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AN ESTIMATE OF THE CONCENTRATION OF 2(THIOCYANOMETHYLTHIO)BENZOTHIAZOLE (TCMTB) IN STORM WATER RUNOFF FROM TREATED LUMBER STORAGE YARDS WHICH COMPLY TO THE CODE OF GOOD PRACTICE

REGIONAL DATA REPORT -

BY

PETER K. KRAHN

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ABSTRACT

This report estimates the concentration of 2(thiocyanomethylthio)-benzothiazole (TCMTB) in storm water runoff from treated lumber storage yards which apply the minimum 2 1/2 hour of covered storage after treatment. The data is extrapolated from reports by Environment Canada, MacMillan Bloedell Research and Forintek Canada Corp. regarding the leaching of Clorinated Phenols (CP) and TCMTB from treated lumber.

Chlorophenols were estimated to leach from 2.7 to 3.2 times the rate of TCMTB under equivalent conditions. Extrapolation of these ratios to TCMTB treated lumber resulted in estimates of 3 hour composite samples of storage yard runoff from:

- Rough cut lumber storage yards ranging from 440 ppb to 513 ppb TCMTB
- Dressed lumber storage yards ranging from 143 ppb to 167 ppb TCMTB
- 50/50 mix of rough cut/dressed lumber storage yards ranging from 291 ppb to 340 ppb TCMTB.

3/14

Table of Contents

List of Figures

1) Introduction

An estimate of the concentration of TCMTB in storm water runoff is required for setting regulatory limits of chemicals in stormwater runoff which will apply at sawmill and lumber export terminals which store treated lumber. There is currently no field data involving the leaching of lumber treated with TCMTB. An estimate based on published reports of field and laboratory leach studies of chlorophenol treated lumber and laboratory leaching studies of TCMTB treated lumber is contained in this report.

2) Conclusions

The following conclusions are based on the data reported in references 1,2,and 3 and the assumptions made in section 3 of this report.

2.1) Clorophenol treated lumber will leach (on average) at a rate that is 3.2 times the rate of TCMTB treated lumber under the same conditions. This will result in the following concentration estimates for:

Average concentration in runoff from a rough cut lumber lumber storage yard is.....440 ppb

Average concentration in runoff from a dressed lumber storage yard is .....142 ppb

Average concentration in runoff from a storage yard which contains a 50/50 mix is.....291 ppb

2.2) A worst case estimate is that chlorophenol treated lumber will leach at a rate that is 2.7 times the rate of TCMTB treated lumber under the same conditions. This estimate uses a leach rate based on the laboratory leach test sample mean concentration plus one standard deviation in the data. This will result in the following concentration estimates for:

Worst case concentration in runoff from a rough cut lumber lumber storage yard is.....513 ppb

Worst case concentration in runoff from a dressed lumber storage yard is .....167 ppb

Worst case concentration in runoff from a storage yard which contains a 50/50 mix is.....340 ppb

Note; The numbers given in conclusions 2.1 and 2.2 were based on a data set that had a 95% confidence interval about the mean. The correlations of fit for the curves in Figure 3 had a value of 98.9 +/- 0.8 %.

2.3) A sawmill/lumber export terminal which operates according to the recommendations of the present code of practice and provides 2.5 hours of covered storage and uses TCMTB to treat lumber would produce a leachate at the storm drain which has concentration ranging from 142 ppb to 513 ppb. This value would be based on a composite sample in which aliquots were collected every 15 minutes for a 3 hour period during a continuous storm event.

2.4) A sawmill/lumber export terminal which uses a relatively non toxic treatment chemical such as the CANFOR "ECOBRITE" to treat rough cut lumber which is stored for short term protection would produce a leachate at the storm drain from a 50/50 dressed/rough mix which would range from 142 ppb to 167 ppb.

2.5) Assuming a sawmill/lumber export terminal applies all elements of the code of good practice and <u>does treat</u> rough cut lumber with a highly toxic product a realistic upper limit for regulatory purposes would be <u>500</u> ppm TCMTB based on a composite sample in which equal volume aliquots were collected every 15 minutes for a 3 hour period during a continuous storm event.

