Environmental Performance of Treated Wood Cooperative

Ninth Annual Report

Gerald Presley

Matthew Konkler

Department of Wood Science & Engineering

Oregon State University

Corvallis, Oregon

February 2020

Advisory Committee Members

Creosote Council (David Webb)

KMG Bernuth (Jason Councill)

Koppers Performance Chemicals (Mark Blattie)

Lonza (Michael Collins)

Nisus (Ken Laughlin/Jeff Lloyd)

Treated Wood Council (Jeff Miller)

Viance, LLC (Bob Baeppler/Kevin Archer)

Western Wood Preservers Institute (Dallin Brooks/Butch Bernhardt)

Wood Preservation Canada (Martin Tauvette)

Associate Members

Allweather Wood LLC	Exterior Wood, Inc.	S.I. Storey Lumber Co.
Amerities Holding LLC	Fontana Wood	Spartanburg Forest Products
BB&S Treated Lumber of New England	JH Baxter & Co.	Stella-Jones
Bell Lumber and Pole	Julian Lumber Co	Sunbelt Forest Products Corp
Bridgewell Resources, LLC	Long Life Treated Wood Inc.	Universal Forest Products Inc.
Brooks Manufacturing Co.	Northeast Treaters	Wheeler Lumber Co.
Brown Wood Preserving Co., Inc.	Osmose Utilities Services Inc	William C. Meredith Company, Inc
Conrad Forest Products	Permapost Products Co.	
Cox Industries (Koppers)	Renewable Resources Group Inc	
Eden Wood Preserving	Royal Pacific Industries	

Personnel

Gerald Presley, Associate Director

Arijit Sinha, Associate Director

Matthew J. Konkler, Senior Faculty Research Assistant I

About the New Associate Director

Dr. Gerald Presley is a new hire in the Oregon State University Department of Wood Science and Engineering who will be taking over direction of the Environmental Performance of Treated Wood Cooperative (EPTW) from Jeff Morrell. Dr. Presley arrived at OSU in September, 2019 and is working to take over the ongoing projects in the EPTW and design new projects that will address research questions from the cooperative. Dr. Presley will continue to work towards improving the analytical capacity of the EPTW so it can continue to produce valuable research for its members. He looks forward to working with each of you in the coming years and appreciates your willingness to support the coop.

TABLE OF CONTENTS

Executive Summary……………………………………………………………..…………………5

Introduction……………………………………………………………..……………………7

Objectives………………………………………………………………..……………….…8

Accomplishments………………………………………………………..…………………8

Objective I……………………………………………………………….……………….…8

DEVELOP FUNDAMENTAL DATA ON PRESERVATIVE MIGRATION FROM WOOD.……………..……..8

A. Evaluate the Effects of Best Management Practices on Preservative Migration Patterns...……7
B. Effect of Damage to Polyurea Coatings on Metal Losses from Ammoniacal Copper Zinc Arsenate Treated Douglas-fir Pile Sections……………………………………………………35
C. Monitor the Migration of Wood Preservatives from Bridges made of Treated Wood.........…..35
D. Effect of Abrasion on Metal Levels in Aquatic Applications of Treated Wood………………...39
E. Preservative Migration into Plant Biomass from Treated Wood-based Trellising Systems….41

Objective II……………………..………………………………..………………..…….…42

DEVELOP STANDARDIZED ACCELERATED METHODOLOGIES FOR ASSESSING TREATED WOOD RISKS ……………………………………………………………………………………….…..42

Objective III………………………………..…………………………………..…..……..42

WORK COOPERATIVELY TO DEVELOP AND IMPROVE MODELS TO PREDCT THE RISK OF USING TREATED WOOD IN VARIOUS APPLICATIONS......………………...……………………….…..…42

Objective IV……………………………..…………………………..………………..….42

IDENTIFY IMPROVED METHODS FOR REDUCING THE POTENTIAL FOR MIGRATION……......……42

Objective V……………………………………………………………………………..…….43

EVALUATE THE ENVIRONMENTAL IMPACTS AND IDENTIFY METHODS FOR REUSE, RECYCLING, AND/OR DISPOSAL OF PRESERVED WOOD THAT IS REMOVED FROM SERVICE ……………………………………………………………………………………………………43

Objective VI……………………..……………………………………………….......……43

DELIVER EDUCATIONAL OUTREACH PROGRAMS ON THE PROPER USE OF TREATED WOOD IN RELATION TO THE BEST MANAGEMENT PRACTICES (BMPs) …………………………...………43

Literature Cited….………………………………………………………………..……..…44

Executive Summary

Objective I: Develop fundamental data on preservative migration from wood

The Environmental Performance of Treated Wood Research Cooperative (EPTW) was established to improve knowledge related to the use and disposal of treated wood. The Coop has been active in a number of areas; progress on each will be reviewed below.

We have completed all remaining waterborne BMP tests that we set out to do in previous reports. These included testing southern pine and hem-fir treated with Wolman or MP200 micronized copper azole for leachability after a luke-warm water bath BMP. Micronized copper was not in the AWPA standards at the time we initiated these tests. The remaining trials show that BMP processes do differ in their ability to limit metal migration. All of these data were used to modify the current BMP processing guidelines to make sure that the most appropriate processes are coupled with each preservative system.

We have begun sampling stream water and sediment around a newly-installed bridge near the Minneapolis, MN metro area. Five bridges sampled were constructed with copper naphthenate-treated wood and five others were constructed with pentachlorophenol (penta)-treated timbers. No penta was detected in any of the water or sediment samples taken around the penta-treated bridges. Sampling efforts to date have been unable to detect any difference in copper levels between sediments or water samples taken from up or downstream from the bridge. We will continue to use these sampling efforts to assess the accuracy of the Environmental Assessment Modeling Tool and identify any areas which need improvement. Field trials on a bridge containing both penta and copper naphthenate treated wood are complete. We have submitted a paper describing these data to the journal of Hölzforschung. We will continue to periodically monitor this site to determine if migration rates change as the wood weathers. We are seeking additional projects to monitor in a similar fashion and have plans to sample sites at an appropriate location in Canada.

As part of our ongoing discussions with cooperative members we have initiated a search for Oregon State University (OSU) agricultural research property that can be used to monitor the migration of preservatives into trellised crops. The goal of this research is to determine the suitability of using preservative-treated wood as trellising supports in organic agriculture. We have identified a site at the Lewis Brown Horticultural Farm where we will have access to three 250’ rows that can be irrigated and planted with common Northwestern fruit crops. We plan on installing a wine grape trellising system that incorporates common commercially available waterborne preservative-treated posts as supports. This study will track the migration of preservative metals into the soil and test whether there is any accumulation in plant biomass relative to metal post alternatives. OSU also has an experimental hop farm near Corvallis, OR that can be used to study preservative migration under commercially-relevant growing conditions.

Objective II: Develop standardized accelerated methodologies for assessing treated wood risks

We are working to develop a number of standardized methodologies that can be used to assess preservative mobility under varying regimes. These include small-scale BMP verification procedures, sachets used to detect preservative migration in aquatic environments, and our efforts to quantify preservative levels in the water column. Our intent is to publish the results of these tests in peer-reviewed journals and, once accepted, move to standardize these methods under the appropriate organizations.

Objective III: Work cooperatively to develop and improve models to predict the risk of using treated wood in various applications

The EPTW website now hosts the Environmental Assessment Modeling Tool, following its update by Western Wood Preservers Institute (WWPI). We are actively using the model as an educational tool for regulators in Washington State. As we learn more about the effectiveness of this model as an educational tool we will continue to provide any user input we are notified of that will improve the model. In addition to the WWPI modelling tool, the EPTW website now hosts the Railroad Tie Association SelecTie Modeling Tool. We intend to explore the use of this model as an educational tool for regulators and are interested in designing studies aimed at model verification and improvement. We invite input from members in proposing migration-related questions that would generate relevant data for this effort.

Objective IV: Identify improved methods for reducing the potential for migration

As part of our study to monitor the migration of preservative chemicals into plant tissue, we will include post sleeves in this study to determine if barriers below groundline reduce the migration of preservatives into soil and plant tissue. We also plan on initiating a field study of polyurea-coated ACZA posts at a freshwater pond site to measure the impact of coating damage on preservative migration into the water column. If the barriers are economical compared to steel, concrete, and untreated wood, it could be a good avenue for this new market we are trying to get established in. We hope this research can provide some reference data for regulators and organic farmers weighing the benefits/drawbacks of using wood versus wood alternatives in agriculture and freshwater applications.

Objective V: Evaluate the environmental impacts and identify methods for reuse, recycling and/ or disposal of preserved wood that is removed from service

Matthew Konkler attended the Railroad Tie Association meeting this year in Tucson, AZ. At this conference many railroad companies were commenting that they need better methods for disposal of used railroad ties. While this is an area we have never ventured into there does seem to be a need for it. We would appreciate input from our members as to whether this is a valuable area of research that they would like us to pursue.

Objective VI: Deliver educational outreach programs on the proper use of treated wood in relation to BMPs

We recently traveled to Olympia, WA for a meeting with WWPI and representatives from several Washington State departments on the regulatory status of oil borne preservatives in that state. We utilized the WWPI environmental assessment modelling tool to help educate the attendees about environmental risk mitigation for preservative treated wood structures. A summary of our prior research related to creosote will be featured in Crossties Magazine. This dissemination also highlights our hosting the SelecTie Modelling Tool which we plan to use to incorporate more economic cost-benefit analysis into our future environmental impacts research on creosote-treated wood. We will continue to seek out opportunities to use our extensive background in environmental chemistry and wood protection to explain the function of the EPTW and how to use treated wood as opportunities arise.

INTRODUCTION

Treated wood is widely used in a variety of environments and has a well-known ability to markedly extend the service life of products, thereby reducing the need to harvest additional trees. The chemicals used to protect wood from degradation are toxic at some levels and all are known to migrate, to some extent, from the products treated with these chemicals into the surrounding environment. The concerns about this migration are highest in aquatic environments. Previous studies have shown that the levels of migration are generally low and predictable, and the Environmental Assessment Modeling Tool has been developed to predict the rates of migration from various treated wood commodities under a range of conditions. The treating industry also uses modified production procedures, Best Management Practices (BMPs), for some site-specific applications to improve the quality of these products, to reduce the presence of surface deposits, limit over-treatment, and, as far as practical, produce products with a reduced environmental footprint. While these actions have proven useful, there are few data demonstrating the benefits of these procedures and a continuing need to better understand the environmental behavior of treated wood products. The EPTW was established to help develop data on the performance of treated wood, beginning with aquatic applications. The program is an extension of studies begun by Dr. Kenneth Brooks of Aquatic Environmental Sciences (Port Townsend, WA; Brooks 2011).

OBJECTIVES

The overall goal of the EPTW is to develop knowledge that improves the ability to use and dispose of treated wood in a safe and environmentally sensitive manner. This goal is being addressed through the following objectives:

1. Develop fundamental data on preservative migration from wood
2. Develop standardized accelerated methodologies for assessing treated wood risks
3. Work cooperatively to develop and improve models to predict the risk of using treated wood in various applications
4. Identify improved methods for reducing the potential for migration
5. Evaluate the environmental impacts and identify methods for reuse, recycling and/ or disposal of preserved wood that is removed from service
6. Deliver educational outreach programs on the proper use of treated wood in relation to BMPs

ACCOMPLISHMENTS

Over the past year, we have continued a number of efforts under some of these objectives, with involvement of the advisory committee. The results will be summarized by Objective.

OBJECTIVE 1

DEVELOP FUNDAMENTAL DATA ON PRESERVATIVE MIGRATION FROM WOOD

A. Evaluate the Effects of Best Management Practices on Preservative Migration Patterns:

In previous reports, we have described efforts to develop data for BMPs on preservative migration. The results have been mixed. In some cases, the results suggest a benefit for using these practices, but many tests suggest that BMPs have little effect. We believe these results occurred because most of the material was already air-dried prior to exposure; in essence, receiving one of the BMPs (air-seasoning). Best management practices were originally developed in response to situations where freshly treated wood was taken out of the cylinder, transported to a site and then installed in projects where it was subjected to nearly immediate rainfall or soaking (WWPI, 2012). To work around this problem and examine the real effect of BMPs on migration, we moved to a smaller scale test where we could control all aspects of the process to produce more reproducible results under worst case conditions.

In last year's report, we described results from several waterborne treatments of three wood species. Results for spruce-pine-fir (SPF) treated with copper azole (CA), alkaline copper quaternary (ACQ), chromated copper arsenate (CCA) or ammoniacal copper zinc arsenate (ACZA) were reported. Additionally, results for southern pine (SYP) treated with CA, ACQ, CCA, or micronized copper azole (MCA) were presented. Finally, results for Douglas-fir treated with CA, ACQ, or ACZA were presented. We also described results from copper naphthenate (Cu-Nap) treated SPF and SYP. These results will not be presented here, but can be found in the 8th Annual Report. Peer reviewed papers are being prepared for all of these results.

