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HARBOR SCREENING TESTS OF MARINE BORER INHIBITORS — III

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U. S. NAVAL CIVIL ENGINEERING LABORATORY

Port Hueneme, California

FOREWORD

This is the ninth in a series of reports[1-8] on studies conducted by the Laboratory to develop more effective methods and materials for preservation of wooden structures exposed to the attack of marine boring organisms.

It is the third of a series of reports on the results of harbor exposure of treated and untreated test panels which are exposed until there is heavy Limnoria attack or until the panel is weakened by Martesia or teredine attack. Some results which have been reported previously[6,7] are included in this report for the purpose of comparison.

HARBOR SCREENING TESTS OF MARINE BORER INHIBITORS — III

Y-R005-07-007

Type C

by

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OBJECT OF TASK

To develop materials and techniques for treating timbers to retard or prevent marine borer attack.

ABSTRACT

The Laboratory is exposing wood panels impregnated with various materials to determine their resistance to attack by marine borers. This report lists the results of harbor tests of treated panels removed from exposure between 1 August 1959 and 15 August 1960. It also lists all treated panels which have been exposed for one year or more and which have shown no attack or very slight amounts of attack. Treatments which have been exposed for less than one year are not reported unless they have failed and have been removed from test.

When impregnated into wood test panels, creosote, coal tar, 70-30 creosote-coal tar solution, tributyltin coconut fatty acid salt, and tributyltin oxide, in general, give protection against Martesia and teredine (Teredo) attack but not against Limnoria. Inorganic copper and mercury compounds, phenylmercuric oleate, dibenzofuran, fluorene, and toxaphene protect against Limnoria attack only. Resistance to Limnoria attack, without adversely affecting resistance to Martesia and Teredo, is increased by the addition to creosote of aluminum, copper, or manganese oxinates, and dieldrin, phenylmercuric chloride, or phenylmercuric oleate; by the addition to coal tar of copper naphthenate or phenyl-mercuric oleate; and by the addition to a 70-30 solution of creosote-coal tar of copper naphthenate, dieldrin, endrin, phenylmercuric chloride, or phenylmercuric oleate. Combinations of copper compounds or complexes plus oxine or polyvinylmethyl ether-maleic anhydride, and dieldrin or endrin plus malachite green oxalate are resistant to Limnoria and teredine borers but not to Martesia.

Copper naphthenate plus linseed oil is resisting all types of borer attack both at Port Hueneme and Pearl Harbor. Nickel sulfate plus sodium monohydrogen arsenate, and tributyltin oxide plus ammonium sulfide show promise but have only been exposed for one year at Port Hueneme. The tropical woods afambeau, antidesma pulvinatum, and greenheart show good resistance to borer attack. Greenheart panels extracted with various solvents, except those which had been extracted with boiling sea water, also are continuing to show borer resistance.

These results together with results obtained from current and future laboratory toxicity tests will be used in developing additional wood treatments. Panel testing will be continued to screen these treatments under harbor exposure conditions. Emphasis will be placed on the addition to creosote and creosote-coal tar solutions of materials which are toxic to Limnoria.

INTRODUCTION

The destructive action of marine boring organisms on structures submerged in sea water presents a major maintenance problem to Navy shore installations. The replacement of wood piling destroyed by these organisms is a costly operation, and, in addition, may remove the pier from operation during the reconstruction period.

Under Project Y-R005-07-007, the Chief, Bureau of Yards and Docks, requested the Laboratory to investigate methods and materials for reducing or preventing borer attack on wooden marine structures of the Naval Shore Establishment.

One phase of this study is the impregnation of wood panels with toxic materials and the exposure of these treated panels to marine borers in harbors. The treating materials are chosen on the basis of their toxicity to marine borers as determined by the Toxicity Testing Procedure developed at this laboratory.[8] The exposure of small treated panels provides a system for rapidly screening large numbers of potentially useful treatments. The panels can be treated in ordinary laboratory equipment, require relatively small quantities of treating materials, and a large number of treatments can be exposed in a relatively small dock area. Also, the surface-to-volume ratio of these panels is so high that the rate of leaching of the preservative by the sea water is much higher than it would be in round piling sections. This small-panel screening procedure is further accelerated by exposing the more promising treatments in Pearl Harbor where, because of higher water temperature and greater numbers and kinds of borers, attack begins after exposure in a half to a fourth the time required for initial attack at Port Hueneme. The exposure of full-sized piles would provide a more accurate evaluation of a preservative treatment, but the use of this method in a preliminary screening would be uneconomical.

PROCEDURE

Treatment

Treating solutions are made up on a volume percent basis for liquids and a weight percent basis for solids. With the exception of coal tar, creosote, creosote-coal tar solutions, and copper naphthenate solution, only inert solvents are used to

make up solutions to 100 percent. In general, these inert solvents are xylene for nonpolar compounds, water for polar compounds, and cellosolve for combinations of polar and nonpolar compounds.

Unless otherwise noted, southern yellow pine panels are used in this study. Sets of ten panels are tagged, weighed, impregnated by the vacuum method, weighed again to determine the amount of preservative retention, and then air-dried to remove any inert solvent present. Details of the procedure are described in Reference 6. Several sets of pressure-treated ponderosa pine samples submitted by the U. S. Forest Products Laboratory, Madison, Wisconsin, are also evaluated.

Exposure and Evaluation

The panels are mounted on single or double Monel racks which are suspended horizontally in the harbor about 3 feet above the mud line by nylon parachute cords. At Port Hueneme, the racks are removed twice monthly for cleaning the panels. Panels are inspected and rated twice monthly during their first year of exposure, and monthly thereafter. Panels are removed whenever structural failure due to borer damage is imminent. At Pearl Harbor, the panels are cleaned and inspected monthly, removed whenever extensive damage is noted, and returned to the Laboratory for evaluation.