2.6) Assuming a sawmill/lumber export terminal applies all elements of the code of good practice and <u>does not treat</u> rough cut lumber with a highly toxic product a realistic upper limit for regulatory purposes would be <u>350</u> ppm TCMTB based on a composite sample in which equal volume aliquots were collected every 15 minutes for a 3 hour period during a continuous storm event.

3) Assumptions

3.1) The major assumption is that the leach rate ratio of chlorophenol (CP) dip treated rough cut lumber vs TCMTB dip treated rough cut lumber will be the same for spray treated dressed lumber. This is a reasonable assumption based on the fact that the only difference between the two application processes is the quantity of water used. Reference #3 found that the major factor in the leachate concentration was the surface area available for leaching not the application methods.

3.2) The second major assumption is that a minimum 2 1/2 hours of drying time is allowed prior to exposure to rainfall. The data used for the estimates was therefore restricted to 2 1/2 hours or greater drying times.

3.3) Any data which ranged outside a 95% confidence limit based on a "Students t" test for the sample mean and a "z" test for outlying data points was rejected from the data set. As it turned out the rejected data points were all located in sets that had less than 2 1/2 hours drying time prior to exposure to rainfall.

4) Graphical Results

Figure #1 shows the continuous leaching curves for rough cut lumber treated with chlorophenols.

Curve 1A has the lowest leach rate which may be attributed to the combination of a long dry storage time of 18 hours and low total surface area of 98 m2/package.

Curves 1B and 1C have higher concentrations with 1.5 hrs. to 3.0 hrs of dry storage before leaching and low total surface are of 98 m2/package.

Curves 1D and 1E have the highest leach rate and the highest surface area of 152 m2 and 157 m2 per package. The longer storage time of 48 hours for package 1E may account for the slightly lower leaching however the larger surface area of 1D and 1E vs the other packages is likely the dominating factor when considering total leaching.

Figure 2 shows the leaching of TCMTB treated rough cut lumber. There is no significant difference in the surface areas of the three packages and the reduction in total leaching appears to be directly related with the covered storage time.