This past year, we continued BMP tests and competed the tests we proposed to perform which included tests on SYP and hem-fir (HF) treated with one of two forms of micronized copper azole (Wolman and MP200). Some of the previous year's data on SYP treated with MCA (MP200) was included in this report for comparison. The completion of these tests mark the end of the BMP testing. However, it is important to note that these tests have only used existing BMPs and were intended to demonstrate that BMPs made a difference. The next step will be to use these data to improve the BMP processes.

Post-Treatment with BMPs

Frozen samples were defrosted before being subjected to one of nine treatments listed in the Western Wood Preservers Institute (WWPI 2014) Best Management Practices requirements or a modified version thereof. The methods were applied to sub-samples of each board treated with a water-based chemical even though we recognize that not all of these processes are currently listed as BMPs for all chemicals.

- **Air-Drying:** Samples were placed on stickers at ambient temperature (20-25 °C), to encourage air-flow, and conditioned to a target moisture content below 19% over a four-week conditioning period. No supplemental airflow was supplied.

- **Steaming:** Samples were subjected to 1, 3, or 6 hours of steaming at 100 °C with stickers between samples. Steaming was performed in an autoclave where steam entered the vessel and was allowed to exit so that pressure remained near atmospheric.

- **Hot Water Bath:** Samples were soaked in water at 100 °C for 1-3 hours.

- **Room Temperature Water Bath:** Samples were soaked in water at room temperature (20-25°C) for 3 hours. This is a modified version of the hot water bath soaks tested in prior year's reports.

- **Ammonia Bath:** Samples were soaked in aqueous 2% ammonia at 100 °C for 1 or 3 hours.

Samples were frozen (-10 °C) after being subjected to a given BMP until needed. Each treatment was replicated on one section cut from each board treated with a given preservative to help reduce the potential for variability between boards. This resulted in each portion of a single parent board being subjected to a given BMP.

Leaching Tests

Samples were thawed overnight before testing. The potential for preservative migration was evaluated in a specially constructed overhead leaching apparatus that applied a controlled amount of simulated rainfall at a desired temperature (Figure 1). Previous studies (Simonsen et al, 2008) have shown that migration is independent of both temperature and rainfall rate so the device operated at room temperature (20~28 °C) and a rainfall rate ranging from 0.1 cm/h to 0.3 cm/h.

Figure 1. Overhead leaching apparatus used to evaluate the effects of BMPs on metal migration from preservative treated wood.

The apparatus (1.5 m wide x 0.6 m long x 0.9 m) was constructed with stainless steel and a plastic panel and had eight 152 mm wide x 457 mm long x 51 mm high sample holders. Holders were placed on a shelf with a 4.5° incline from the horizontal to allow water to flow down the wood. Simulated rainfall was produced by four spray nozzles connected to a deionized water supply. The rate of water spray was controlled by a small pump and an electronic controller. A pressure gauge near the spray nozzles also helped control flow.

BMP-treated samples were placed into each holder and subjected to simulated overhead rainfall for 2 hours. Previous tests had shown that metal levels in runoff drop off sharply to a steady state by this time. Runoff was collected in tared Erlenmeyer flasks that were weighed after rainfall exposure to determine the total volume of water applied per board for each time period. The weight of water was recorded and 4.85 mL of each water sample was placed into a vial. Water was collected at 15-minute intervals for the first hour then at 30-minute intervals for the last hour. Preservative retention in the samples was determined using either net solution uptake for SYP samples treated with waterborne preservatives or by x-ray fluorescence for both SYP and HF samples treated with oil-borne preservatives.

Chemical Analysis

Runoff from samples treated with waterborne preservatives was acidified by adding 0.15 mL of 1 N nitric acid into 4.85 mL of leachate. The samples were stored at 4 ºC until they could be analyzed for residual metal using a Perkin Elmer Optima 3000DV inductively-coupled plasma optical emission spectrometer with a diode array detector (ICP) at the Oregon State University Central Analytical Laboratory. Water samples collected over the first two hours of simulated rainfall were tested for copper, zinc, chromium, or arsenic (depending on the treatment). The exposed wood samples were frozen and retained in the event we needed to perform additional rainfall exposures. Copper concentrations were used as a measure of BMP effectiveness.

Retentions were determined by solution uptake and listed by each treatment the treated wood was subjected to (Table 1). Retention levels were generally below the target retention of 5.0 kg/m^3 for MCA, but were consistent within wood species and MCA type save a few treatments that had retentions noticeably below that seen for the no BMP control. These variations will be considered when interpreting the runoff data gathered for this study.

Table 1: Retentions of two types of MCA treatment (MP200 and Wolman) in Hem-fir or SYP lumber used in each of the BMP treatments.

	Average Uptake Retentions (kg/m^3)[a]			
BMP Treatment	Hem-Fir MP200	SYP MP200	Hem-Fir Wolman	SYP Wolman
No BMP	2.58 (1.08)	4.60 (1.52)	2.47 (0.89)	2.12 (0.54)
Air Dry	2.77 (1.00)	4.65 (1.34)	2.09 (0.85)	2.27 (0.62)
1 Hour Steam	2.69 (1.24)	4.06 (0.89)	2.12 (0.93)	2.29 (0.66)
3 Hour Steam	2.62 (1.22)	4.11 (1.90)	2.56 (0.84)	2.11 (0.53)
6 Hour Steam	2.73 (1.13)	4.88 (1.50)	2.15 (0.82)	2.10 (0.54)
Hot Water Bath 1 hour	2.27 (1.04)	4.50 (1.44)	2.03 (0.87)	2.30 (0.72)
Hot Water Bath 3 hour	2.27 (1.08)	3.86 (1.67)	2.19 (0.89)	2.12 (0.56)
Room Temp Water Bath 1 hour	2.20 (1.88)	N/A	0.96 (0.63)	2.57 (0.76)

Ammonia Bath 1 hour	2.29 (0.97)	4.40 (1.69)	2.69 (0.95)	1.92 (0.28)
Ammonia Bath 3 hour	2.77 (1.14)	3.32 (1.37)	2.29 (1.03)	2.14 (0.61)

[a] Values in parentheses are standard deviations of eight replicate pieces of wood.

Copper Levels in Rainfall from MCA Treated Lumber

In this study, BMPs were compared for MCA-treated SYP and Hem-fir that were treated with two different MCA formulations, MP200 or Wolman MCA. Five different BMPs were tested, air drying, steaming, hot water bath, lukewarm water bath, and ammonia water bath. The duration of each BMP was varied as was the temperature of the hot water bath to determine which alterations in the BMP yield the best results. Most of the BMPs were effective in reducing copper concentrations in runoff from both wood species and both MCA types, however some were more effective than others or not effective at all in reducing runoff Cu concentrations.

For both wood species treated with no BMP, copper concentrations in runoff were generally higher in MP200-treated wood, especially in Hem-Fir wood. For SYP this was likely due to higher overall retentions in the MP200-treated wood, but the retentions for MP200 and Wolman MCA were similar in Hem-fir indicating another factor was driving the difference in runoff concentrations from Hem-fir wood. Average copper concentrations were highest in runoff from the first 15 minutes of simulated rainfall and decreased in the next 30 minutes to levels that ranged from 21-67% of the initial impulse (Table 2). Copper concentrations in runoff rapidly stabilized in MP200-SYP and maintained similar levels through to 120 minutes of simulated rainfall (Figure 2). Average copper concentrations in runoff from MP200-Hem-Fir continued to decline through the entire 120 minutes of rainfall, ending at 31.13 µg/mL, only 21% of the initial impulse concentration (Figure 4). Average copper concentrations in runoff from Wolman-SYP continued a steady decline less sharp than the drop in concentration between 15 and 30 minutes reaching 1.23 µg/mL, only 17% of the initial impulse after 120 minutes of rainfall (Figure 3). Wolman-Hem-Fir continued a steady decrease in average runoff copper concentrations after 30 minutes reaching 14.23 µg/mL, 51% of the initial impulse, after 120 of rainfall.

Air drying dramatically decreased copper runoff levels across both species and treatment types (Table 2). The initial 15 minutes of rainfall produced runoff with average copper concentrations ranging from 3.14-4.96 µg/mL, far lower than the 7.08-153.83 µg/mL range seen in wood with no BMP. Average copper concentrations steadily declined across both species and treatments with steady rainfall exposure, ending in the range of 0.99-3.19 µg/mL after 120 minutes of rainfall (Figure 2-5).

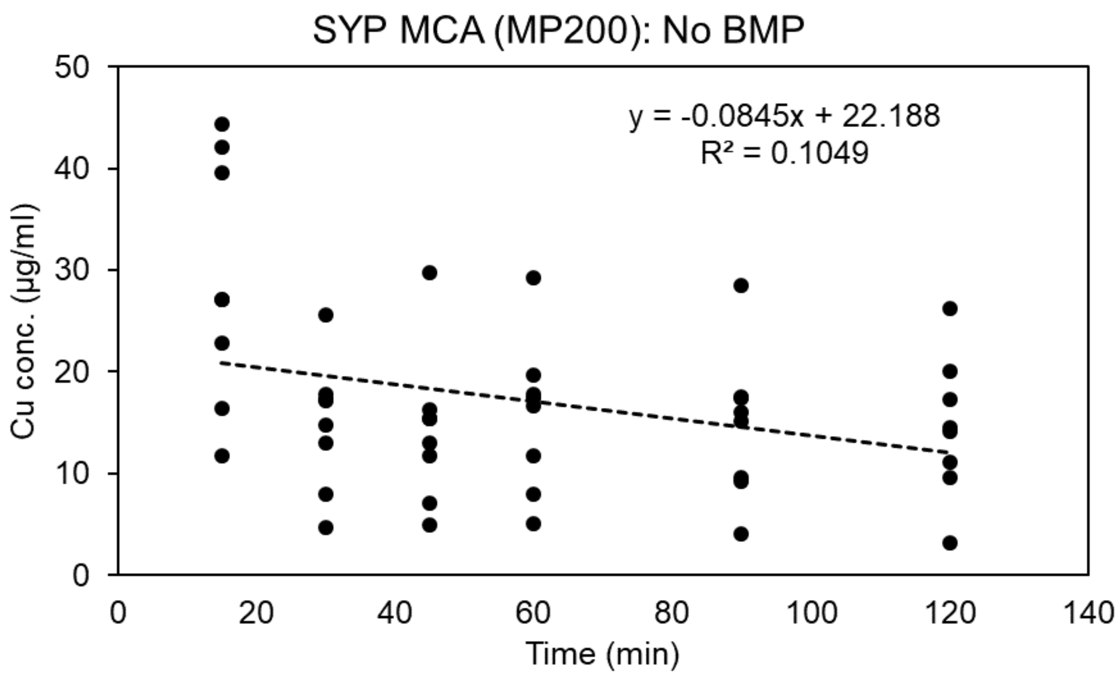
Steaming for 1,3, or 6 hours also decreased average copper concentrations in runoff from both species and treatment types relative to no BMP with the initial runoff concentrations ranging from 2.3-12.73 µg/mL (Table 2). Longer steaming times did not impart any obvious additional benefits above a one hour steam. In fact, the 6-hour steam appeared to slightly increase copper discharge from MCA-treated SYP relative to the 1 hour steam, but this difference was not statistically significant. The same downward trend in copper concentrations was observed over time in all cases and they reached a range of 1.03-3.85 µg/mL.