The extent of Limnoria and Martesia attack can be readily determined by inspection of the surface of the panel. In its early stages, teredine attack is very difficult to detect by surface inspection. When this type of attack reaches an advanced stage, the panel loses much of its structural strength and can easily be bent or snapped in two. All panels which are removed from exposure test are sawed in two to show the amount of teredine damage. Damage is assessed as follows:

0	=	none
T	=	trace
VL	=	very light
L	=	light
M	=	moderate
H	=	heavy
VH	=	very heavy

Limnoria, Martesia, and teredine damage are always rated separately. Although individual records are kept for each panel which has been treated and exposed, the tabular data presented in this report represent average data for all panels of a given treatment exposed at the location specified.

EVALUATION OF TREATMENTS

This report deals with all treated and untreated panels which have been removed from exposure between 1 August 1959 and 15 August 1960, and all panels which have been exposed for at least one year and which were still under test on 15 August 1960.

1. Creosote, Coal Tar, and Creosote-Coal Tar Solutions (Table I): Both creosote and coal tar resist Martesia attack and their preservative ability toward teredine borers increases with increasing concentration. Neither is resistant to Limnoria attack, however. From data obtained to date, 70-30 creosote-coal tar solution is, at best, only equal to creosote in preservative ability. The addition of coal tar to creosote does not improve resistance to Limnoria attack.

2. Inorganic Compounds (Table II): Panels treated with copper acetate (1-5%), copper sulfate (2-10%), cuprammine sulfate (5%), cupric ethylenediamine sulfate (5%), mercuric acetate (1 and 5%), and mercuric chloride (1%) are showing excellent resistance to Limnoria attack and good resistance to teredine attack at Port Hueneme. Exposure of some of these treatments at Pearl Harbor revealed good resistance to Limnoria, but their early failure because of Martesia and teredine attack rates them as inferior to creosote. Redwood and western red cedar panels treated with copper sulfate (1 and 10%) have a much longer service life than similarly treated southern yellow pine panels.[6,7] According to data collected thus far, copper naphthenate (containing 6% copper) and solubilized copper oxinate (containing 4% copper) are providing better protection against all types of marine borers than is creosote or 70-30 creosote-coal tar solution. They are extremely effective against Limnoria.

3. Metal Organic Compounds (Table III): The incomplete data indicate that p-aminophenylmercuric acetate (0.5 and 1%) and phenylmercuric oleate (5%) are quite effective against Limnoria but rather ineffective against Martesia and teredine borers. Also, tributyltin coconut fatty acid salt (1%) and tributyltin oxide (0.5 and 1%) are less effective against Limnoria than are organic mercury compounds, but are more effective against Martesia and teredine borers than these compounds.

4. Organic Compounds (Table IV): The incomplete data indicate that dibenzofuran (10%) and toxaphene (1%) have merit as preservative additives because of their resistance to Limnoria attack, although they do not resist teredine attack. Malachite green oxalate (1%) in redwood is more effective than the same treatment in southern yellow pine,[6] but this resistance is only toward teredine attack.

5. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar Solutions (Table V): Combination treatments containing creosote, coal tar, or creosote-coal tar solutions plus an additive toxic to Limnoria are being studied. Although data are incomplete, the results to date show the following trends:

When added to creosote, aluminum oxinate (1-5%), copper arsenate (14.7%), copper oxinate (1-5%), dieldrin (1-5%), manganese oxinate (1-5%), phenylmercuric chloride (1%), and phenylmercuric oleate (1 and 5%) improve its resistance to Limnoria by lengthening the time to initial attack by these organisms. When added to coal tar, copper naphthenate (0.5-2%) and phenylmercuric oleate (1 and 5%) improve its resistance to Limnoria attack. When added to creosote-coal tar solutions, copper naphthenate (3%), dieldrin (1 and 5%), endrin (1 and 5%), phenylmercuric chloride (1%), and phenylmercuric oleate (1 and 5%) improve their resistance to Limnoria attack. Biphenyl (10%), chlordan (5 and 10%), diphenylmethane (10%), solubilized tributyltin oxide (1%), tributyltin oxide (0.5 and 1%), and zinc naphthenate (5%) do not increase the time to initial Limnoria attack when added to creosote and/or coal tar.

6. Other Combination Treatments (Table VI): Although most of the data on these treatments are incomplete, some trends are indicated. Copper naphthenate (3%) plus linseed oil (50%) shows good resistance to all types of borer attack both at Port Hueneme and Pearl Harbor. Copper sulfate (1%) plus oxine (2%), copper sulfate (5 or 10%) plus polyvinylmethyl ether-maleic anhydride (PVM/MA) (3.2%), and cuprammine sulfate (5%) plus PVM/MA (3.2%) are effective against Limnoria and teredine borers at Port Hueneme. Both dieldrin (1 or 5%) and endrin (1 or 5%) plus malachite green oxalate (1 or 2%) are effective against all borers but Martesia. Biphenyl (5%) and diphenylmethane (5%) plus malachite green oxalate combinations are effective against teredine borers, slightly effective against Martesia, and ineffective against Limnoria. Panels treated with copper epoxy (2%) plus malachite green oxalate (1%) are still under test after 24 months at Port Hueneme, but failed at Pearl Harbor in 9 months because of Martesia attack. Panels double-treated with copper sulfate (14.73%) or nickel sulfate (14.86%) plus sodium monohydrogen arsenate (20.06%) by the Forest Products Laboratory and panels treated with tributyltin oxide (1%) plus ammonium sulfide (20-24%) by NCEL were not attacked by any type of borer during their first 12 months in Port Hueneme harbor. Similarly treated panels have been exposed at Pearl Harbor for less than one year and therefore are not included in this report. Panels double-treated with sodium silicate (5 and 10%) plus hydrochloric acid (0.8 and 1.5 M) followed by autoclaving were extremely brittle and many were broken during cleaning. However, one set has not been attacked after 18 months in Hueneme harbor.