4.1) Comparison of Leach Rates of Chlorophenols vs TCMTB

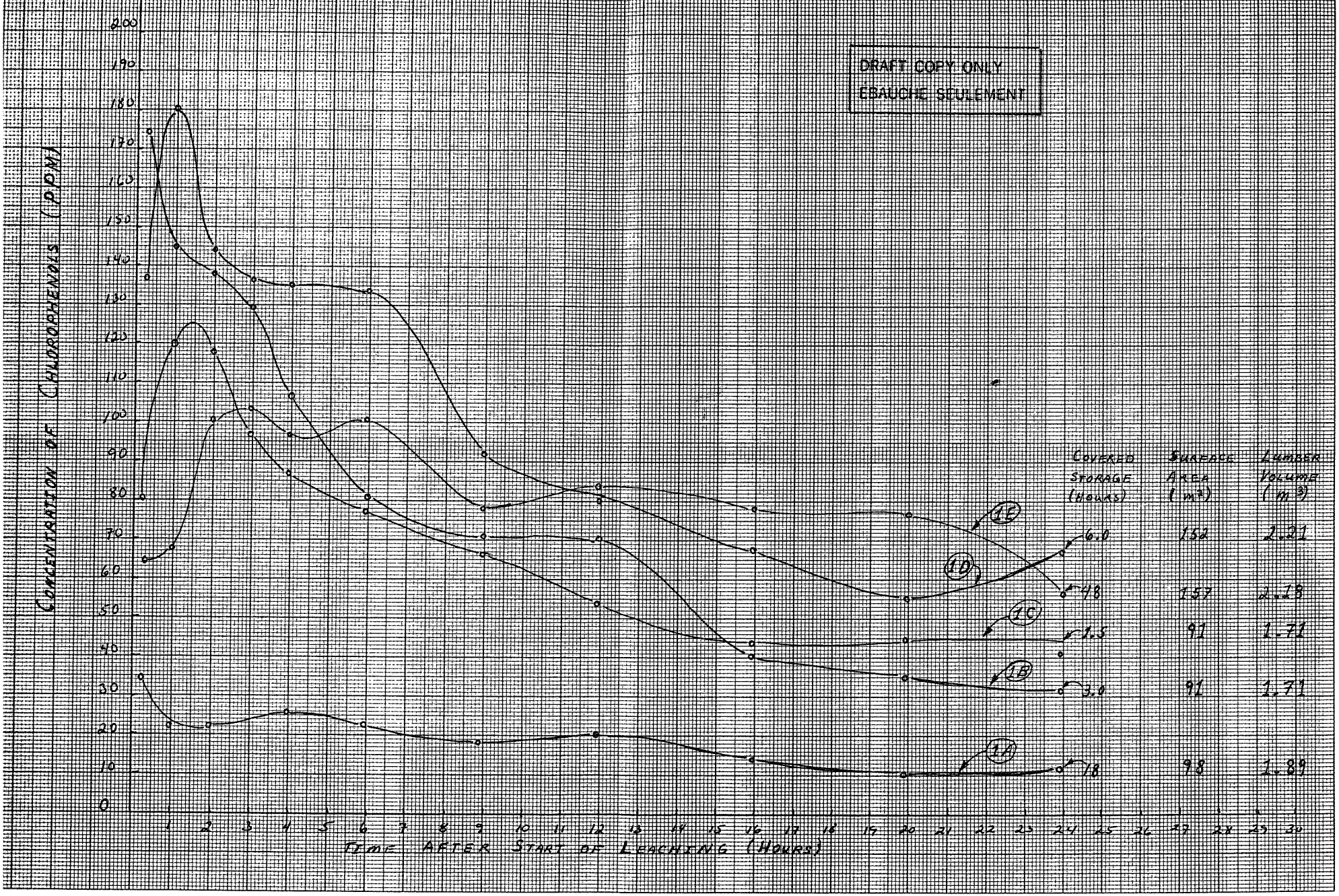
Figure 3 compares the leach rate of TCMTB to Chlorophenols. Curve 3A is the leaching curve for TCMTB at 3.3 mm/hr of rainfall. Curve 3B is an adjusted curve which has been multiplied by a factor of (3.3/2.1 =) 1.57 to account for the dilution effect of the higher rainfall used to test the TCMTB lumber. Curve 3C is Curve 3B plus one standard deviation added to each data point to produce an upper limit of the average total leaching curve.

Curves 3A - 3C show that TCMTB treated lumber has a decelerating leach rate for the first eight to nine hours during which excess chemical is likely being washed off. After nine hours the leach rate is relatively constant and is likely the resolublization of chemical from the wood.

Curves 3D - 3E show similar trends for Chlorophenols with the decelerating leach rate continuing for 18 to 19 hours after which the rate appears to become constant.

A comparison of the leach rates is made by integration of the areas under the mean leaching curves and then dividing the area under the chlorophenol curve by the area of the TCMTB curve. The area under the Clorophenol curve 3D was found to be 1323 units. Curve 3B which is

FIGURE #1 SIMULATED LEACHING OF CHLORINATED PHENOLS FROM DIP TREATED ROUGH CUT HEMFIR LUMBER SUBJECTED TO 2.1 mm/day RAINFALL



	Covered Storage (Hours)	Surface Area (m^2)	Lumber Volume (m^3)
1E	6.0	152	2.21
1D	48	157	2.18
1C	1.5	91	1.71
1B	3.0	91	1.71
1A	18	98	1.89

FIGURE #2 SIMULATED LEACHING OF TCMTB FROM DIP TREATED ROUGH CUT HEMFIR LUMBER SUBJECTED TO 3.33 mm/HR RAINFALL. (MACMILLAN BLOEDEL RESEARCH BD-301, REPORT #2 DEC. 8, 1986) (DIP SOLUTION CONTAINED 0.4% TCMTB OR 4000.0 PPM)