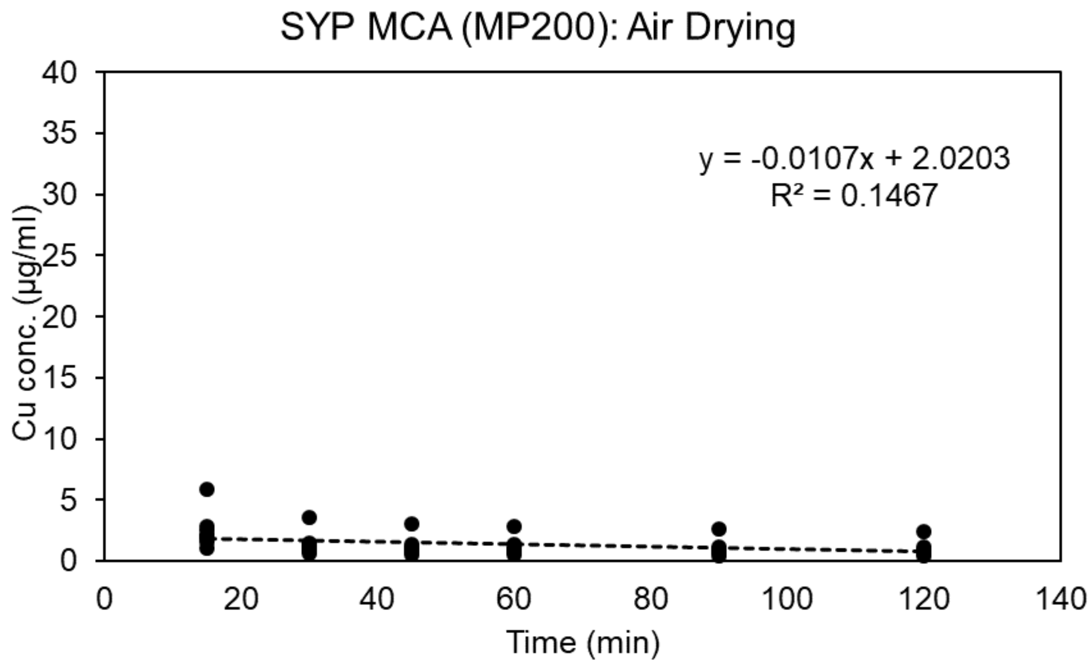
Soaking in a hot water bath for 1 hour was effective in reducing average copper concentrations in runoff from both species and treatment types relative to no BMP (Table 2). However, a longer 3-hour soak in a hot water bath led to much higher runoff copper concentrations than the 1-hour soak in some cases, ranging from 2.58-42.47 µg/mL. In one case, Wolman-Hem-Fir, the 3-hour soak actually led to higher copper concentrations in the first 30 minutes of rainfall than equivalent treatments with no BMP. Based on observations in this experiment, soaking in hot water for over 1 hour does not appear to be as effective in reducing copper runoff for MCA-treated wood as a shorter soak. Copper concentrations gradually decreased over time and after 120 minutes of rainfall ended between 0.70 and 1.95 µg/mL for the 1 hour soak and between 0.6 and 8.21 µg/mL for the 3 hour soak (Figure 2-5). A room temperature water bath was also tested as a BMP for MP200-Hem-Fir, Wolman-SYP, and Wolman-Hem-Fir. The treatment appeared to be successful in reducing runoff copper concentrations in all treatments tested. Reductions were less than those seen for the hot water bath for MP200-Hem-Fir and Wolman-Hem-Fir, despite the latter being undertreated relative to the wood used for no BMP (Table 1). Room temperature water soak was the most effective in reducing copper runoff from Wolman-SYP which had average runoff copper concentrations at 1.85 µg/mL after 15 minutes and decreasing to 0.51 µg/mL after 120 minutes. We did not test this method on MP200-SYP because we did not have enough material leftover from the treatment to test it.

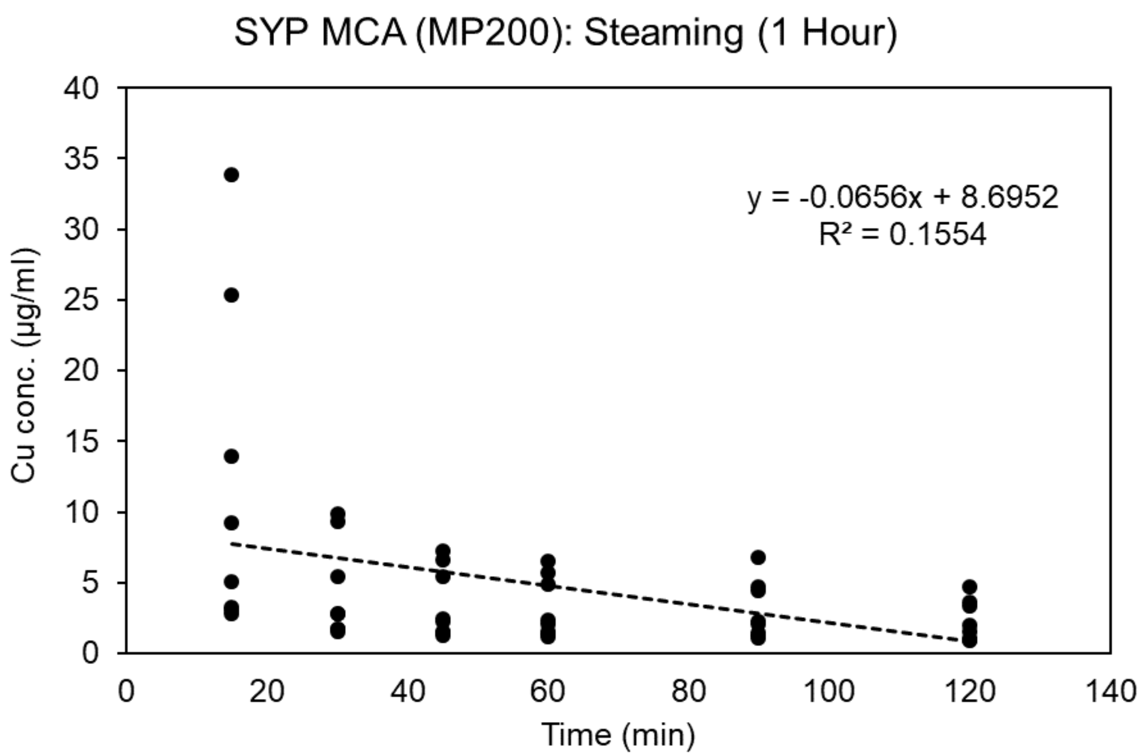
Soaking in an ammonia bath for 1 or 3 hours was also successful at reducing copper runoff concentrations in both species and treatments relative to no BMP. The longer ammonia bath soak appeared to be slightly more effective at reducing copper runoff concentrations, but the differences between 1 and 3 hours were not statistically significant. After 15 minutes of rainfall average copper concentrations from the 1 hour soak ranged from 1.21-8.41 µg/mL whereas equivalent samples from the 3-hour soak ranged from 1.33-4.06 µg/mL. Overall, this BMP was effective but not any more than some of the other BMPs tested such as air drying and hot water bath.

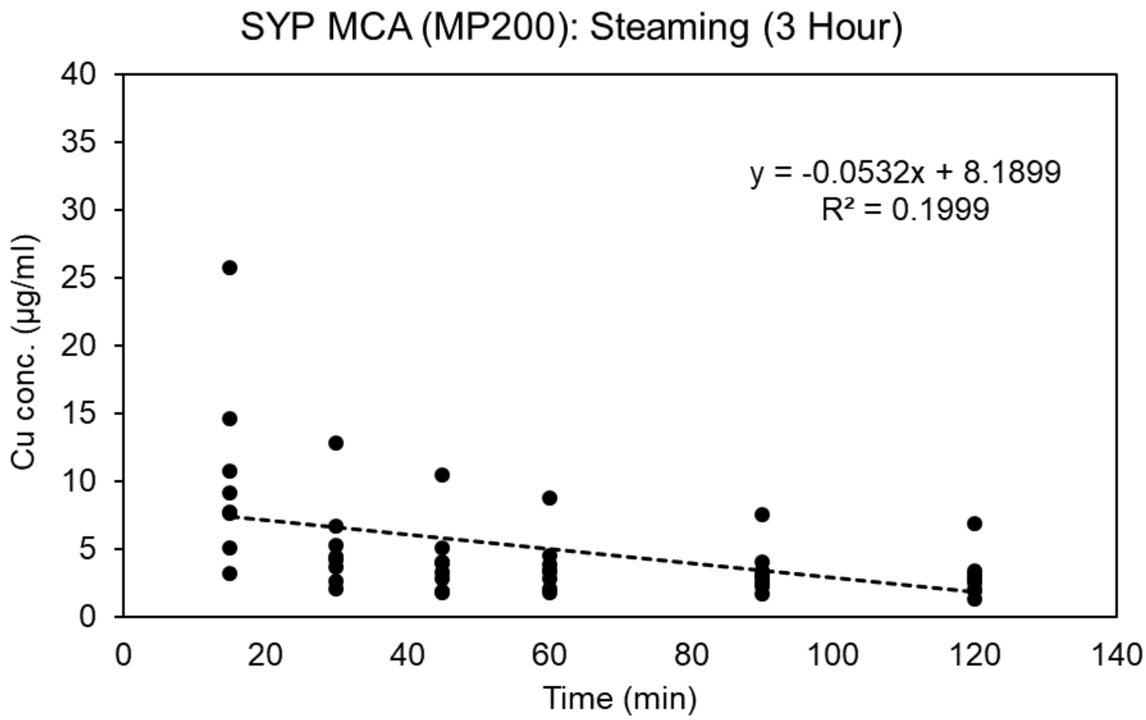
Most of the BMPs tested here were effective in reducing copper discharge from MCA-treated wood. These data along with those presented in prior reports supports BMPs as an effective tool to help reduce preservative loss from treated wood into the environment.

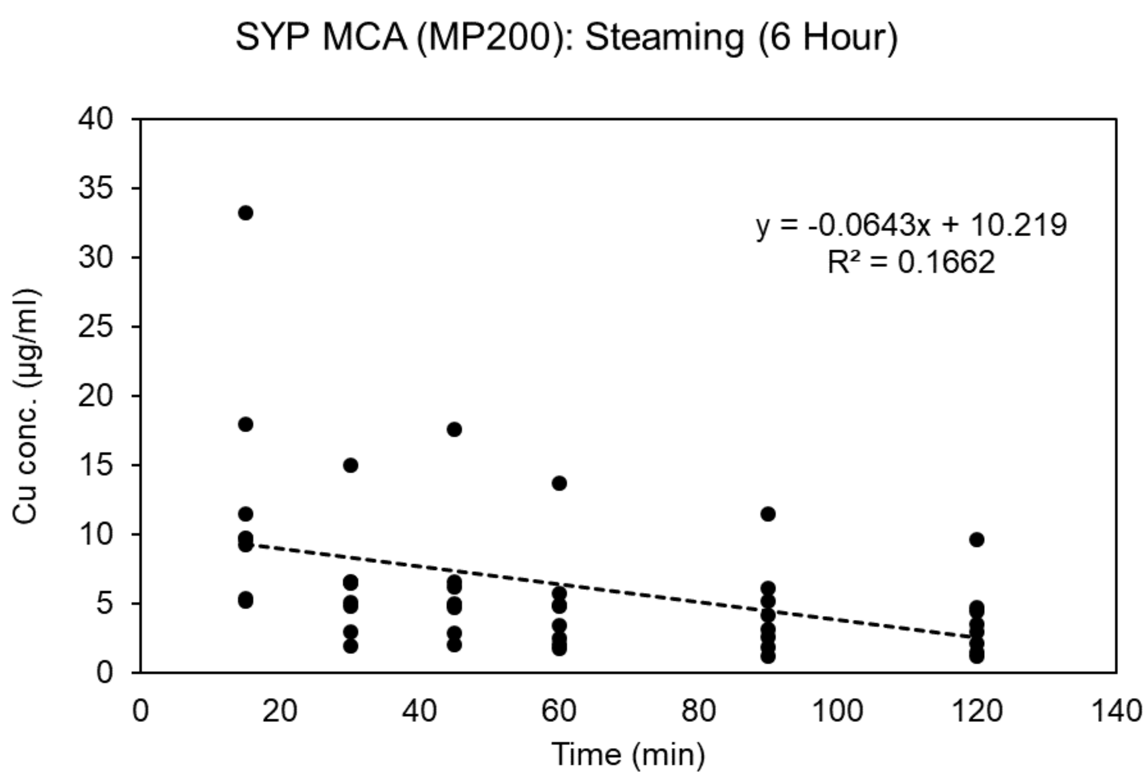
Figure 2. Effect of various BMP processes on copper losses from MP200 MCA-treated SYP lumber exposed to simulated rainfall. All data except air-dry BMP was previously published in the 2018 report.

