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

SUPPLEMENT TO
HEALTH HAZARD EVALUATION DETERMINATION
COMPOSITE REPORT ON THIRAM FOR HHE 75-184-356

KLAMATH REFORESTATION, INC.
TOLEDO, OREGON

DECEMBER, 1976

I. INTRODUCTION

The National Institute for Occupational Safety and Health received the request for a hazard evaluation from the owner of Klamath Reforestation, Inc. This Supplement to the Composite Report on Thiram contains specific data on work process, study conduct, and results for the Klamath Reforestation, Inc. A discussion of the findings and the conclusions drawn from the study as a whole are contained in the Composite Report.

II. HEALTH HAZARD EVALUATION

A. Description of Process

Klamath Reforestation, Inc., plants reforestation trees under contract to various land holders such as lumber firms, the U.S. Forest Service, etc. During the survey, they were planting "plug" seedlings for the Georgia Pacific Company and bare root trees for Starker Forest Company.

The planters working for this concern make their own living arrangements in the community as they regularly work out of Toledo. Planters average about 1200 trees per day per man. Most planters work a five (5) day work week with weekends off, although some variation is allowed.

B. Study Progress and Design

1. General

The environmental-medical evaluations were conducted on April 5-6, 1976. The bare root trees being planted on April 5 by part of the crew were 2-1 hemlock and the plug seedlings being planted both days were douglas fir. All the trees planted had been treated with a Thiram-Latex mixture.

On April 5, the weather was cloudy, 47° - 50°F, and there was a slight breeze. On April 6 it was sunny, 50° - 60°F, and there was a slight breeze. There was a creek nearby, however, no one was observed washing their hands prior to eating.

Medical interviews were conducted in the field. Pre-exposure bloods were drawn before going into the field on April 5 and post-exposure blood after returning from the field April 6. Exposure was 2 work days, either both to plug planting or the first to bare root planting and the second to plug planting.

2. Environmental Sampling

For this evaluation 18 breathing zone samples were collected on April 5 and 6, 1976. Fifteen were from persons planting plugs and three were from persons planting bare root trees.

Two trees were collected from the lot of bare root trees being planted in order to determine the concentration of Thiram per gram of trees (above ground portion only). Two plug trees were also collected. In addition, one cigarette was collected from a planter after he had simulated smoking it to determine if Thiram particles were being transferred to the cigarette during smoking.

3. Medical Sample

The 10 man crew was included in the study with questionnaires completed on all 10. All the planters were men with an average age of 26.6, a median age of 26.5, and a range of 18 to 40.

C. Evaluation Results

1. Environmental (Tables III and IV taken from Composite Report)

As shown in Table III (Company Number 6) none of the three breathing zone air samples collected on April 5 during the planting of Thiram treated bare root trees by Klamath Reforestation contained detectable amounts (5.0 micrograms) of Thiram per filter.

In contrast 5 of 15 (33%) breathing zone air samples collected during the planting of Thiram treated plug seedlings were positive and 10 of the 15 (67%) were not detectable. The five positive samples contained 0.011, 0.012, 0.019, 0.020 mg of Thiram per cubic meter of air.

These concentrations are 1/450th (0.2%) to 1/250th (0.4%) the existing Federal standards of 5 mg/m^3 or 1/12th (8.3%) to 1/7th (14.3%) of the amount needed to achieve, through inhalation, a daily intake of 2 mg per day which the World Health Organization considers a maximum daily exposure.

Results of the tree samples taken (Table IV) show that there were 400 and 700 micrograms per grams of tree for the 2-1 hemlock being planted (trees #23 and 24) and 8400 and 6100 micrograms per gram of plug seedling being planted (trees #25 and 26). (For all trees sampled during the study, the amount of Thiram on the trees ranged from 89 ug thiram/gm of tree to 8400 ug/gm).

No Thiram was detectable on the cigarette examined after being handled as if it were being smoked.

2. Medical

Table VIII E shows symptoms developing over the study period and Table IX B gives symptoms reported on detailed questioning.

All planters had worked for more than two weeks on the job. Means for systolic and diastolic blood pressure and pulse along with the 95% confidence limits of the mean for these 10 planters were (respectively): 120.6 $\pm$ 5.6 mm Hg; 68.8 $\pm$ 8.0 mm Hg; 74.4 $\pm$ 6.2 /min. Blood pressures below 140 mm Hg systolic and 90 mm Hg diastolic are considered normal. Younger persons would expect to be lower than older adults. There is no defined lower limit of normal in otherwise healthy individuals.

One of the pre-test blood specimens contained 30 ppm Thiram. The other 9 were below the limits of detection. All planters had been planting Thiram treated trees during the preceding few weeks. The mean Dopamine beta-Hydroxylase level for the group was 71.1 $\pm$ 42.2 units/liter.

III. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE III

RESULTS OF PERSONAL BREATHING ZONE AIR SAMPLES COLLECTED DURING TREE PLANTING OPERATIONS
THIRAM STUDY, REFORESTATION, PACIFIC NORTHWEST

COMPANY IDENTIFICATION NUMBER	TYPE OF TREES PLANTED	TREE TREATMENT	NUMBER POSITIVE* FOR THIRAM DETECTION	NUMBER NEGATIVE FOR THIRAM DETECTION	THIRAM CONCENTRATION mg/m^3	TOTAL NUMBER SAMPLES
3	Bare Root	"Snow"**	0	10	10 < 0.02	10
	Bare Root	Thiram	4	6	0.029 0.028 0.030 0.157 6 < 0.02	10
4	Bare Root	"Snow"	0	9	9 < 0.01	9
	Bare Root	Thiram	3	14	0.021 0.021 0.018 14 < 0.02	17
5	Bare Root	Thiram	1	5	0.021 5 < 0.02	6
6	Bare Root	Thiram	0	3	3 < 0.02	3
	Plugs	Thiram	5	10	0.012 0.020 0.021 0.011 0.019 10 < 0.02	15
7	Bare Root	None (no Thiram or Snow)	0	7	7 < 0.02	7

* Minimum detectable amount of Thiram was 5.0 micrograms per filter.
** Snow - a substance similar in appearance to Thiram.