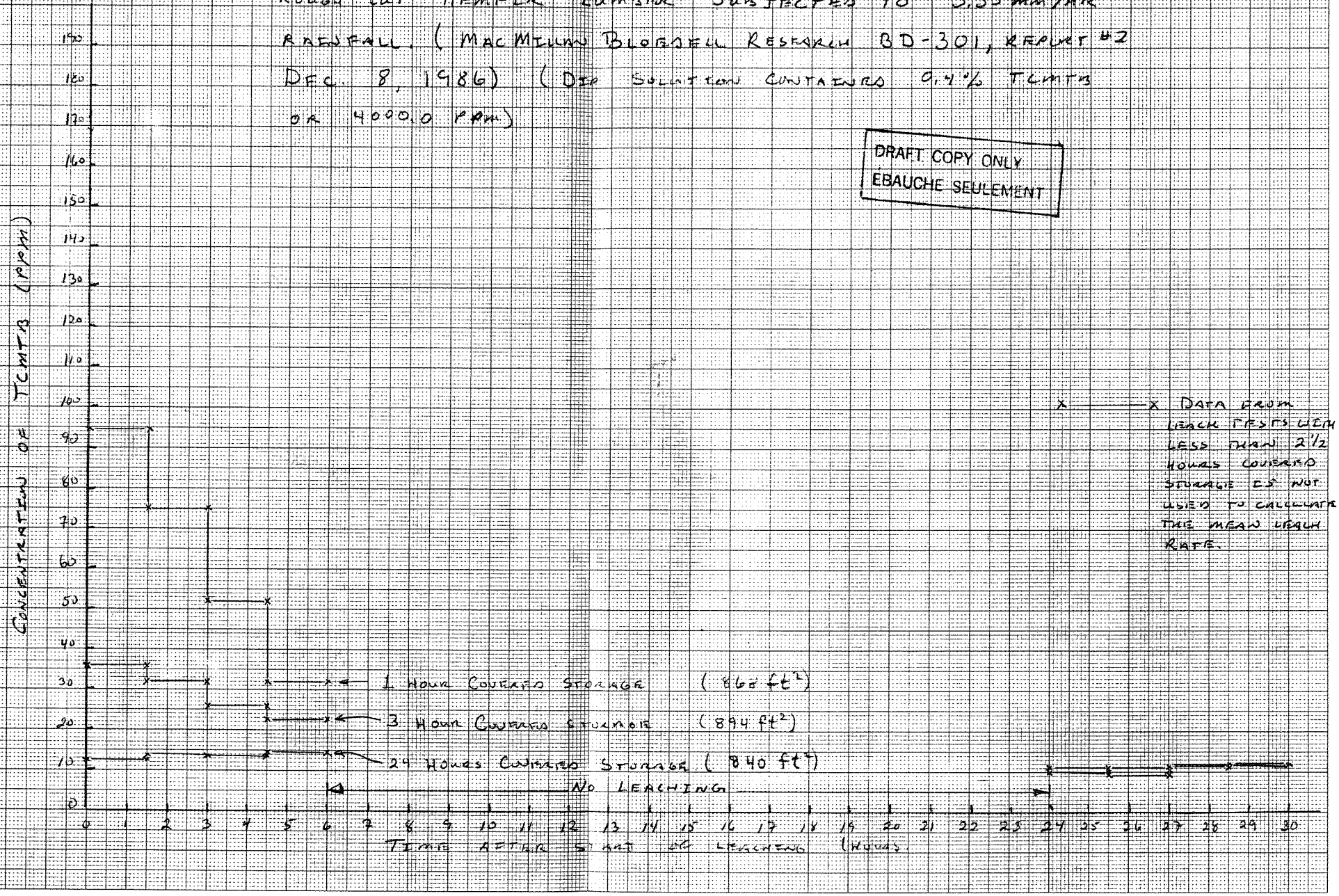