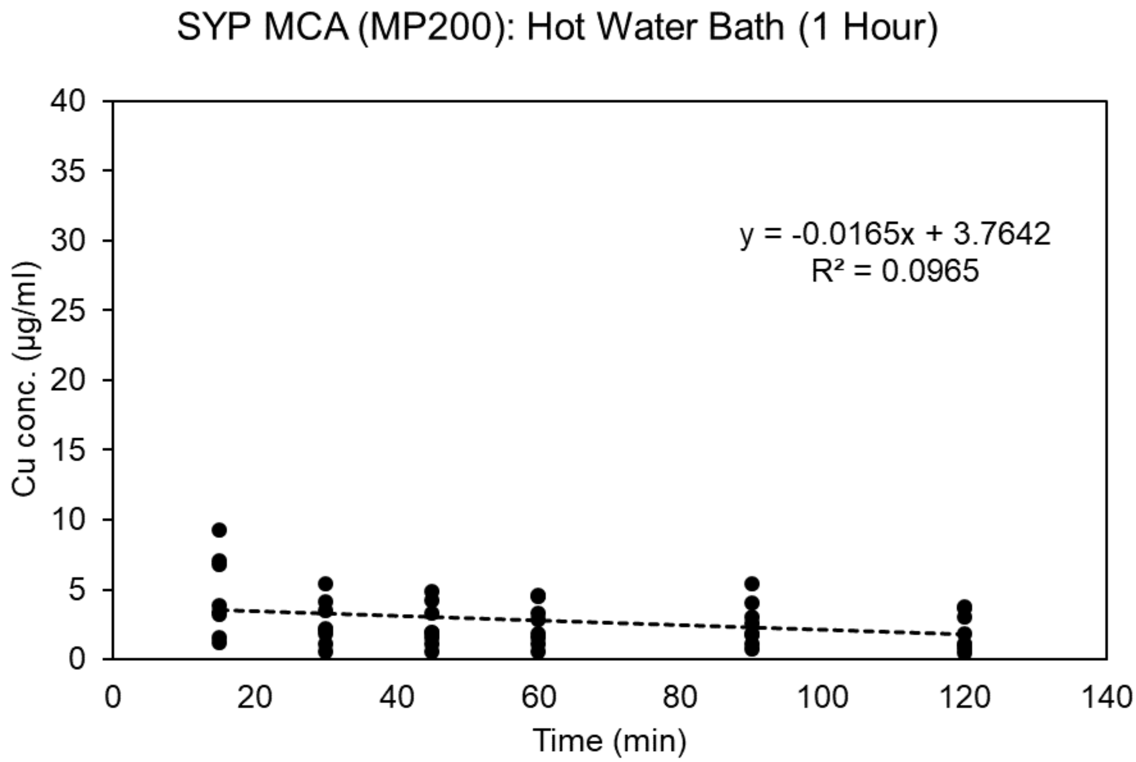


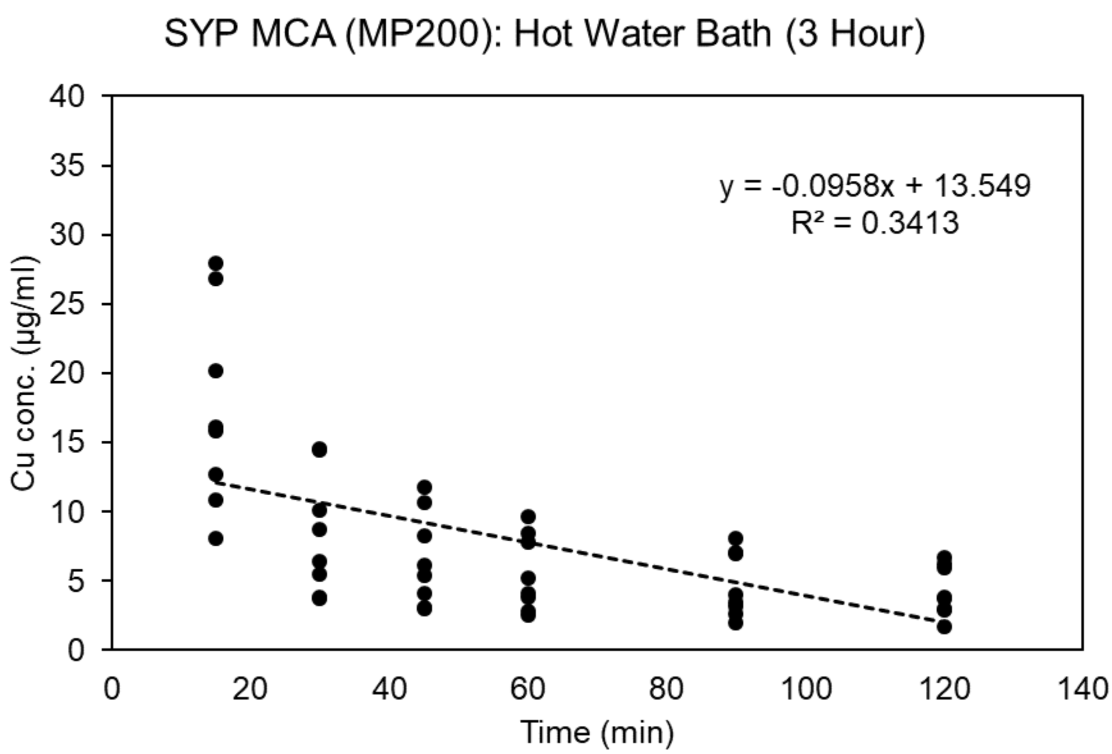

SYP MCA (MP200): Air Drying
y = -0.0107x + 2.0203
R² = 0.1467
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140

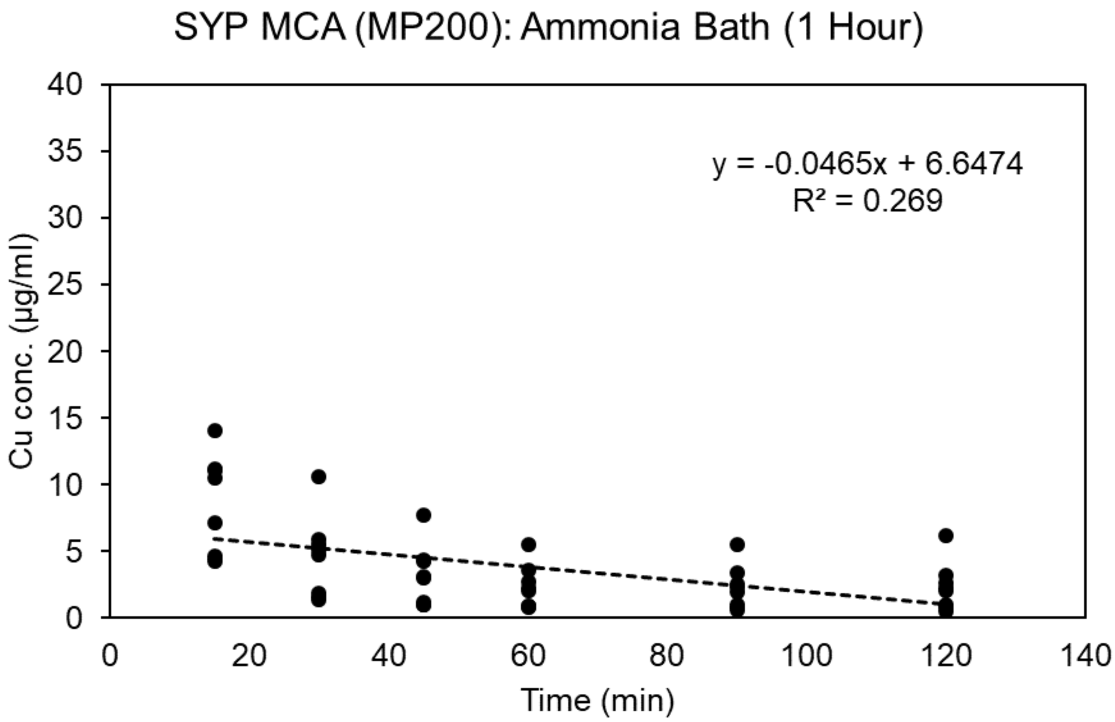

SYP MCA (MP200): Steaming (1 Hour)
y = -0.0656x + 8.6952
R² = 0.1554
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140


SYP MCA (MP200): Steaming (3 Hour)
y = -0.0532x + 8.1899
R² = 0.1999
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140


SYP MCA (MP200): Steaming (6 Hour)
y = -0.0643x + 10.219
R² = 0.1662
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140


SYP MCA (MP200): Hot Water Bath (1 Hour)
y = -0.0165x + 3.7642
R² = 0.0965
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140


SYP MCA (MP200): Hot Water Bath (3 Hour)
y = -0.0958x + 13.549
R² = 0.3413
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140



