are made:

(1) Workers experienced negligible exposures to vapors of carbon tetrachloride and carbon disulfide, potentially toxic components of the fumigant Weevil-Cide.® No direct fumigation procedures were conducted within the elevator during the period of the evaluation, however, prior treatment of some of the grain handled had been noted.

(2) Grain dust exposures were generally low, but the potential for significant dust exposures at the barge unloading, galley, and basement bin operations was demonstrated.

(3) No cases of severe skin problems were found during the survey. It is impossible because of the lack of objective information to predict what agent or agents caused the two or three reported cases of severe dermatitis. Malathion is known to be a primary sensitizer and could have been responsible, however since only those on board ship contracted the dermatitis, it is equally possible that some ship board contaminant may have been the culprit.

(4) The paucity of physical findings to correlate with symptoms by history of upper respiratory irritation, cough and breathing difficulties most likely reflects the time of year and weather conditions during which the survey was conducted. It was cool, wet, and windy, all of which according to employees interviewed were ideal situations for handling grain.

(5) In conclusion at the time of the evaluation, no serious health hazard was believed to exist at the Cargill Grain Elevator - Terminal 4.

(6) Because of the known toxicity of the agents being used, a series of of recommendations for surveillance and health maintenance are enclosed in this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this hazard evaluation determination report are available upon request from NIOSH, Division of Tecnnical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies were sent to:

(a) Cargill Elevator - Terminal 4
(b) Representative of Employees, I.L.W.U. Local #8
(c) U.S. Department of Labor - Region X
(d) NIOSH - Region X

For the purposes of informing affected employees of the determination, the employer shall upon its receipt post a copy of the Determination Report for a period of 30 calendar days at or near the work place(s) of affected employees. The employer shall take steps to insure that the posted determination is not altered, defaced, or covered by other material during such period.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S. Code 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 concentration 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 Cargill Elevator, I.L.W.U. Local #8, expressing concern regarding the alleged occurrence of dermatitis and respiratory difficulties in operations at the Terminal 4 elevator in Portland, Oregon. The fumigant "Weevil-Cide"® had reportedly been used at the elevator for approximately 15 years; further, malathion frequently had been applied to outgoing grain and 2-3 employees working on board ship had recently developed severe dermatitis of the hands, face and trunk.

IV. HEALTH HAZARD EVALUATION

A. Description of Operations - Conditions of Use

Cargill Grain Elevators of Portland, Oregon, were constructed in 1917 and several additions and improvements have been made since that time. On the occasion of the visit to Cargill a rather extensive renovation of the grain elevators was underway. The purpose of this remodeling was to install modern dust protection equipment, the major part of which was the installation of enclosed conveyor systems.

Many different varieties of wheat are handled and stored at Cargill. The grain is brought to Cargill by barge, truck and railroad car.

The grain is unloaded, sampled, and weighed by Oregon State inspectors and then transferred to storage bins. If evidence of insect contamination is observed during storage the grain is treated with Weevil-Cide® at the rate of 15 gallons per 10,000 bushels. The Weevil-Cide® consists of 81% carbon tetrachloride, 17% carbon disulfide and 2% sulfur dioxide and is applied to the storage bin by dumping the liquid through a hatch on the top of the bin itself. The Weevil-Cide® is volatile and rapidly dissipates leaving residual sulfur dioxide as an indicator of grain treatment.

When the grain is being removed from the storage areas it is again weighed and sampled by the State inspector. Not infrequently, malathion is applied to the grain if the purchaser requests it. This is accomplished by an open-spray system that delivers the insecticide to the conveyor carrying the grain as it leaves the storage bin.

B. Evaluation Progress and Design

A NIOSH investigating team including two industrial hygienists and a physician conducted an on-site evaluation of the Cargill Elevator operations on March 22-24, 1976.

Twenty members of I.L.W.U. Local #8 were evaluated by questionnaire and physicial examination. The physical consisted of examination of the skin, nose, throat, and lungs. Seventeen of the 20 worked in various areas of the grain elevator itself, the remaining three were those who worked on board ship while grain was being loaded.