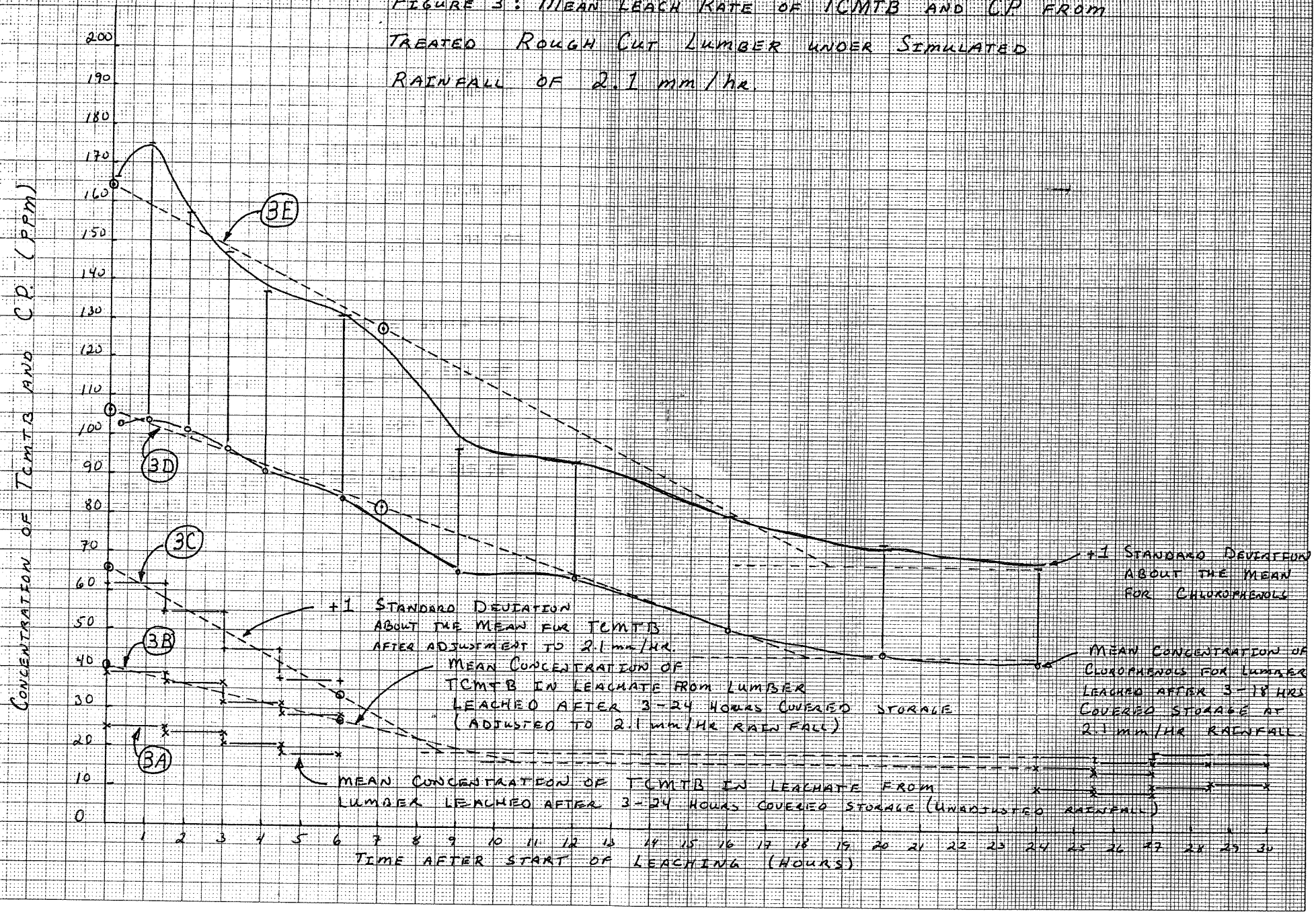