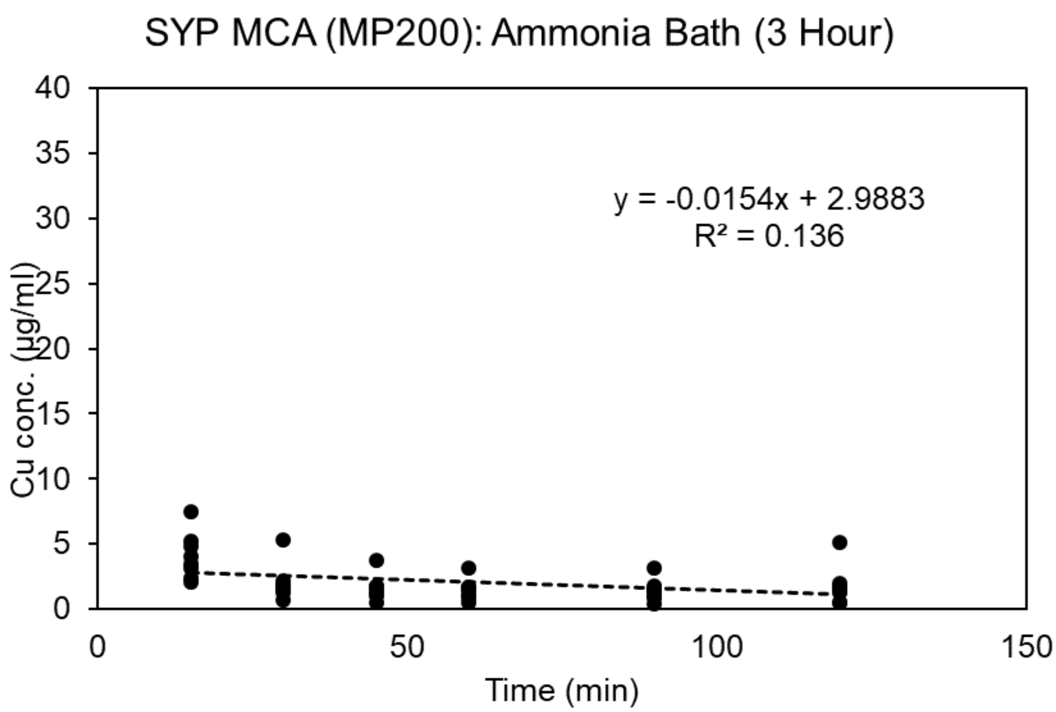
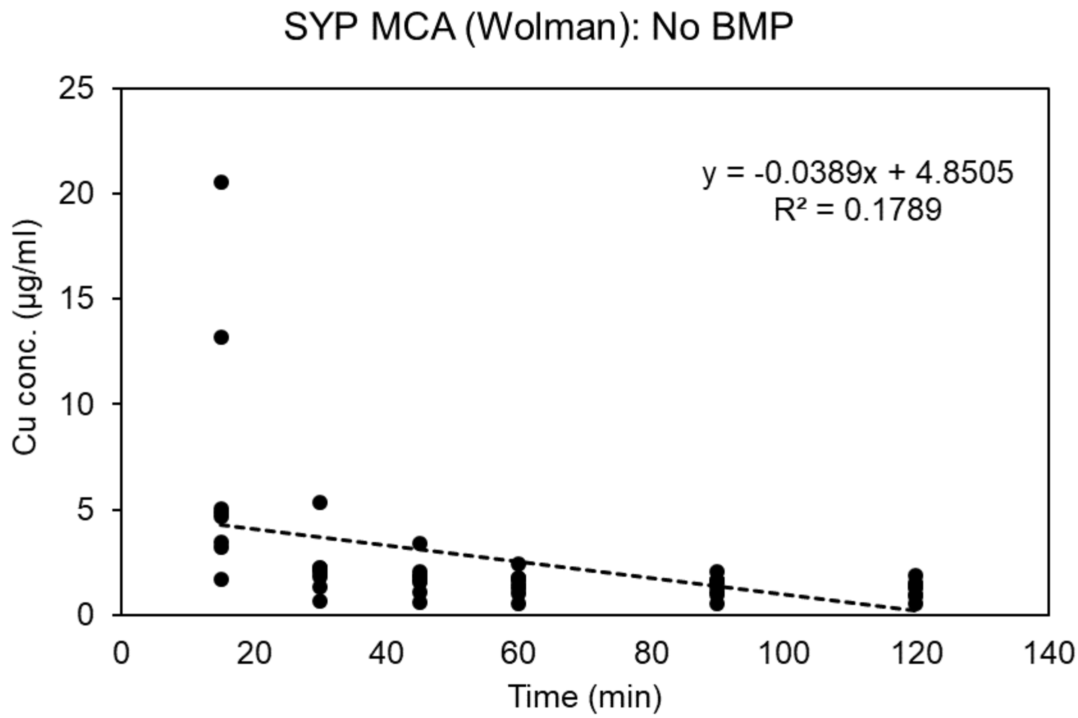
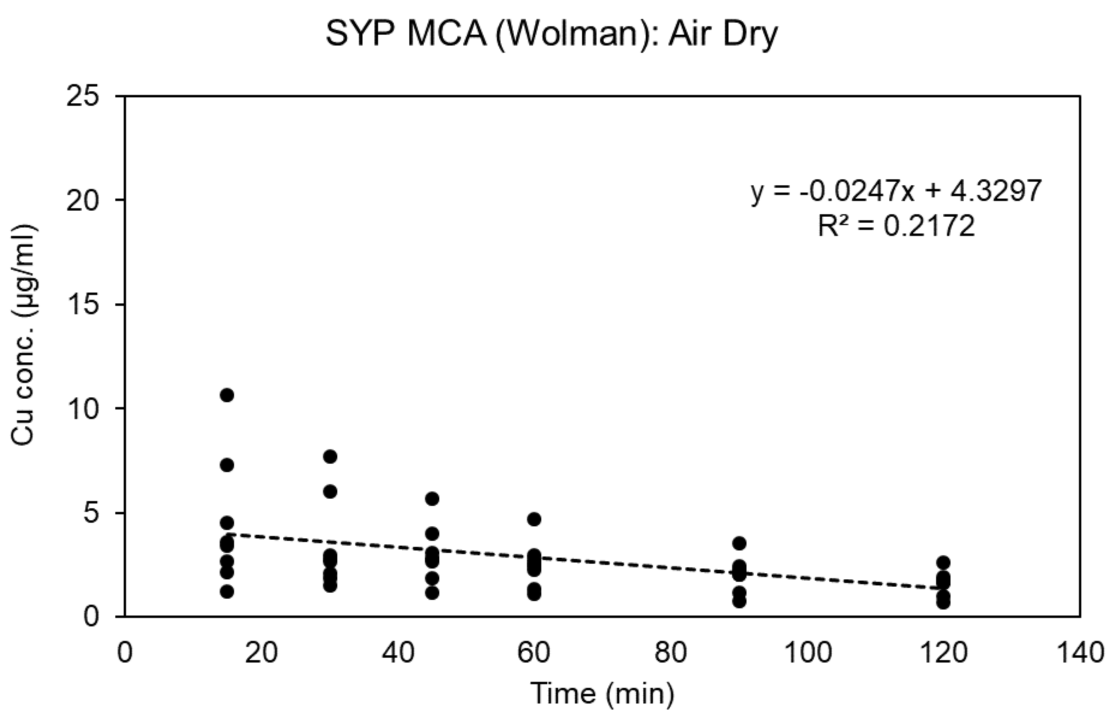
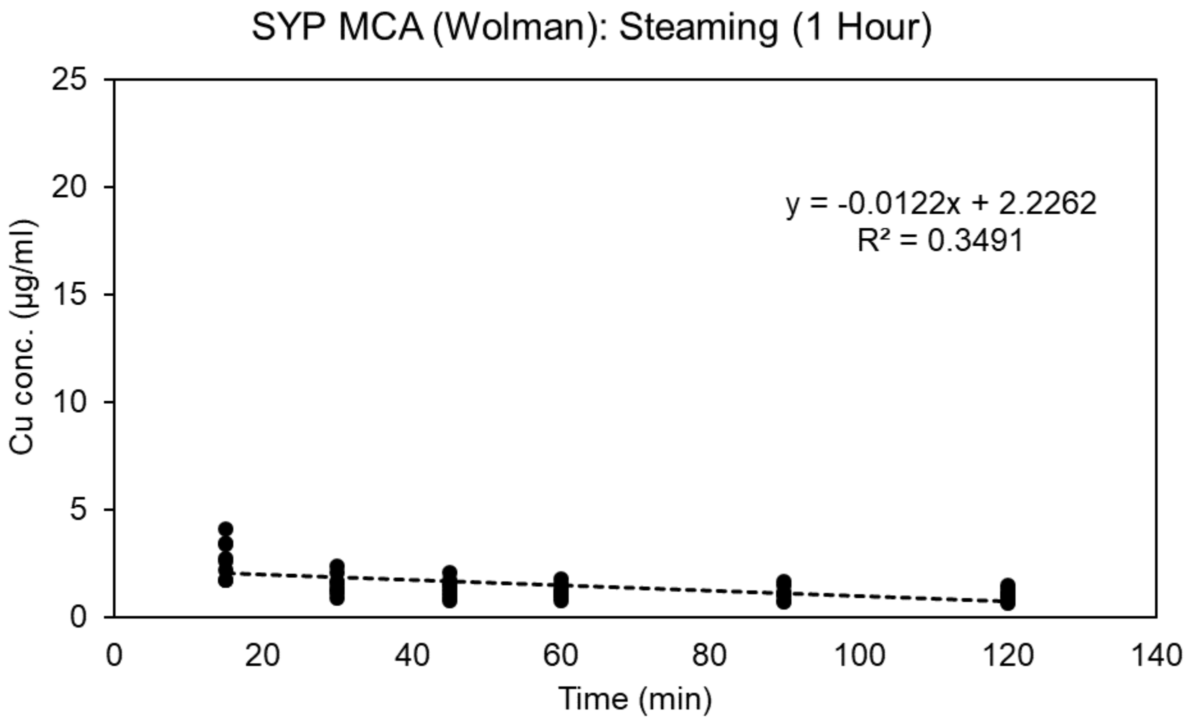
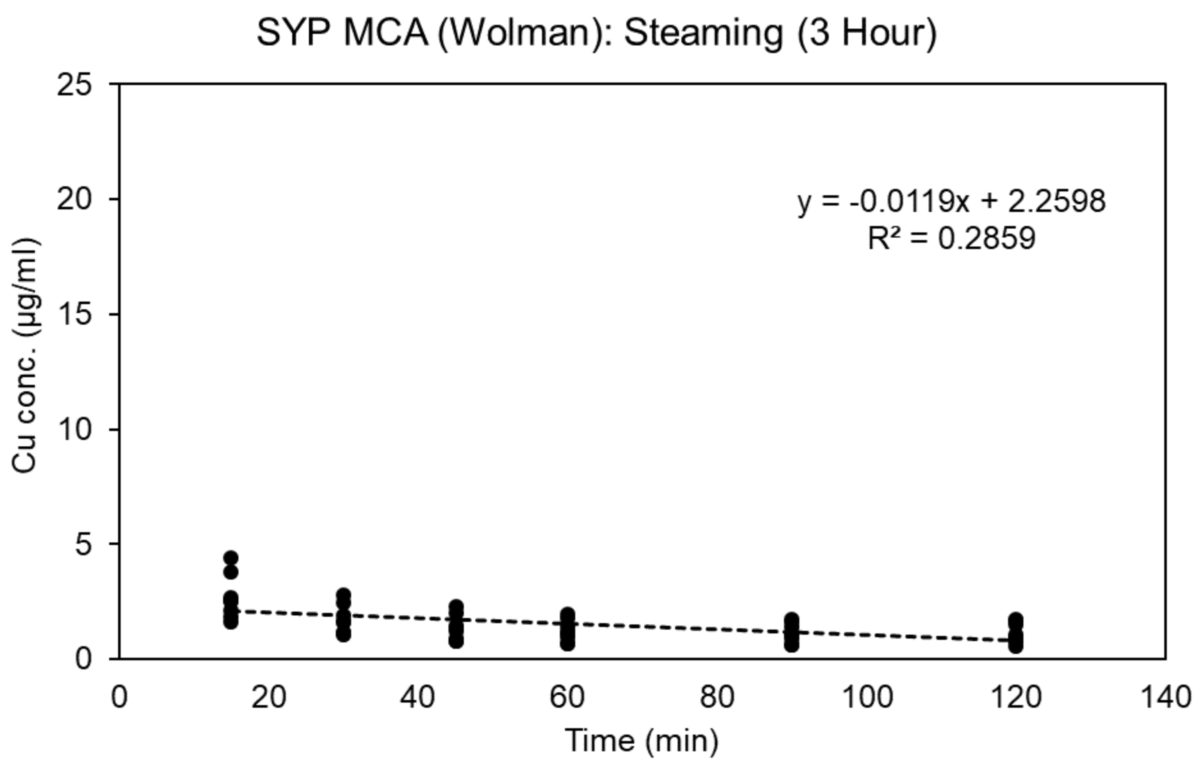


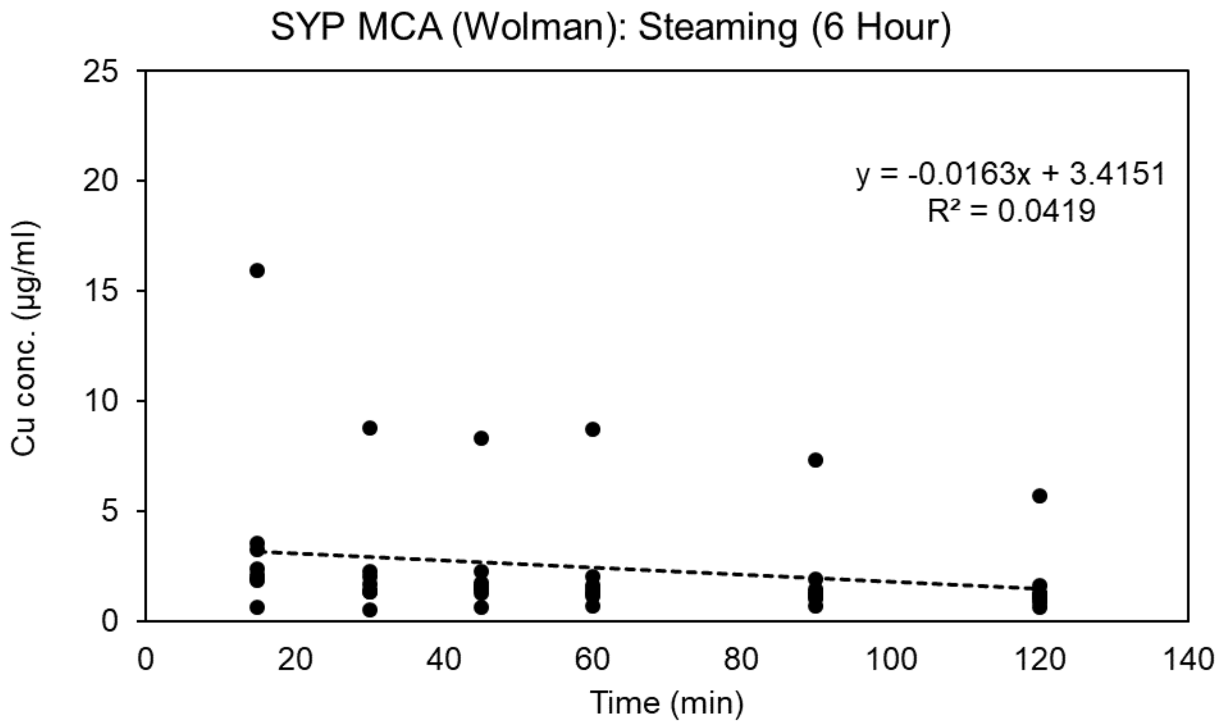
Figure 3. Effect of various BMP processes on copper losses from Wolman MCA-treated SYP lumber exposed to simulated rainfall.

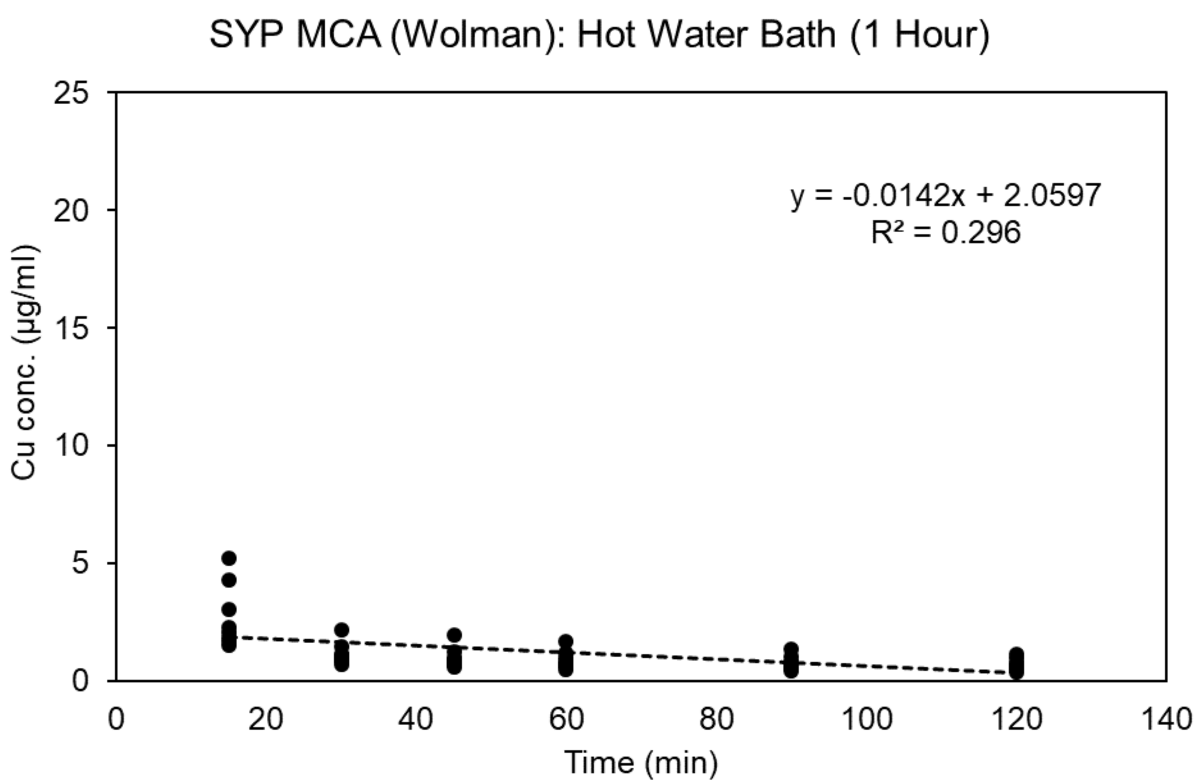

SYP MCA (Wolman): No BMP
y = -0.0389x + 4.8505
R² = 0.1789
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