7. Untreated Panels and Solvent-Extracted Untreated Panels (Table VII): The tropical woods afambeau, antidesma pulvinatum, and greenheart are far superior to the domestic woods Douglas fir, ponderosa pine, and southern yellow pine in borer resistance. In fact, these tropical woods seem to be comparable to domestic woods which have been treated with creosote or 70-30 creosote-coal tar solution. Greenheart panels which have been extracted with acetic acid, chloroform, ether, or methanol are also showing good borer resistance, but those extracted with boiling sea water failed in 14 months at Port Hueneme.[7]

DISCUSSION

No one has yet discovered a single material which is effective in preventing all types of marine borer attack. However, studies both at this laboratory and elsewhere have shown that certain materials are specifically toxic to individual types of marine borers. Therefore, treatments consisting of a combination of materials, each of which is toxic to one or more of the species of marine borers can be used in the improvement of existing preservatives and in the development of new preservatives. Creosote, for example, is effective against Martesia and teredine attack but ineffective against Limnoria attack; and certain metal organic compounds and organic insecticides are toxic only to Limnoria.

The addition of a metal organic compound or an organic insecticide to creosote or creosote-coal tar solutions will, generally, produce a treatment which increases the time to initial Limnoria attack and thus also increases the harbor life of a test panel. In some combination treatments, however, initial Limnoria attack occurred earlier than was expected, based on results obtained by exposing panels treated with the individual components. For example, panels treated with 1 percent dieldrin sustained no Limnoria attack but very heavy teredine attack at Port Hueneme in 9-1/2 months;[7] panels treated with 50 percent creosote in xylene sustained initial Limnoria attack in an average of 14 months and very heavy Limnoria attack but no teredine attack in an average of 35 months (Table I). Panels were therefore treated with a combination of 1 percent dieldrin and 50 percent creosote in xylene. The average time to initial (trace) Limnoria attack was only 12 months, but these panels still showed only a trace of Limnoria attack after 21 months. According to monthly inspection records, the panels treated with 50 percent creosote had sustained, on the average, very light Limnoria attack in 21 months, with an increase in the rate of attack from that time until their removal from test, after an average of 35 months of exposure.

Therefore, in spite of the fact that the data for the time to initial Limnoria attack are useful in developing new treatments, only exposure to failure will establish the superiority of one treatment over another. Only then can the total exposure time and the type and amount of borer attack sustained by an experimental treatment be compared to that sustained by a standard treatment.

CONCLUSIONS

1. Creosote and creosote-coal tar solutions are effective against Martesia and teredine borers but not against Limnoria. Creosote and 70-30 creosote-coal tar solution have about the same preservative ability.

2. In general, inorganic copper and mercury compounds and cuprammonium compounds are effective against Limnoria only, but copper naphthenate and solubilized copper oxinate have exhibited a degree of effectiveness toward all types of borers.

3. Phenylmercury compounds are effective against Limnoria attack; tributyltin compounds, against Martesia and teredine attack.

4. Dibenzofuran and toxaphene should be investigated further because of their resistance to Limnoria attack.

5. The addition of certain inorganic and metal organic compounds and insecticides to creosote or creosote-coal tar solutions improves their resistance to Limnoria attack.

6. Combination treatments of a copper compound plus a precipitating agent or of an insecticide plus malachite green oxalate show some promise as preservatives in areas where only Limnoria and teredine borers are present.

7. Afambeau, antidesma pulvinatum, and greenheart are comparable to creosoted Douglas fir or southern yellow pine in borer resistance.

FUTURE PLANS

1. Exposure tests of treated wood panels will be continued.

2. The results of harbor exposure tests together with laboratory toxicity tests will be used in developing additional wood treatments.

3. Panels will be treated with individual materials which exhibit high toxicity to marine borers and resistance to leaching in laboratory screening tests.

4. Emphasis will be placed on the addition to creosote, coal tar, or creosote-coal tar solutions of materials which are toxic to Limnoria.

5. Materials which show a high toxicity toward Limnoria and which are soluble in polar solvents will be mixed with compounds such as malachite green oxalate.

6. Materials which show a high toxicity toward Limnoria and which are soluble in nonpolar solvents will be mixed with compounds such as tributyltin coconut fatty acid salt.

7. Panels will be double-treated when two specifically toxic agents cannot be dissolved in a single solvent system.

8. Treatments which show promise in panel tests will be used to impregnate piling for use in the Naval Shore Establishment.

ACKNOWLEDGMENT

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7. NCEL. Technical Report 077, Harbor Screening Tests of Marine Borer Inhibitors — II, by H. Hochman and T. Roe, Jr., 16 March 1960.

8. NCEL. Technical Report 048, The Toxicity of Chemical Agents to Marine Borers — I, by H. Vind and H. Hochman, 29 June 1960.

SYMBOLS USED IN TABLES

* This panel series, or part thereof, was still under test as of 15 August 1960.

** One or more panels in this series had been attacked by this species as of 15 August 1960.

*** One or more panels in this series were not attacked by this species during the entire period of harbor exposure.

N No panels in this series had been attacked by this species as of 15 August 1960.

NC Not checked.

S Panel split during cleaning operations.

X Data not available as of 15 August 1960.