FIGURE 3: MEAN LEACH RATE OF TCMTB AND C.P FROM TREATED ROUGH CUT LUMBER UNDER SIMULATED RAINFALL OF 2.1 mm/hr.



the TCMTB curve corrected for dilution was found to be 416 units and the curve C which is the upper limit of leaching of TCMTB was found to be 484 units. The ratio of the leaching rates of CP/TCMTB was found to be 1323/416 = 3.2 for curve 3B and 1323/484 = 2.7 for curve 3C.

4.1.1 Estimates of Concentrations of TCMTB in Storm water Runoff.

The estimates of the average concentrations of TCMTB in storm water runoff were calculated by dividing the known rates for chlorophenols as listed in Appendix 1 by the ratios determined in section 4.3.

Concentration of TCMTB in storm runoff from a rough cut lumber storage yard. $= \frac{1402}{3.2}$ ppb = 440.4 ppb

Concentration of TCMTB in storm runoff from a dressed lumber storage yard. $= \frac{456}{3.2}$ ppb = 142.5 ppb

Average Concentration of TCMTB in Storm run off from a storage yard containing a 50/50 mix of rough cut and dressed lumber. $= \frac{440 + 142.5}{2} = 291$ ppb

The estimates of the maximum concentrations of TCMTB in storm water runoff are;

Concentration of TCMTB in storm runoff from a rough cut lumber storage yard. $= \frac{1402}{2.7}$ ppb = 513 ppb

Concentration of TCMTB in storm runoff from a dressed lumber storage yard. $= \frac{456}{2.7}$ ppb = 167 ppb

Average Concentration of TCMTB in Storm run off from a storage yard containing a 50/50 mix of rough cut and dressed lumber. $= \frac{513 + 167}{2} = 340$ ppb

References

1) Cserjesi, A.J., Johnson, E.L., Byrne, A., "Simulated Rainwater Leaching of Chlorinated Phenols from Dip treated Lumber.", Forintek Canada Corp., Forintek Contract No. 65-68-610, DSS Contract No. 06SB. KE603-3-0221, Jan. 1984

2) Martin, H.V., "The leaching of Busan 1030 from Dip Treated Lumber.", Project BD-301, Report No. 2, MacMillan Bloedel Research, Dec. 8, 1986.

3) Krahn, P.K., Shrimpton, J.A., Glue, R.D., "Assessment of Storm Water Related Chlorophenol Releases from Wood Protection Facilities in British Columbia.", Environment Canada, Conservation and Protection, Environmental Protection, Pacific and Yukon Region, Regional Program Report 87-14, August 1987

Appendix I

TABLE 4 AVERAGE TOTAL CHLOROPHENOL CONCENTRATIONS IN STORM WATER RUNOFF BASED ON TREATMENT METHOD AND LUMBER CHARACTERISTICS

TREATMENT METHOD AND LUMBER CHARACTERISTICS	TOTAL CHLOROPHENOL CONCENTRATIONS PARTS PER BILLION (ug/l)			
	n	- S.D.	$\bar{x}$	+ S.D.
Dipped Lumber, Rough Cut, Drip Time Greater Than 24 Hours*	1	-	258	-
Dipped Lumber, Planed, Strapped and End Sealed, Greater Than 24 Hours Storage	3	322	443	564
Low Pressure Sprayed Lumber, Unstrapped, No Drying Time	6	2 069	13 562	25 055
Low Pressure Sprayed Lumber, Planed, Strapped, End Sealed, Greater Than 24 Hours Storage	3	328	456	559
High Pressure Sprayed Lumber, Rough Cut Unstrapped	4	967	1,402	1,837

n = number of samples, $\bar{x}$ = arithmetic mean, S.D. = Standard deviation

6.2.1 **Dipped Lumber - Rough Cut, Drip Time Greater Than 24 Hours.** At the site used for monitoring dipped rough cut lumber it was difficult to determine the time period lumber was stored in the basin or the drainage patterns for the yard. The runoff discharged at several locations and a composite of all these discharges was impossible to collect. In the basin which was monitored the value of 258 ppb is suspected to be a low value, and a poor representation of the average concentration over the entire yard.

6.2.2 **Dipped Lumber - Planed, Strapped and End Sealed, Greater Than 24 Hours Storage.** Similar difficulties mentioned in 6.2.1 were experienced at this site in addition to repeated theft of sampling equipment. The average total chlorophenol concentration in storm water runoff for the two storm events monitored was 443 $\pm$ 121 ppb and is also considered low. It was found that a significant proportion of the lumber had been in the basin over several storm events and that less than 40% was freshly treated lumber.