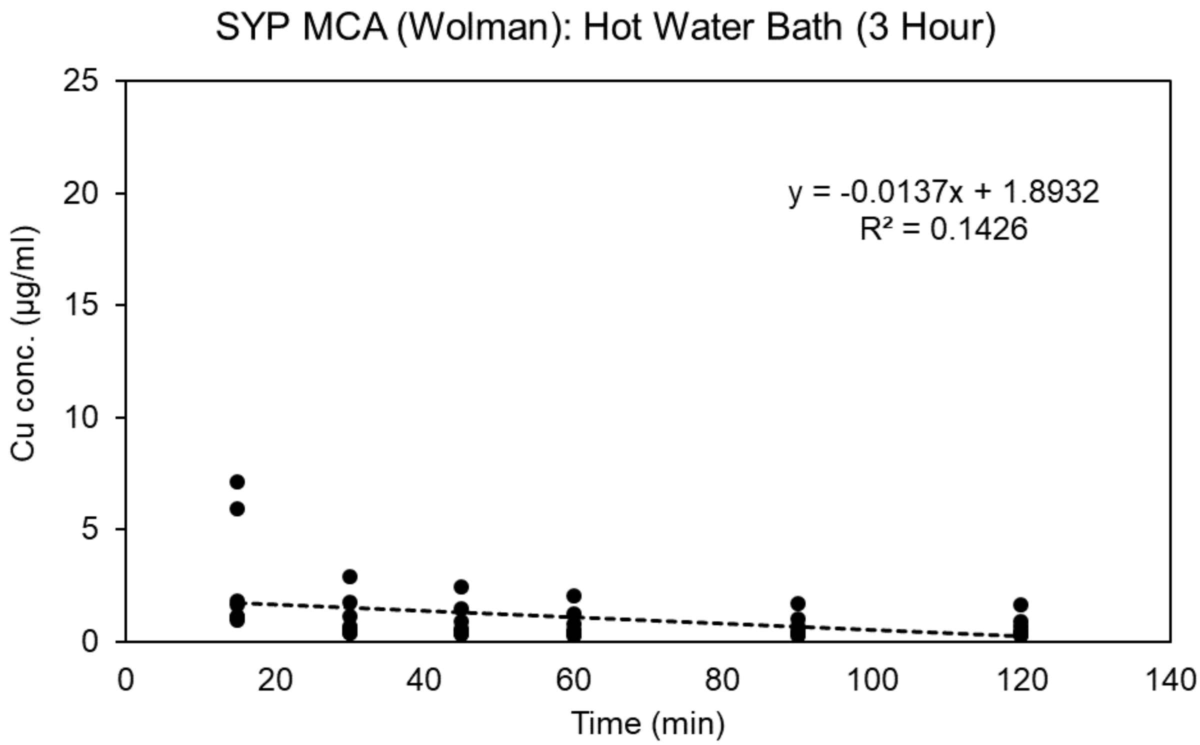

SYP MCA (Wolman): Air Dry
y = -0.0247x + 4.3297
R² = 0.2172
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

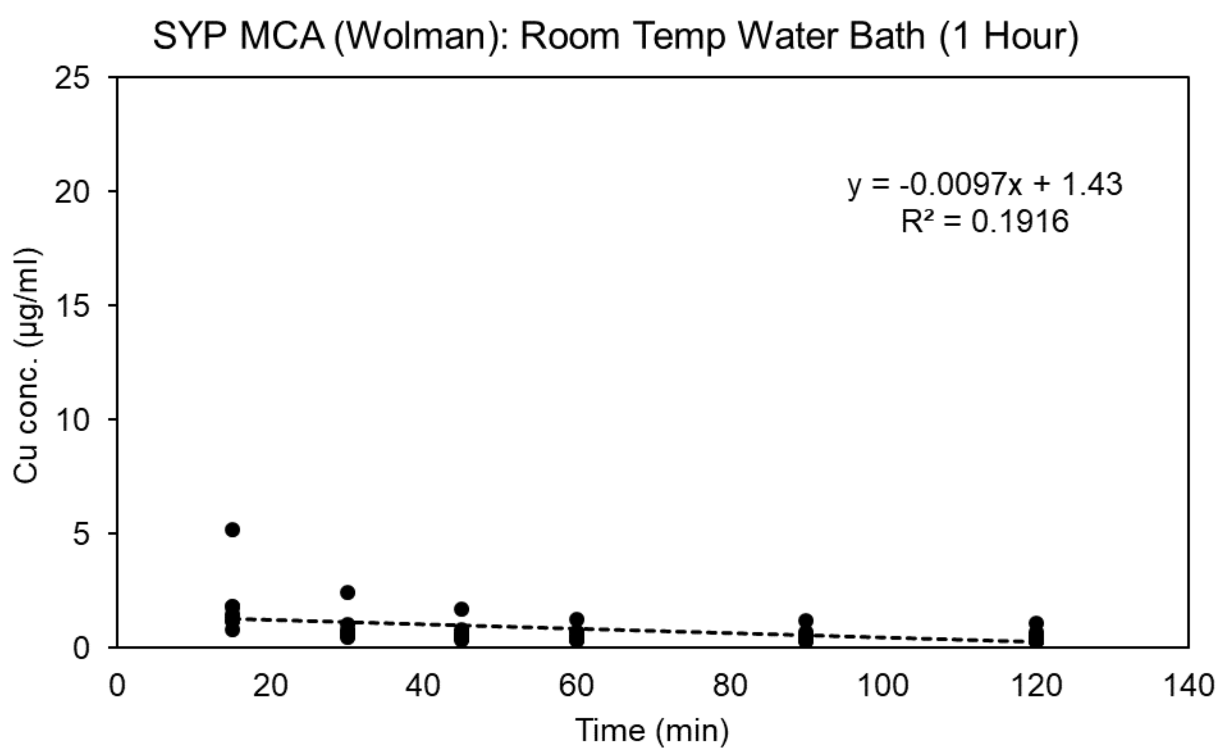

SYP MCA (Wolman): Steaming (1 Hour)
y = -0.0122x + 2.2262
R² = 0.3491
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

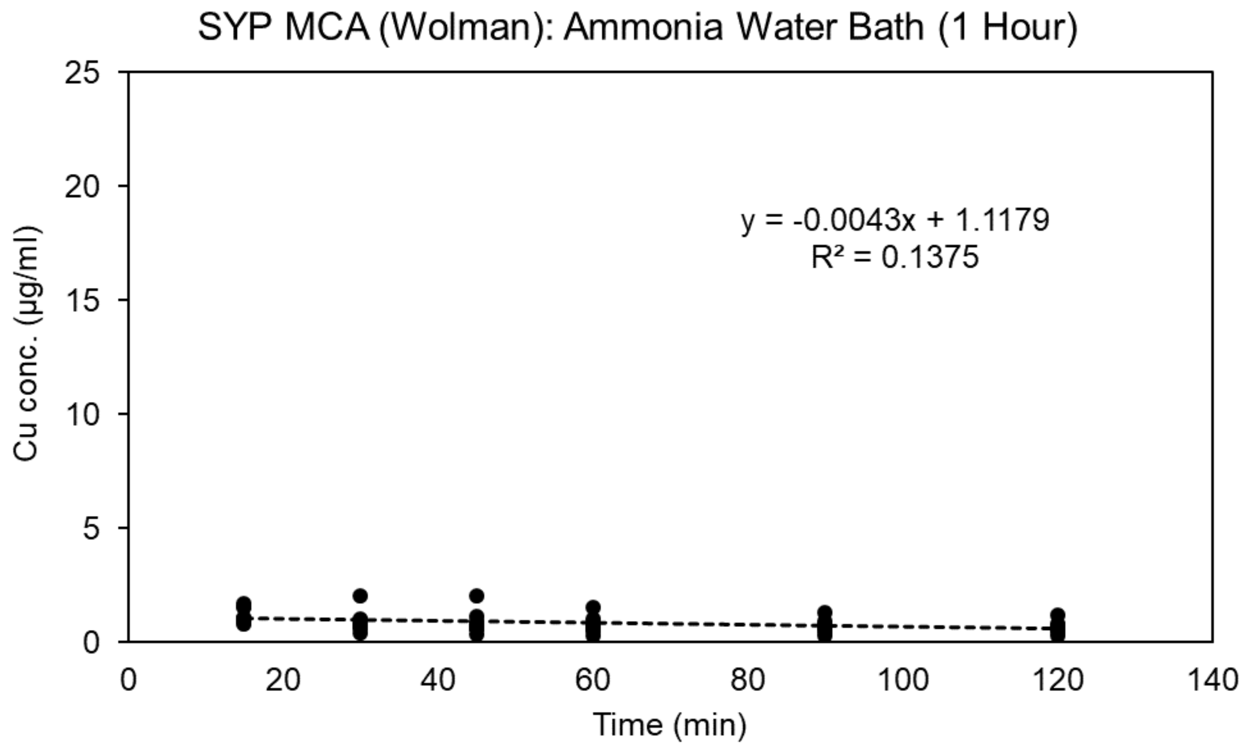

SYP MCA (Wolman): Steaming (3 Hour)
y = -0.0119x + 2.2598
R² = 0.2859
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


SYP MCA (Wolman): Steaming (6 Hour)
y = -0.0163x + 3.4151
R² = 0.0419
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


SYP MCA (Wolman): Hot Water Bath (1 Hour)
y = -0.0142x + 2.0597
R² = 0.296
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


SYP MCA (Wolman): Hot Water Bath (3 Hour)
y = -0.0137x + 1.8932
R² = 0.1426
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


SYP MCA (Wolman): Room Temp Water Bath (1 Hour)
y = -0.0097x + 1.43
R² = 0.1916
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


SYP MCA (Wolman): Ammonia Water Bath (1 Hour)
y = -0.0043x + 1.1179
R² = 0.1375
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