FPL Panels furnished by the Forest Products Laboratory, Madison, Wisconsin.

0 No attack.

T Trace attack.

VL Very light attack.

L Light attack.

M Moderate attack.

H Heavy attack.

VH Very heavy attack.

† Does not include the weight of ammonium sulfide solution absorbed.

Note: In some cases there are discrepancies between the time to initial attack and the total exposure time of the panel. This generally occurs when one or more panels in a series are not attacked by a given species. The data presented in the tables are the average of time to initial attack of those panels which were attacked by a given species and the average of the total exposure time of all panels in the series.

Table I. Creosote, Coal Tar, and Creosote-Coal Tar Solutions

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
50% Coal Tar	17.3	14	31	VH	O	15.9	3	NC	8	M	L	O
10% Creosote	3.32	9-1/2	13	H	T	3.24	5	NC	7	M	T	T
25% Creosote (1/8" panel)	7.92 7.84	21 12	30-1/2 15	M L	T L	6.56	5	NC	8	H	T	VL
50% Creosote	16.3 18.6 17.0	14 10-1/2 9	35 30 22	VH VH H	O O O	16.2 18.4	5-1/2 5	NC N	11 31*	M	O	O
50% Creosote (1/8" panel)	14.5	19	32	M	T	14.4	5-1/2	NC	9-1/2	H	T	O
60% Creosote 1/8" panel)	18.6	23	39	M	O	18.8	7-1/2	16***	15	H	T	O
70% Creosote (1/8" panel)	24.9	27	44	M	O	22.6	7-1/2	NC	13	M	O	O
80% Creosote (1/8" panel)	29.0	25	36	M	O	22.6	6	NC	13-1/2	L	O	O
90% Creosote (1/8" panel)	35.2	27	37	M	O	35.5	**	**	42*			
100% Creosote (1/8" panel)	31.0	32-1/2	58-1/2*			34.3	7-1/2	--	15	H	O	O
100% Creosote	35.7 40.2 32.7 33.3 37.2 29.9 33.5 39.1	22 26 29 19-1/2 17-1/2 16 11 2	49* 41-1/2* 40-1/2* 39* 36-1/2* 32* 30* 12*			40.8 35.7 42.4	9 11 5	-- ** 17	17 39* 31*	M	O	O
100% Creosote (FPL)	45.8	**	12*									

Table 1. Creosote, Coal Tar, and Creosote-Coal Tar Solutions (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
100% Creosote in Douglas fir	39.8	N	25-1/2*									
	41.8	**	12*			41.5	7-1/2	**	20*			
70-30 Creosote-Coal Tar	40.4	28	49*			38.4	10	--	22-1/2	M	O	O
	27.1	N	30*			32.6	5	--	22	VH	O	O
	19.7	12	24*									
	23.1	7	18*									
70-30 Creosote-Coal Tar in Douglas fir	38.5	**	25-1/2*			33.9	9	10-1/2	20*			
	41.4	4	12*									

Table II. Inorganic Compounds

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Copper Acetate	0.38	N	24*									
1% Copper Acetate + ht. tr.	0.38	**	24*									
1% Copper Acetate in Douglas fir	0.21	N	24*									
1% Copper Acetate + ht. tr. in Douglas fir	0.30	N	24*									
2% Copper Acetate	0.75	**	24*									
2% Copper Acetate + ht. tr.	0.74	**	24*									
2% Copper Acetate in Douglas fir	0.71	N	24*									
2% Copper Acetate + ht. tr. in Douglas fir	0.67	**	24*									
5% Copper Acetate	1.86	N	24*									
5% Copper Acetate + ht. tr.	1.98	N	24*									
5% Copper Acetate in Douglas fir	1.14	N	24*									
5% Copper Acetate + ht. tr. in Douglas fir	1.36	N	24*									
2% Copper Epoxy	0.65	10***	14	T	H	0.66	6	5-1/2	20*			
2% Copper Epoxy (high resin)	0.55	9***	12	T	VH	0.68	6	6	9	L	L	L

Table II. Inorganic Compounds (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
2% Copper Sulfate + ht. tr. in Douglas fir	0.71	N	18*									
5% Copper Sulfate	1.84	20-1/2	25-1/2*									
5% Copper Sulfate in Douglas fir	1.54	N	23*									
5% Copper Sulfate + ht. tr. in Douglas fir	1.75	**	23*									
10% Copper Sulfate	3.89	**	24*									
10% Copper Sulfate + ht. tr.	3.95	**	24*									
10% Copper Sulfate in Douglas fir	3.19	N	23*									
10% Copper Sulfate + ht. tr. in Douglas fir	3.51	N	23*									
10% Copper Sulfate in Redwood	3.55	N	40-1/2*			3.49	--	17	17	O	L	O
10% Copper Sulfate in Western Red Cedar	2.52	N	40-1/2*			3.88	--	9	11-1/2	O	M	VL
5% Solubilized Copper Oxinate	1.55	22***	30	L	M	1.74	6***	6	9-1/2	VL	L	VL
10% Solubilized Copper Oxinate	3.22	**	40-1/2*			3.18	--	14-1/2	18	O	H	T
25% Solubilized Copper Oxinate	7.3	**	40-1/2*			8.1	22***	21	30-1/2	L	M	VL
50% Solubilized Copper Oxinate	15.5	N	40-1/2*			14.9	N	**	39*			
5% Cuprammine Sulfate	1.33	N	25-1/2*			1.38	**	N	20*			