TABLE IV

THIRAM CONCENTRATION ON TREES
THIRAM STUDY, REFORESTATION, PACIFIC NORTHWEST

SAMPLE NUMBER	HOW TREATED	TYPE AND SIZE OF TREE	RESULTS ug THIRAM/gm TREE*	WEIGHT OF TREE gm*
Tree 1	No Thiram	Plug Douglas Fir	0	2.0**
Tree 2	No Thiram	Plug Douglas Fir	0	2.4
Tree 3	Thiram	Plug Douglas Fir	1800	2.0**
Tree 4	Thiram	Plug Douglas Fir	1800	2.0**
Tree 5	"Snow"***	2-0 Douglas Fir	4	12.0**
Tree 6	"Snow"	2-0 Douglas Fir	6	12.0**
Tree 7	Thiram	2-0 Douglas Fir	105	13.8
Tree 8	Thiram	2-0 Douglas Fir	97	16.7
Tree 9	Thiram	2-1 Douglas Fir	89	19.8
Tree 10	Thiram	2-1 Douglas Fir	122	14.1
Tree 11	No Thiram	2-1 Douglas Fir	1	27.4
Tree 12	No Thiram	2-1 Douglas Fir	1	21.5
Tree 13	Thiram	2-0 Hemlock	707	4.2
Tree 14	Thiram	2-0 Hemlock	628	5.0

* Above Ground Portion of Tree

** Estimated Weight of Tree (Laboratory only reported total weight of Thiram found on these samples).

*** Snow - A substance similar in appearance to Thiram

TABLE IV, cont.

THIRAM CONCENTRATION ON TREES

THIRAM STUDY, REFORESTATION, PACIFIC NORTHWEST

SAMPLE NUMBER	HOW TREATED	TYPE AND SIZE OF TREE	RESULTS ug THIRAM/gm TREE*	WEIGHT OF TREE - gm*
Tree 15	"Snow"	2-0 Douglas Fir	7	6.8
Tree 16	"Snow"	2-0 Douglas Fir	1	8.5
Tree 17	Thiram	2-1 Douglas Fir	3000	50.1
Tree 18	Thiram	2-1 Douglas Fir	2800	15.9
Tree 19	Thiram	1-1 Douglas Fir	3700	15.9
Tree 20	Thiram	1-1 Douglas Fir	4300	25.2
Tree 21	Thiram	2-0 Douglas Fir	3100	12.3
Tree 22	Thiram	2-0 Douglas Fir	3000	13.5
Tree 23	Thiram	2-1 Hemlock	400	18.1
Tree 24	Thiram	2-1 Hemlock	700	7.6
Tree 25	Thiram	Plug Douglas Fir	8400	3.1
Tree 26	Thiram	Plug Douglas Fir	6100	3.9

* Above ground portion of tree

TABLE VIII E

SYMPTOMATOLOGY BY EXPOSURE GROUP - TREE PLANTERS
THIRAM STUDY, KLAMATH REFORESTATION, INC., TOLEDO, OREGON
HHE 75-184
April 5-6, 1976

Symptoms Developing Over the Study Period

SYMPTOMS	THIRAM TREES TOTAL	PERCENT
Number of Workers	10	
Eye Complaints	4	44
Nasal Irritation	1	11
Throat Irritation	1	11
Cough	3	33
Chest Discomfort or Shortness of Breath	2	22
Skin Problems	2	22
Total with Local Symptoms Likely To Be Due to Thiram in the Planters Planting Thiram Trees	6	67
Headaches	1	11
Dizziness or Lightheadedness	1	11
Fatigue	0	0
Nausea or Upset Stomach	0	0
Diarrhea	0	0
Alcohol Intolerance	1 of 8	12
Total with Systemic Symptoms Likely To Be Due to Thiram in the Planters Planting Thiram Trees	1	11
Kidney Complaints	3	33
Total with No Complaints	3	33

TABLE IX E

SYMPTOMATOLOGY BY EXPOSURE GROUP - TREE PLANTERS
THIRAM STUDY, KLAMATH REFORESTATION, INC., TOLEDO, OREGON
HHE 75-184
April 5-6, 1976

Symptoms by History

SYMPTOMS	TOTAL	PERCENT
Number of Workers	10	
Self Health Assessment		
Good	7	70
Fair	1	10
Poor	1	10
Omitted	1	10
Eye Complaints	5	50
Nasal Irritation	3	30
Throat Irritation	1	10
Cough	1	10
Chest Discomfort or Shortness of Breath	0	0
Skin Problems	2	20
Total with Local Symptoms Likely To Be Due to Thiram	6	60
Headaches	1 (2)*	10
Dizziness or Lightheadedness	0	0
Fatigue	1	10
Increased Problem with Prolonged Work Week	1	10
Nausea or Upset Stomach	0	0
Diarrhea	0	0
Alcohol Intolerance	2(1) of 9	22
Total With Systemic Symptoms Likely To By Due to Thiram	2(2)	20
Total Other Problems Probably or Definitely Not Related to Thiram	3	33
Total With No Health Complaints	3	33

*Nature of the problem was insufficiently clear to definitely categorize it. These are not included in the percentages. Workers with the questionable complaints were excluded from the "No health complaint" group.