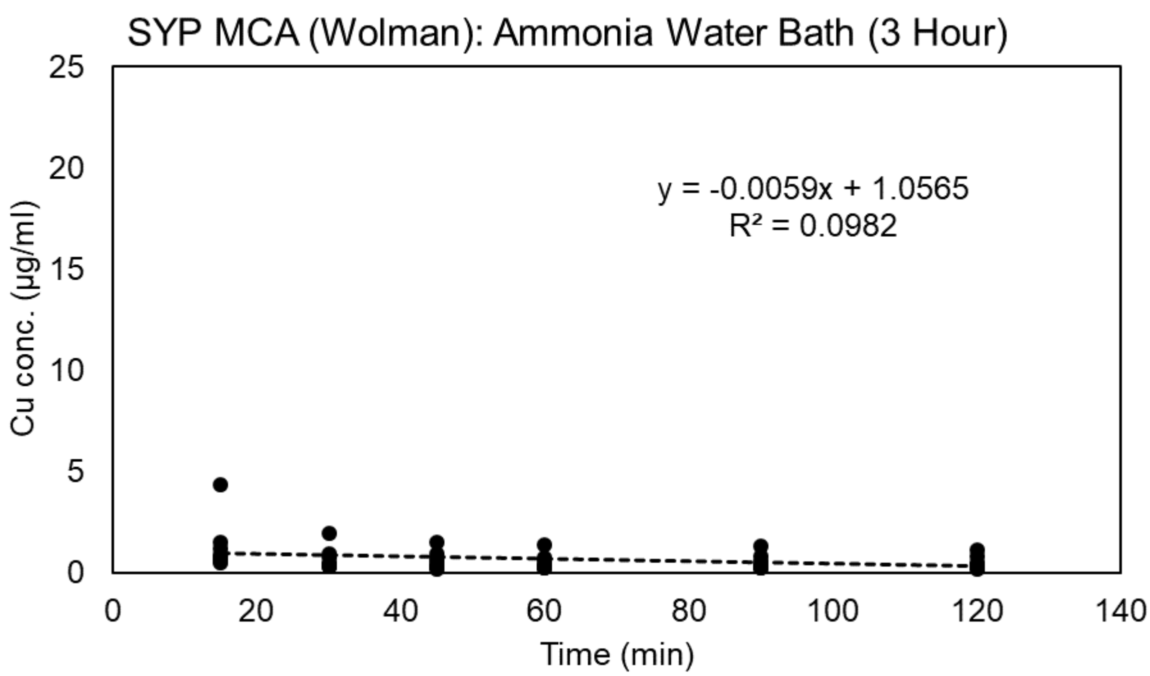
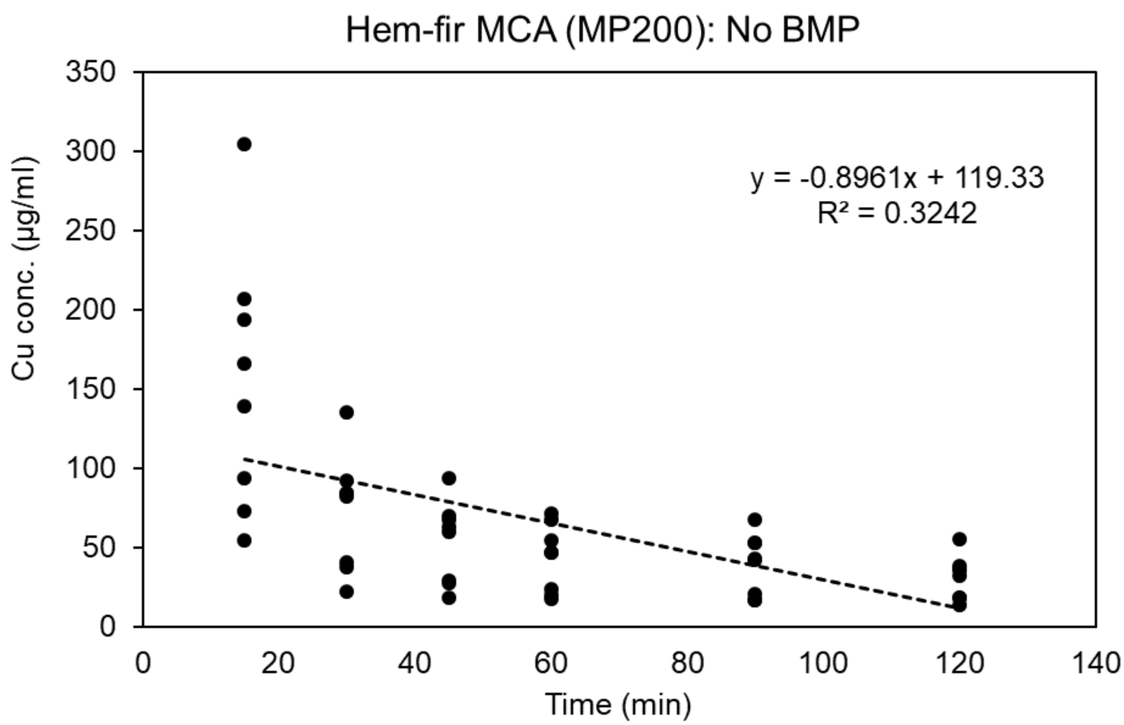
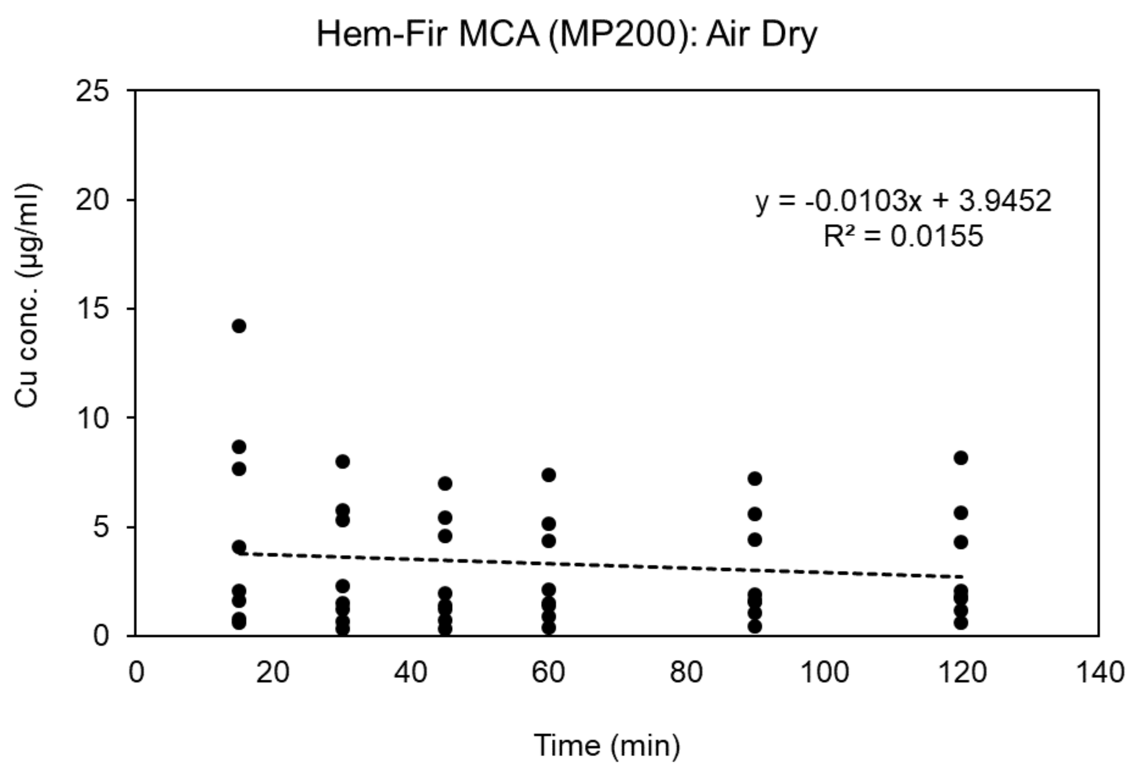
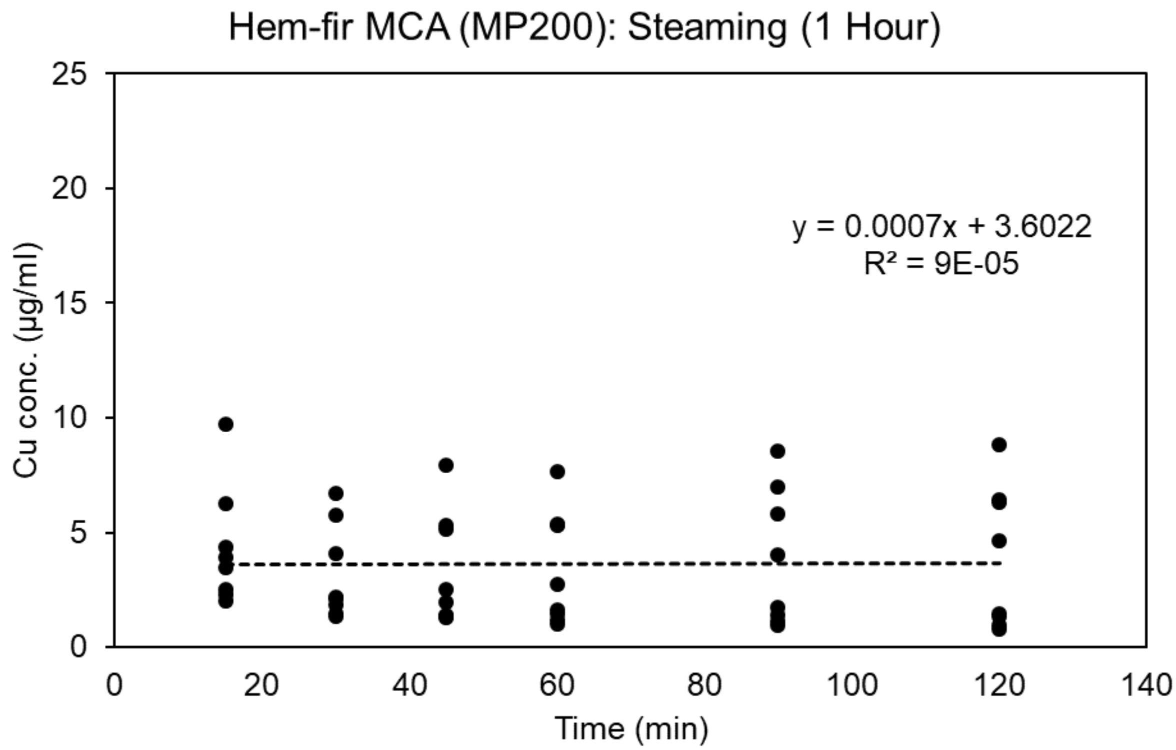
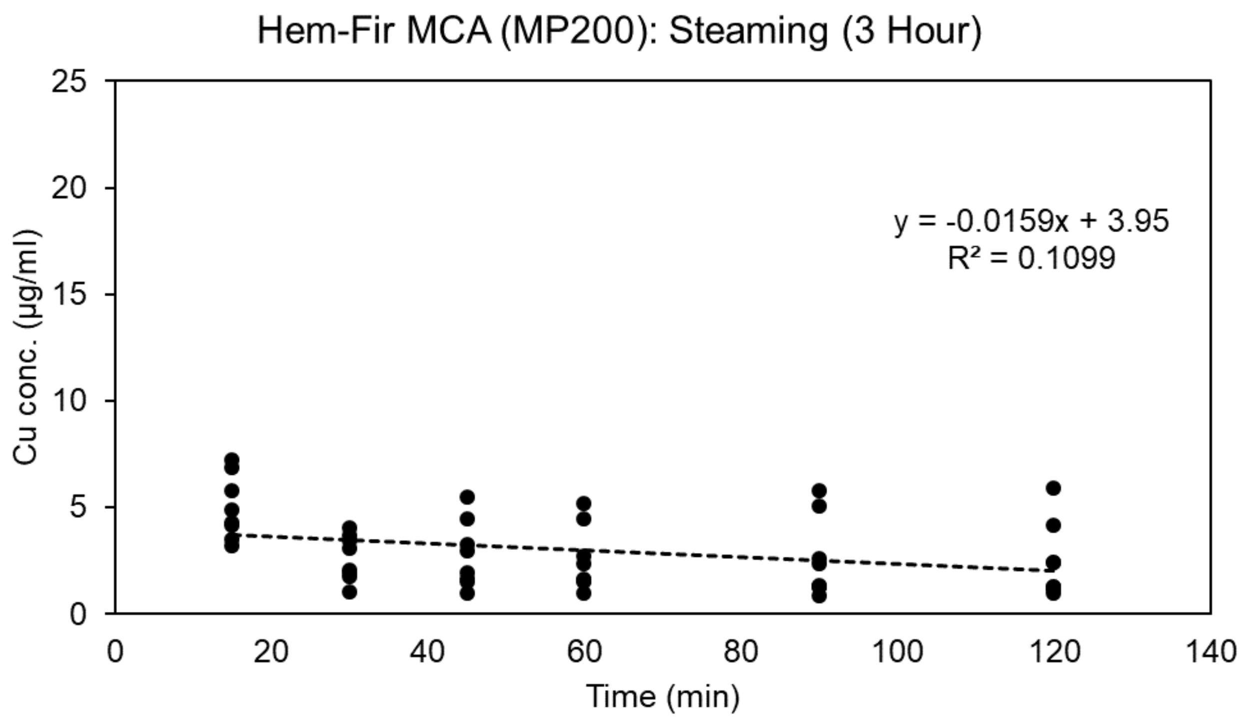

SYP MCA (Wolman): Ammonia Water Bath (3 Hour)
y = -0.0059x + 1.0565
R² = 0.0982
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

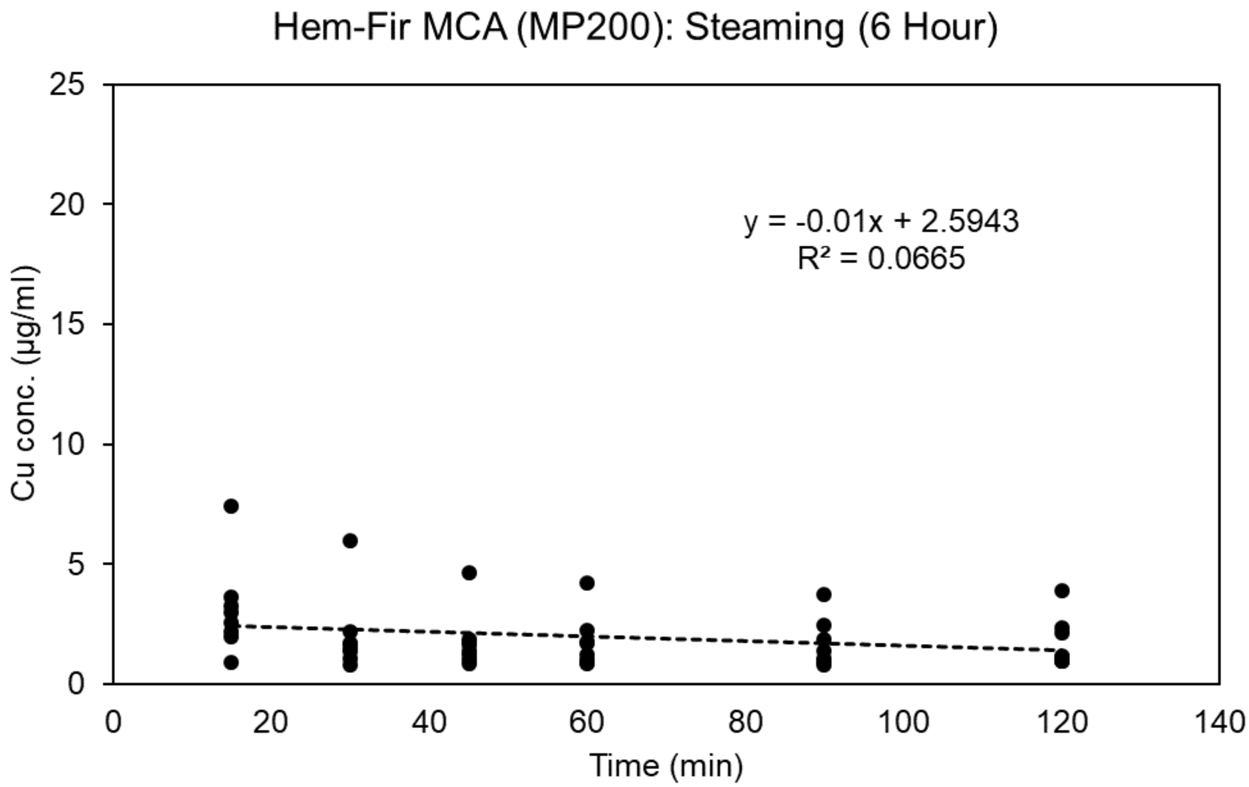
Figure 4. Effect of various BMP processes on copper losses from MP200 MCA-treated Hem-Fir lumber exposed to simulated rainfall. Note the difference in y-axis scale for no BMP treatment and room temp water bath as compared to all other BMP treatments.