Table II. Inorganic Compounds (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
5% Cuprammine Sulfate + ht. tr.	1.85	N	24*			1.89	15	N	20*			
5% Cuprammine Sulfate in Douglas fir	2.45	**	25-1/2*			2.33	**	N	20*			
5% Cuprammine Sulfate + ht. tr. in Douglas fir	1.59	N	23*			1.47	**	**	20*			
5% Cupric Ethylenediamine Sulfate	1.79	11	16-1/2	VL	VH	1.84	6-1/2	7	8	L	T	H
5% Cupric Ethylenediamine Sulfate ht. tr.	2.01	**	24*			1.91	9	10-1/2	12	VL	VL	H
5% Cupric Ethylenediamine Sulfate in Douglas fir	1.23	N	23*			1.49	11	**	20*			
5% Cupric Ethylenediamine Sulfate ht. tr. in Douglas fir	1.69	**	21-1/2*			1.85	**	12	20*			
7% Cupric p-Phenylenediamine Sulfate	2.79	7	9-1/2	VL	H	2.72	N	5	20*			
7% Cupric p-Phenylenediamine Sulfate +ht. tr.	2.71	7***	7	T	H	2.62	**	5	20*			
7% Cupric p-Phenylenediamine Sulfate in Douglas fir	2.48	11***	12	T	VH	2.60	X	6	9	T	L	H
7% Cupric p-Phenylenediamine Sulfate +ht. tr. in Douglas fir	2.07	14***	12	T	VH	2.12	X	6	20*			
1% Mercuric Acetate	0.33	21***	20-1/2	T	VH	0.32	8-1/2	9	10	VL	L	H
1% Mercuric Acetate+ht. tr.	0.41	9 1/2***	12	T	VH	0.44	10***	9-1/2	9-1/2	T	L	VH

Table II. Inorganic Compounds (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Copper Formate + ht. tr. in Douglas fir	0.45	**	25-1/2*			0.47	7	10	12	L	L	M
2% Copper Formate + ht. tr. in Douglas fir	0.95	N	25-1/2*			0.94	12	12	14	L	VL	L
1% Copper Naphthenate	0.29 0.28	** N	41-1/2* 12*			0.26	24-1/2	26-1/2	27-1/2	L	L	L
1% Copper Naphthenate in Douglas fir	0.18	**	21-1/2*			0.16	**	**	20*			
2% Copper Naphthenate	0.53	11-1/2***	15	T	H	0.54	6-1/2***	7	9	L	L	M
3% Copper Naphthenate in Douglas fir	0.31	N	21-1/2*			0.45	N	N	20*			
6% Copper Naphthenate	1.18 1.31	N N	41-1/2* 12*			1.22	N	39	39*			
6% Copper Naphthenate in Douglas fir	0.46	N	21-1/2*			0.32	**	**	20*			
1% Copper Sulfate in Redwood	0.35	**	40-1/2*			0.38	--	9	11	O	H	O
1% Copper Sulfate in Western Red Cedar	0.34	**	40-1/2*			0.46	--	6	9-1/2	O	H	O
2% Copper Sulfate	0.75	**	24*									
2% Copper Sulfate + ht. tr.	0.75	N	24*									
2% Copper Sulfate in Douglas fir	0.55	N	18*									

Table II. Inorganic Compounds (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
5% Mercuric Acetate	2.03	**	30*			2.06	panels lost					
5% Mercuric Acetate + ht. tr.	2.10	N	30*			2.26	--	13-1/2	13-1/2	O	L	H
1% Mercuric Chloride	0.45	21	22	M	VH	0.44	NC	NC***	12-1/2	T	VL	H
	0.44	--	22	O	H							
	0.45	--	26-1/2	O	VH							
1% Mercuric Chloride + ht. tr.	0.45	--	44	O	M	0.44	14-1/2	17	19	VL	L	H
	0.44	--	34	O	M							
	0.45	--	32	O	H							

Table III. Metal Organic Compounds

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
0.5% p-Aminophenylmercuric Acetate	0.19	19	26	O	H	0.21	11-1/2	**	30*			
1% p-Aminophenylmercuric Acetate	0.39	19	30*			0.37	11***	8-1/2	13	T	L	H
1% p-Dimethylaminophenylmercuric Acetate in Douglas fir	0.35	**	23*			0.35	N	**	20*			
5% Phenylmercuric Oleate	1.7	--	29	O	H	1.7	--	17	17	O	H	H
1% Tributyltin Coconut Fatty Acid Salt	0.27	N	32*			0.25	8	--	20	H	O	O
0.5% Tributyltin Oxide	0.13	**	25-1/2*									
1% Tributyltin Oxide	0.27	N	25-1/2*			0.25 0.26	10 5	N N	18* 13-1/2*			

Table IV. Organic Compounds

Treatment	Port Hueneme					Pearl Harbor						
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test		
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Dimethyl alkyl (C_{16-18}) Amine	0.26	5	11	M	H							
1% N-Cocomorpholine	0.26	3-1/2	4	VL	H							
10% Dibenzofuran	2.8	**	12*									
10% Fluorene	2.8	3	10-1/2	VL	H							
1% Malachite Green Oxalate in Redwood	0.42	22	49*			0.41	3***	9	10	VL	M	O
1% Toxaphene	0.26	N	25-1/2*									