In addition to the medical evaluation multiple environmental studies were performed for dust and organic vapors which workers may normally encounter. Personal breathing zone air samples were collected for potential exposure to grain dust and components of Weevil-Cide (carbon tetrachloride and carbon disulfide) during normal operations on two days of operation. Malathion was not sampled for because it had not been used for 6-8 weeks prior to this visit.

C. Evaluation Methods

1. Environmental

(a) Organic Vapors - Carbon Tetrachloride ($CC\ell_4$) and Carbon Disulfide (CS_2).

A sampling train consisting of two glass tubes containing activated charcoal in series was used to collect breathing zone air samples at a flow rate of 50 cc/minute. Separate trains were employed for collection of organic vapors; laboratory analyses were separately performed for either $CC\ell_4$ or CS_2 utilizing gas chromatographic techniques by the NIOSH contract laboratory in Salt Lake City, Utah.

(b) Grain Dust

Total particulate, breathing zone grain dust air samples were collected on pre-weighed vinyl metricel filters at an air flow rate of 1.5 liters/minute. Gravimetric analysis for total weight gain on particulate-laden filters was likewise performed in the Salt Lake City laboratory.

D. Evaluation Criteria

In evaluating the alleged problems at Cargill, four major agents to which the employees might be exposed were present. These were carbon tetrachloride, carbon disulfide, malathion and grain dust.

Carbon Tetrachloride

Carbon tetrachloride is potentially the most problematical substance to which the Cargill employees are exposed. It is known to be a mucous membrane irritant, and a central nervous system depressant. It can cause red blood cell damage as well as affecting-liver and kidney cells resulting in cellular disruption with resultant hepatic and/or renal failure. The major routes of exposure are inhalation or oral ingestion. NIOSH in its Criteria for a Recommended Standard, Occupational Exposure to Carbon Tetrachloride[1], recommends a safe exposure level of 2 ppm (or ~12 mg/M^3) for an 8-hour time-weighted average daily exposure. The legal health standard currently being enforced by OSHA is 10 ppm as an 8-hr. TWA, with an accepted ceiling concentration of 25 ppm.

Carbon Disulfide

The most common effects of carbon disulfide are on the central nervous system. Irritability, nervousness, insomnia, neuropathies, and excessive fatigue are the effects most commonly encountered. Exposure by inhalation or skin contact are the most common avenues of carbon disulfide contact. The American Conference of Governmental Industrial Hygienists have recommended[2] a permissible exposure level of 20 ppm or 60 mg/M^3 based upon an 8-hour TWA, a value similarly enforced at the present time by OSHA.

Malathion (O'O-Dimethyl dithiophosphate of diethyl mercaptosuccinate)

Malathion is a commonly used insecticide whose toxic effects are minimal at commonly encountered concentrations. However, it has been reported to be a primary sensitizer and as such may be responsible for inducing contact dermatitis. The American Conference of Governmental Industrial Hygienists have recommended[2] a permissible exposure level of 10 mg/M^3 based upon an 8-hour TWA exposure. The OSHA standard presently in effect is 15 mg/M^3.

Grain Dust

This entity is currently quite difficult to describe in so far as its position relative to disease processes is concerned. It has been suggested to be an irritant, a sensitizer, or capable of producing a "bysinossis" like pulmonary disease[3]. Standards of exposure are nonexistent and none are being enforced. Much work is being done at this time which ultimately will lead to the clarification of the current situation.

E. Evaluation Results and Discussion

1. Environmental

The results of environmental studies conducted on March 23 and 24, 1976 are summarized in Table I. Seventeen personal breathing zone samples were collected during the evaluation. Total grain dust concentrations ranged from 0.2 to 70.6 milligrams/meter ^{3}. Results were generally low: 14 of 17 samples were less than 5 mg/M^3, however, sample concentrations of the galley operators - 70.6, barge unloader - 6.2, and the basement bin floor operator - 7.8 mg/M3 were considerably higher. Concurrent sampling results of organic vapors were minimal: carbon tetrachloride concentrations ranged from 0.0001 to 0.82 mg/M^3 - well below the recommended criteria of 12.6 mg/M^3; carbon disulfide was not detected in any samples, so that all samples were less than 0.08 mg/M3 - criterion of 60 mg/M3.