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Aluminum Oxinate in Creosote (1/8" panel)	0.35 34.5	37	58-1/2*			0.34 33.7	6	9	20*			
2.5% Aluminum Oxinate in Creosote (1/8" panel)	0.77 29.9	22-1/2	58-1/2*			0.73 27.7	5-1/2	**	20*			
5% Aluminum Oxinate in Creosote (1/8" panel)	1.47 28.3	27	41-1/2	H	O	1.67 31.8	6	8-1/2**	14-1/2	H	VL	O
1% Azoxybenzene 50% Coal Tar	0.30 14.5	7	20	VH	O	0.29 14.8	7	9-1/2	14-1/2	H	L	T
10% Biphenyl 50% Creosote	3.0 15.6	11	18*			3.1 15.5	**	N	14*			
						3.1 15.7	**	12-1/2	18*			
5% Chlordan 50% Creosote	1.51 15.1	**	12*									
5% Chlordan 50% 70-30 Creosote-Coal Tar	1.52 15.2	3	12*									
10% Chlordan 50% Creosote	2.45 12.2	**	12*									
10% Chlordan 50% 70-30 Creosote-Coal Tar	3.49 17.5	**	12*									
0.5% Copper Naphthenate 50% Coal Tar	0.15 15.2	22-1/2	30*			0.14 13.6	9	9	20	M	M	VL

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
0.5% Solubilized Copper Oxinate 50% Coal Tar	0.15 14.7	7	19	VH	O	0.14 14.2	6	9	9	H	VL	O
1% Solubilized Copper Oxinate 50% Coal Tar	0.31 15.4	9-1/2	29	VH	VL	0.31 15.4	9	9	16	M+	M	O
3% Solubilized Copper Oxinate 50% Creosote	0.50 8.4	N	18*			0.46 7.7	**	N	13-1/2*			
						0.59 9.9	N	N	18*			
1% Dieldrin 50% Creosote	0.29 14.8	12	21-1/2*			0.29 14.2	9	8	20*			
1% Dieldrin 50% Creosote in Douglas fir	0.22 10.9	**	21-1/2*			0.24 11.8	**	10	20*			
1% Dieldrin 50% 70-30 Creosote-Coal Tar	0.30 15.0	17	21-1/2*			0.31 15.5	9***	8	20*			
1% Dieldrin 50% 70-30 Creosote-Coal Tar in Douglas fir	0.25 12.8	**	21-1/2*			0.20 9.9	**	8-1/2	20*			
1% Dieldrin in Creosote	0.35 33.2	**	21-1/2*			0.34 33.2	**	**	20*			
1% Dieldrin in Creosote in Douglas fir	0.22 21.6	**	21-1/2*			0.22 22.0	**	10	20*			
1% Dieldrin in 70-30 Creosote-Coal Tar	0.29 28.9	**	21-1/2*			0.32 31.5	**	**	20*			

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
5% Phenylmercuric Oleate 10% Creosote 30% Coal Tar	1.6 3.1 9.4	34-1/2	46-1/2*			1.8 3.7 10.6	--	20	28	0	H	0
5% Phenylmercuric Oleate 50% Creosote 10% Coal Tar	1.9 19.3 3.9	41	46-1/2*			1.6 16.5 3.3	19	22-1/2	42*			
5% Phenylmercuric Oleate 50% Creosote 30% Coal Tar	1.5 15.3 9.2	38-1/2	46-1/2*			1.7 16.9 10.1	27	22-1/2	42*			
5% Phenylmercuric Oleate 51.2% Creosote 30% Coal Tar	1.8 18.4 10.2	36	46-1/2*			1.6 16.4 9.6	**	**	42*			
5% Phenylmercuric Oleate 71% Creosote 10% Coal Tar	1.8 24.8 3.5	38	46-1/2*			2.0 28.8 4.1	25-1/2	15-1/2	42*			
6% Phenylmercuric Oleate in Creosote	2.2 39.6	30	46-1/2*			2.5 41.4	**	24	42*			
1% Solubilized Tributyltin Oxide 50% Coal Tar	0.33 16.3	11	30*			0.31 15.4	6-1/2	**	30*			
0.5% Tributyltin Oxide 50% Coal Tar	0.15 14.6	12	25-1/2*									
1% Tributyltin Oxide 50% Coal Tar	0.27 13.5	12-1/2	25-1/2*			0.31 15.8	6	N	13-1/2*			

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Phenylmercuric Oleate 50% Creosote 10% Coal Tar	0.27 13.7 2.7	30	46-1/2*			0.29 14.4 2.9	9	NC	20	M	T	[illegible]
1% Phenylmercuric Oleate 50% Creosote 30% Coal Tar	0.31 15.7 9.4	33-1/2	46-1/2*			0.37 18.6 11.1	6	9***	25	VH	VL	[illegible]
1% Phenylmercuric Oleate 60% Creosote 30% Coal Tar	0.24 22.5 10.3	**	46-1/2*			0.33 21.5 9.8	17	23	42*			
1% Phenylmercuric Oleate 74% Creosote 10% Coal Tar	0.20 15.1 2.0	34	46-1/2*			0.29 21.1 2.9	7-1/2	18	42*			
5% Phenylmercuric Oleate 10% Coal Tar	1.2 2.4	30	46-1/2*			1.2 2.3	15	19-1/2	20-1/2	VL	H	VL
5% Phenylmercuric Oleate 30% Coal Tar	1.1 6.6	33	46-1/2*			1.2 7.3	17***	16-1/2	29	T	H	L
5% Phenylmercuric Oleate 10% Creosote	1.7 3.4	28	40	M	L	1.7 3.3	15***	21	24	VL	H	VL
5% Phenylmercuric Oleate 50% Creosote	2.0 19.7	29	46-1/2*			1.7 17.4	17-1/2	15-1/2	36	H	M	T
5% Phenylmercuric Oleate 10% Creosote 10% Coal Tar	1.1 2.3 2.3	40	46-1/2*			1.27 2.52 2.52	18	21	36	T	M	VL

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Dieldrin in 70-30 Creosote-Coal Tar in Douglas fir	0.23 22.7	**	21-1/2*			0.25 24.7	**	**	20*			
5% Dieldrin 50% Creosote	1.53 15.3	**	18*			1.31 13.1	**	8	18*			
						0.84 8.4	8	6	13-1/2*			
5% Dieldrin 50% 70-30 Creosote-Coal Tar	1.50 15.0	**	18*			1.48 14.8	N	**	13-1/2*			
10% Diphenylmethane 50% Creosote	2.81 14.1	9	18*			3.07 15.4	6	**	18*			
1% Endrin 50% Creosote in Douglas fir	0.24 11/8	N	21-1/2*			0.27 13.4	**	11	20*			
1% Endrin in Creosote in Douglas fir	0.24 24.1	N	21-1/2*			0.26 26.0	N	9	20*			
1% Endrin in 50% 70-30 Creosote-Coal Tar in Douglas fir	0.25 12.2	**	21-1/2*			0.25 12.4	N	11	20*			
1% Endrin in 70-30 Creosote-Coal Tar in Douglas fir	0.24 23.7	**	21-1/2*			0.23 23.2	**	11-1/2	20*			
5% Endrin 5% Creosote	1.41 14.1	**	18*			1.43 14.3	**	4	18*			
						1.38 13.8	11	6	13-1/2*			

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
5% Endrin 50% 70-30 Creosote-Coal Tar	1.67 16.7	**	18*			1.49 14.9	**	7	18*			
1% Manganous Oxinate in Creosote (1/8" panel)	0.34 32.9	36	58-1/2*			0.36 35.6	6	7	14-1/2	H	VL	O
2.5% Manganous Oxinate in Creosote (1/8" panel)	0.92 35.5	30	58-1/2*			0.86 33.1	6	7	14	H	VL	O
5% Manganous Oxinate in Creosote (1/8" panel)	1.71 32.7	35	58-1/2*			1.85 34.8	11	11 1/2	18 (S)	VL	VL	O
1% Aluminum Oxinate 1.25% Copper Oxinate 0.56% Manganous Oxinate in Creosote (1/8" panel)	1.06 36.7	33	37	M	O							
14.86% Nickel Sulfate 20.06% Sodium mono H Arsenate in Creosote (FPL)	3.71 3.43 20.7	N	12*									
10% Phenyl Ether 50% Creosote	3.02 15.1	7	18*			2.91 16.6	7	**	18*			
1% Phenylmercuric Chloride 10% Creosote	0.34 3.4	24-1/2	32	H	L	0.38 3.8	13-1/2	9	16-1/2	L	L	M
1% Phenylmercuric Chloride 50% Creosote	0.36 18.1	28	49*			0.37 18.8	7-1/2	15***	19	H	T	O

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Copper Naphthenate 50% Coal Tar	0.28 14.1	**	30*			0.26 12.9	18	N	31*			
2% Copper Naphthenate 50% Coal Tar	0.60 15.0	16	24*			0.59 14.9	10	5-1/2	20*			
3% Copper Naphthenate 50% Creosote in Douglas fir	0.51 8.6	**	21-1/2*			0.64 10.7	N	**	20*			
3% Copper Naphthenate 50% 70-30 Creosote-Coal Tar in Douglas fir	0.56 9.3	N	21-1/2*			0.43 7.1	**	**	20*			
1% Copper Oxinate in Creosote (1/8" panel)	0.34 33.1	39	58-1/2*			0.35 35.1	10	8	20*			
2.5% Copper Oxinate in Creosote (1/8" panel)	0.58 22.2	35	58-1/2*			0.72 27.3	6	9	20*			
5% Copper Oxinate in Creosote (1/8" panel)	1.58 30.0	36	58-1/2*			1.45 27.5	6	6	15	M	L	O
	1.30 24.4	32	50*									
14.73% Copper Sulfate 20.06% Sodium mono H Arsenate in Creosote (FPL)	3.23 3.01 3.87	N	12*									
5.3% Copper Salt of Naphthenic Acid in 50% Creosote	1.64 15.5	7	25-1/2*			1.54 14.4	9	10-1/2	20*			

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Phenylmercuric Chloride in Creosote	0.26 26.2	28-1/2	49*			0.42 41.9	12-1/2	15-1/2	42*			
1% Phenylmercuric Chloride 50% 70-30 Creosote-Coal Tar in Douglas fir	0.23 11.8	**	21-1/2*			0.23 11.4	**	7	13-1/2*			
1% Phenylmercuric Chloride in 70-30 Creosote-Coal Tar in Douglas fir	0.16 15.1	**	21-1/2*			0.19 18.4	**	**	20*			
1% Phenylmercuric Oleate 10% Coal Tar	0.23 2.3	24	39	VH	L	0.25 2.5	6	NC	13-1/2	L	L	H
1% Phenylmercuric Oleate 30% Coal Tar	0.18 5.3	24	39	M	L	0.17 5.21	6-1/2	NC	12	VL	H	M
1% Phenylmercuric Oleate 10% Creosote	0.36 3.6	25	34	H	L	0.33 3.3	6-1/2	15	13-1/2	M	M	H
1% Phenylmercuric Oleate 50% Creosote	0.34 17.0	26-1/2	49*			0.33 17.1	11-1/2	**	42*			
1% Phenylmercuric Oleate in Creosote	0.37 36.8	29-1/2	49*			0.37 37.3	6	NC	11	M	T	O
1% Phenylmercuric Oleate 10% Creosote 10% Coal Tar	0.23 2.3 2.3	24-1/2	31	L	M	0.25 2.5 2.5	5	NC	11-1/2	L	M	M
1% Phenylmercuric Oleate 10% Creosote 30% Coal Tar	0.36 3.6 10.7	29-1/2	46-1/2*			0.32 3.2 9.5	6	15	14-1/2	M	M	O