Elevator activities conducted on March 23 consisted of the following:

(a) Car unloading - 23 hopper cars/100 ton each
(b) Barge unloading - 2000 ton/72 million bushel
(c) Ship unloading - 5300 ton/190 million bushel

Activities on March 24 were:

(a) Car unloading - 15 hopper cars
(b) Ship unloading - 5000 ton

Some hopper cars (4 or 5) unloaded on March 23 were noted with placards indicating a treatment with the fumigant "Dowfume EB5" within the period of 4 to 7 days prior to unloading at Cargill. "Dowfume EB5" contains approximately 65% by volume carbon tetrachloride.

No treatment of grain within the elevator, either by Weevil-cide or malathion, occurred during the time of this evaluation.

Weather conditions during the two days of the survey were characteristic of the location and time of year: temperatures ranged from 40-55°F, light to heavy rainfall occurred intermittently, winds were variable from 5-15 mph.

2. Medical

Seventeen workers from the grain elevator and three workers from the ship area, most of whom were sampled environmentally, were investigated by questionnaire and physical examination. The grain elevator workers had a mean age of 46.6 years with a range of 27-59 years, and a duration of employment of 6.4 years with a 0.2-17 year range. The ship workers had a mean age of 47 years with a range of 39-55 years and mean work time of 18.3 years with a range of 16-20 years. Because of the small number in the on-board ship group, they will be considered a part of the other population, but it must be noted that they are not employees of Cargill.

Table II reflects the symptoms elicited by history. Forty percent (8 of 20) thought they had symptoms related to their work. Thirty percent (6 of 20) reported upper respiratory irritation symptoms, 20% (4 of 20) reported cough, 25% (5 of 20) shortness of breath, 0% chest pain or tightness, 5% (1 of 20) wheezing, and 15% (3 of 20) skin rash. Forty-five percent (9 of 20) of those interviewed were smokers.

Table III reflects the findings elicited by physical examination. Skin rash was observed in 5% (1 of 20), erythema of nose or throat was not observed in any of the workers examined, and 10% (2 of 20) had abnormal lung examinations consisting of either distant breath sounds or rales. No other abnormalities were detected.

The original health hazard evaluation request was submitted primarily because two or three unionized employees working on ship board while grain was being loaded, developed severe skin rash. These employees were not available for interview at the time of our visit. The workers who were interviewed and gave a positive history of skin rash related it to the grain dust adhering to their skin secondary to excessive perspiration during the hot months of the year. These were reported to be minor irritations. The upper respiratory irritancy was thought by the workers to be related to grain dust.

Approximately 2-3 months prior to the visit, 2 or 3 employees working on board ship while malathion treated grain was being loaded developed severe dermatitis of the hands, face and trunk. No other workers in the area, that is either on the ship or in the elevators themselves had any difficulties at that time. No recurrent difficulties have occurred since the initial incident. Several man-days of lost work time resulted from this episode, but no hospitalization was necessary. The rash was reported to have lasted for a short time (less than 10 days) then disappeared and has not recurred.

F. Conclusions

The environmental samples collected indicate negligible concentrations of carbon tetrachloride and carbon disulfide that are well within the recommended standard for each of these compounds. Grain dust exposures were generally low, but the potential for significant dust exposures at the barge unloading, galley, and basement bin operations was demonstrated.

No cases of severe skin problems were found during our survey. The one occurrence detected by physical examination was of minor gradation and is not felt to be signficant. It is impossible because of the lack of objective information to predict what agent or agents caused the two or three reported cases of severe dermatitis. Malathion is known to be a primary sensitizer and could have been responsible. However, since only those on board ship contracted the dermatitis, it is equally possible that some ship board contaminant may have been the culprit. The number of symptoms by history of upper respiratory irritation, cough and breathing difficulties are as stated in Table II. The paucity of

physical findings to correlate with these symptoms most likely reflects the time of year during which this survey was conducted. It was cool, wet, and windy, all of which according to the employees interviewed, were ideal situations for grain handling.

The conclusion at this time no serious health hazard problem is believed to exist at Cargill Grain Elevator #4.

V. RECOMMENDATIONS

Because of the known toxicity of the substances being used the following recommendations are offered to provide for the continued worker protection, surveillance, and health maintenance.

1. The retention of a dermatologist by Union or Management to be available to readily evaluate skin problems should they arise again in the future. If these problems should become evident, appropriate skin testing should be instituted to assess the causitive agent. NIOSH will be available to assist in this endeavor if necessary.

2. Initial employment chest X-ray and pulmonary Function studies with follow-up at 1-2 year intervals depending on the workers age are recommended.

3. Initial employment blood profiles for assessment of liver function with appropriate follow-up are recommended based on length of employment, work place, and employee age.

If any further problems arise and the suggestions made in this report prove inadequate to deal with these problems, then a resubmission of hazard evaluation request should be executed.

VI. REFERENCES

1. Criteria for a Recommended Standard...Occupational Exposure to Carbon Tetrachloride, NIOSH Publication, 1975.

2. American Conference of Governmental Industrial Hygienists' TLVs for 1975, and Supporting Documentation of TLVs, 1971.

3. "Report on Grain Millers Survey Study," John Rankin, M.D., University of Wisconsin, #HL15389, SCOR Grant 1976.

4. Industrial Hygiene and Toxicology, Volume II, F. A. Patty, Second Edition, 1963.

VII. AUTHORSHIP AND ACKNOWLEGMENT

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TABLE I: RESULTS OF PERSONAL BREATHING ZONE AIR SAMPLES COLLECTED AT CARGILL ELEVATOR, PORTLAND, OREGON ON MARCH 23-24, 1976

Concentration values are reported in units of milligrams (mg) of specified substance (grain dust, carbon tetrachloride - $CC\ell_4$, and carbon disulfide - CS_2 per cubic meter of air and represent time-weighted average concentrations over the associated sampling periods shown.

March 23, 1976

Operator	Sampling Period	Grain Dust	$CC\ell_4$	CS_2
Hopper Car Unloader	10:27 - 16:40	1.8	0.0001	<0.05 *
Hopper Car Unloader	09:50 - 16:49	1.2	0.0002	<0.08
Galley Operator	09:12 - 16:47	70.6	0.0002	<0.07
Barge Unloader	09:06 - 11:45	6.2	0.72	<0.08
Scale Floor Operator	08:55 - 16:48	1.0	0.0003	<0.05
Scale Floor Operator	09:42 - 16:46	1.6	0.0002	<0.06
Millwright	08:52 - 16:17	0.4	0.0002	<0.06
Millwright	09:01 - 16:17	0.2	0.0007	<0.07
Millwright	08:45 - 16:29	2.7	0.0003	<0.04
Oiler	08:58 - 16:18	1.1	0.002	<0.04
Recommended Environmental Criteria		N.A.	12.6	60

*None detected, minimum detection level 0.5 microgram (μg) for carbon disulfide (CS_2) per tube

March 24, 1976

Hopper Car Unloader	08.57 - 11:39	2.1	0.0001	<0.06
Hopper Car Unloader	09:08 - 11:45	3.6	0.0005	<0.06
Top Bin Floor Operator	09:14 - 16:52	1.3	-	<0.07
Basement Bin Floor Operator	09:10 - 16:44	7.8	0.82	<0.04
Galley Operator	09:15 - 16:03	3.1	0.0081	<0.06
Ship Operator	08:43 - 11:47	3.6	0.0001	<0.07
Ship Operator	08:36 - 14:56	3.2	0.0002	<0.07

TABLE II

HISTORY OF SYMPTOMS ELICITED BY QUESTIONNAIRE
CARGILL ELEVATOR - TERMINAL 4
PORTLAND, OREGON

Symptoms thought to be work related	8 of 20	40%
Upper respiratory irritation	6 of 20	30%
Cough	4 of 20	30%
Shortness of breath	5 of 20	25%
Chest pain or tightness	0 of 20	0%
Wheezing	1 of 20	5%
Skin rash	3 of 20	15%
(Smokers	9 of 20	45%)*

TABLE III

FINDINGS BY PHYSICAL EXAMINATION
CARGILL ELEVATOR - TERMINAL 4
PORTLAND, OREGON

MARCH 23-24, 1976

Skin rash	1 of 20	5%
Nose and throat erythema	0 of 20	0%
Lungs (distant breath sounds or rales)	2 of 20	10%
Other abnormalities	0 of 20	0%

*"Smokers" - not a symptom.