Table V. Combination Treatments Containing Creosote, Coal Tar, or Creosote-Coal Tar (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Tributyltin Oxide 50% Creosote	0.33 16.6	**	18*			0.30 14.6	11-1/2	N	18*			
5% Zinc Salt of Naphthenic Acid in 50% Creosote	1.6 16.3	6-1/2	25-1/2*			1.5 14.9	6-1/2	7	20*			

Table VI. Other Combination Treatments

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
5% Biphenyl 2% Malachite Green Oxalate	1.66 0.66	4	18*			1.8 0.70	3	7-1/2	13	VH	L	O
5% Chlordan 2% Malachite Green Oxalate	1.87 0.72	**	12*									
2% Copper Acetate 1% Malachite Green Oxalate	0.75 0.38	N	24*			0.75 0.38	10-1/2	11-1/2	15	H	L	O
2% Copper Acetate 1% Malachite Green Oxalate in Douglas fir	1.00 0.51	N	21-1/2*			1.14 0.57	**	**	20*			
1% Copper Epoxy 1% Malachite Green Oxalate	0.33 0.33	5-1/2	14	H	M	0.33 0.33	7	5-1/2	8	VL	L	L
2% Copper Epoxy 1% Malachite Green Oxalate	0.67 0.34	12	24*			0.66 0.33	--	5	9	O	M	T
3% Copper Naphthenate 50% Linseed Oil	0.61 10.1	N	24*			0.66 11.0	N	N	20*			
3% Copper Naphthenate 50% Linseed Oil in Douglas fir	0.35 5.9	**	24*			0.21 3.5	**	**	20*			
1% Copper Sulfate 2% Agar	0.14 0.27	13	13	H	H	0.13 0.26	**	**	20*			
1% Copper Sulfate 1% Diazoaminobenzene (1/8" panel)	steep	--	28	O	H							
1% Copper Sulfate 1% 1,4-Naphthoquinone (1/8" panel)	steep	21***	28-1/2	T	L							

Table VI. Other Combination Treatments (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
1% Copper Sulfate 2% Oxine	steep	25	39*									
5% Copper Sulfate 3.2% PVM/MA	1.4 0.92	**	25-1/2*									
10% Copper Sulfate 3.2% PVM/MA	3.7 1.2	N	25-1/2*									
14.73% Copprr Sulfate 20.06% Sodium mono H Arsenate (double treatment) (FPL)	3.23 3.01	N	12*									
5% Cuprammine Sulfate 3.2% PVM/MA	1.8 1.2	N	25-1/2*									
1% Dieldrin 1% Malachite Green Oxalate	0.30 0.30	**	18*			0.33 0.33	**	4	13-1/2*			
5% Diphenylmethane 2% Malachite Green Oxalate	1.6 0.64	3	18*			1.7 0.67	3-1/2	6-1/2	12	VH	L	O
1% Endrin 1% Malachite Green Oxalate	0.36 0.36	**	18*			0.32 0.32	--	4-1/2	10-1/2	O	M	O
2% Malachite Green Oxalate 5% Dieldrin (double treatment)	0.74 1.4	N	18*			0.78 1.5	N	7	18*			
2% Malachite Green Oxalate 5% Endrin (double treatment)	0.73 1.4	N	18*			0.75 1.4	N	10	18*			

Table VI. Other Combination Treatments (Cont'd)

Treatment	Port Hueneme					Pearl Harbor					
	Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		Wt. Solute Absorbed, lb/cu ft	Mos. to Init. Attack		Total Exposure Time, Mos.	Damage When Removed from Test	
				Lim.	Ter.		Lim.	Mart.		Lim.	Mart.	Ter.
14.86% Nickel Sulfate 20.06% Sodium mono H Arsenate (double treatment)(FPL)	3.7 3.4	N	12*									
14% Phenylmercuric Oleate 50% Linseed Oil	4.0 14.3	**	24*			3.8 13.7	**	**	20*			
14% Phenylmercuric Oleate 50% Linseed Oil in Douglas fir	1.8 6.5	**	24*			2.4 8.5	**	12	20*			
5% Sodium Silicate 0.8M Hydrochloric Acid + ht. tr. (double treatment)	1.3 1.1	N	18*			1.7 1.1			S			
10% Sodium Silicate 1.5M Hydrochloric Acid + ht. tr. (double treatment)	2.1 2.1		S			2.14 2.05			S			
1% Tributyltin Oxide 20-24% Ammonium Sulfide (double treatment)	0.28†	**	12*									

Table VII. Untreated Panels and Solvent-Extracted Untreated Panels

Wood	Port Hueneme				Pearl Harbor					
	Mos. to Init. Lim. Attack	Total Exposure Time, Mos.	Damage When Removed from Test		T. to Init. Attack, Mos.		Total Exposure Time, Mos.	Damage When Removed from Test		
			Lim.	Ter.	Lim.	Mart.		Lim.	Mart.	Ter.
Afambeau	N	21-1/2*			N		20*			
Antidesma Pulvinatum	N	12*								
Douglas fir	1	4	VH	VL						
Greenheart	N	39*			N	5	20*			
	N	21-1/2*								
	**	18-1/2*								
Greenheart, acetic acid extracted	**	39*								
Greenheart, chloroform extracted	**	39*								
Greenheart, ether extracted	23-1/2	39*								
Greenheart, methanol extracted	N	39*								
Greenheart, sea water extracted	11-1/2	14	M	VH						
Lignum Vitae	N	39*			--	11	12	O	M	M
Ponderosa Pine (FPL)	1-1/2	3	L	H	3	--	4	L	O	H
Southern Yellow Pine	1	4	H	M	3	NC	4	VL	T	VH

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