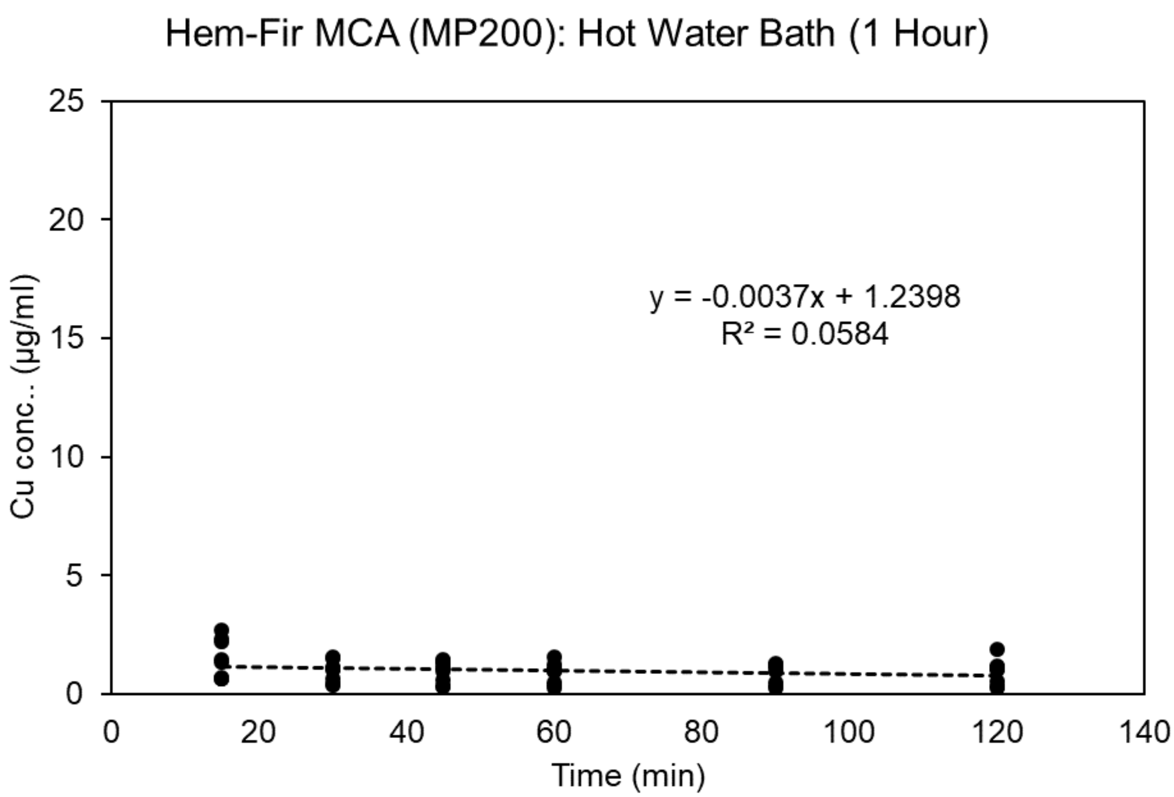


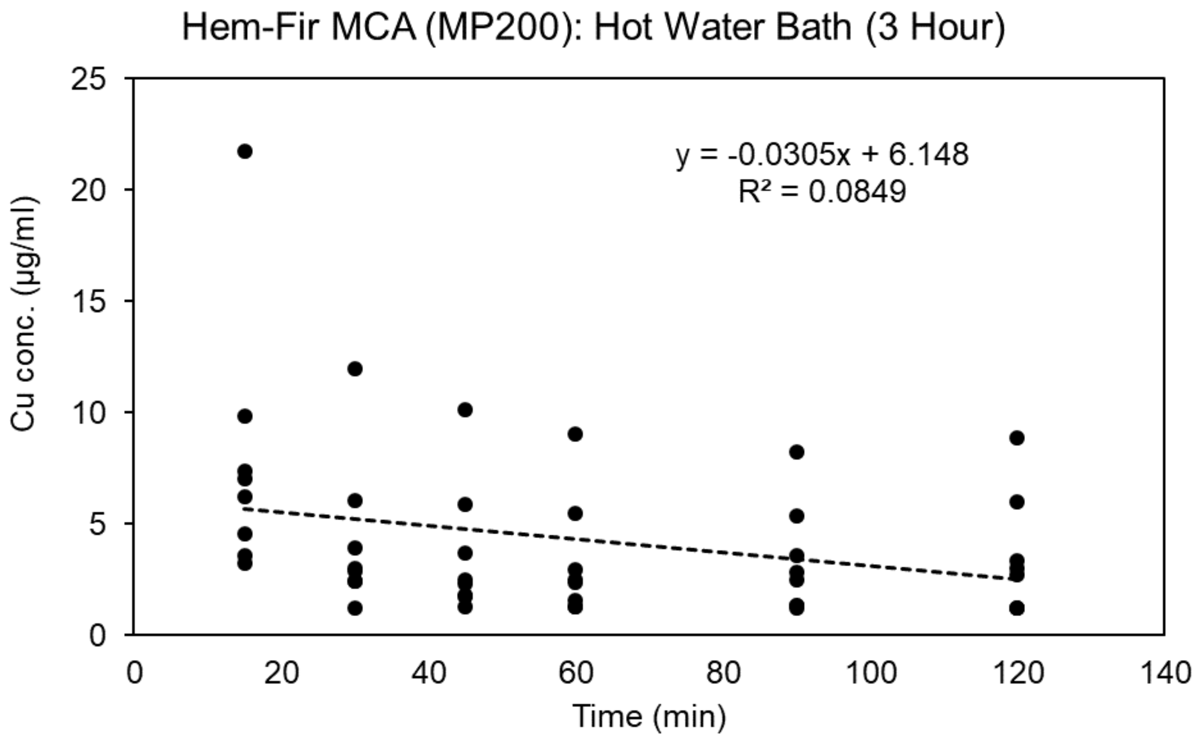


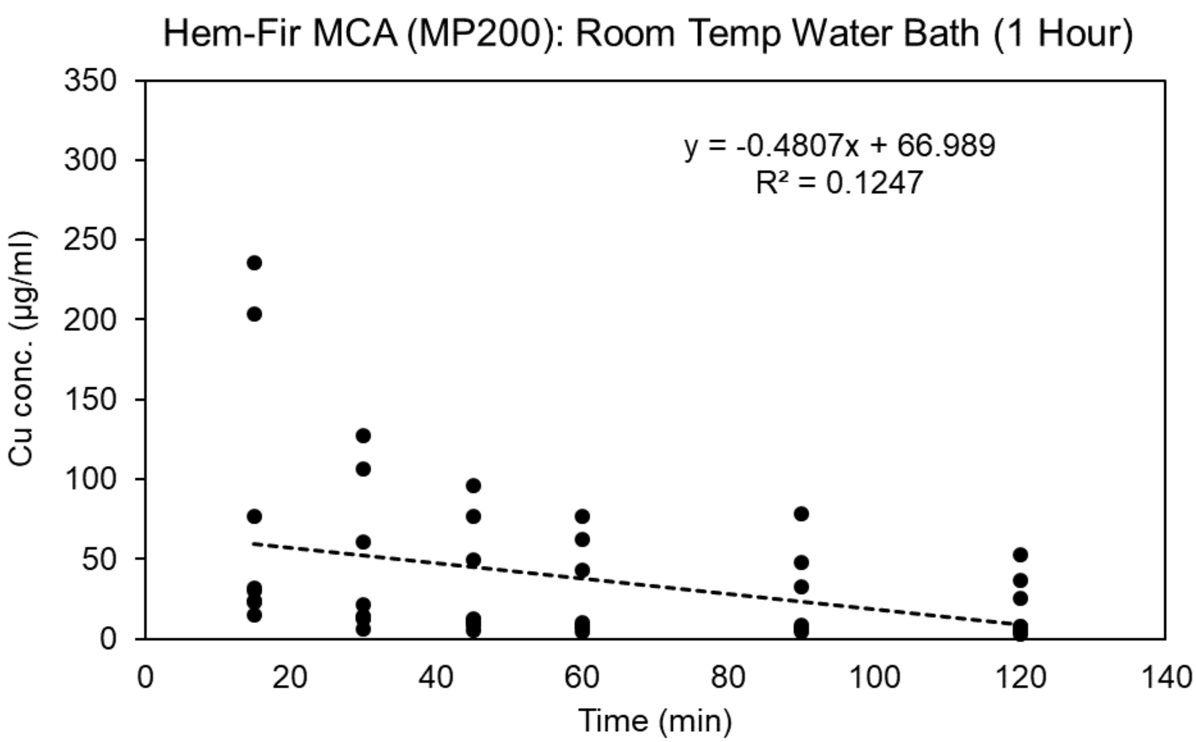

Hem-fir MCA (MP200): Steaming (1 Hour)
y = 0.0007x + 3.6022
R² = 9E-05
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

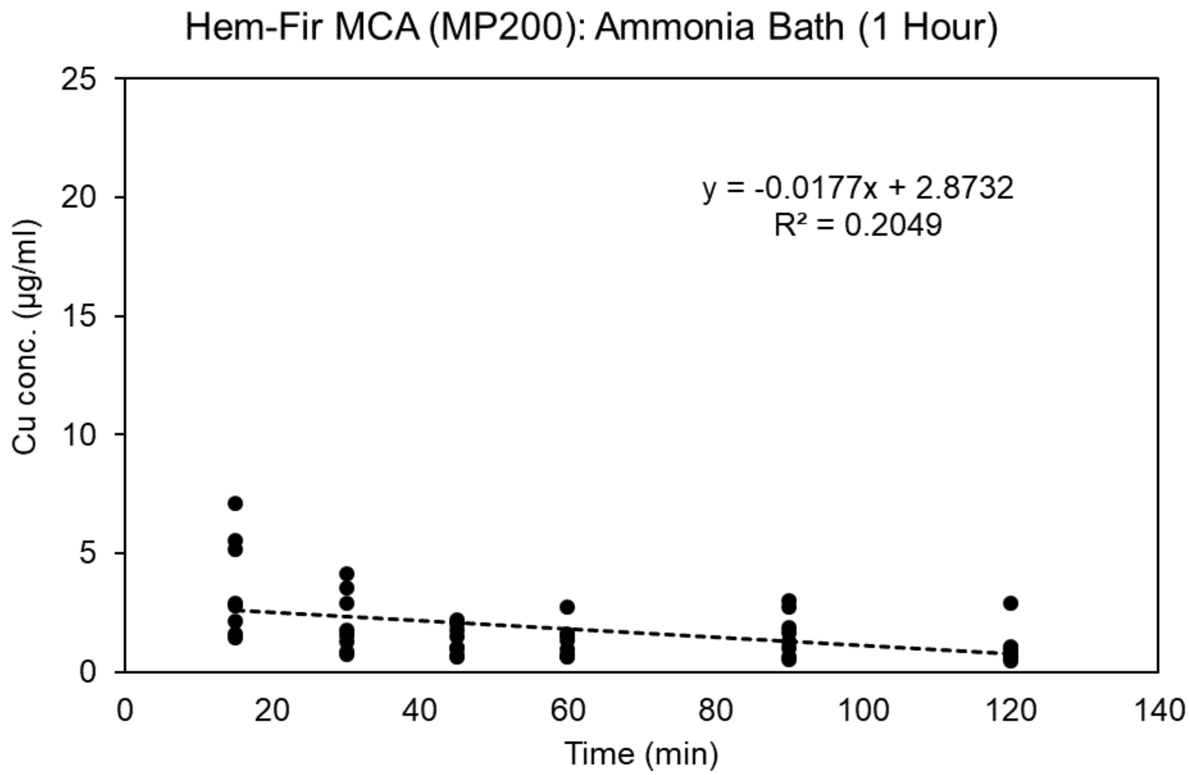

Hem-Fir MCA (MP200): Steaming (3 Hour)
y = -0.0159x + 3.95
R² = 0.1099
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


Hem-Fir MCA (MP200): Steaming (6 Hour)
y = -0.01x + 2.5943
R² = 0.0665
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


Hem-Fir MCA (MP200): Hot Water Bath (1 Hour)
y = -0.0037x + 1.2398
R² = 0.0584
Cu conc.. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140


Hem-Fir MCA (MP200): Hot Water Bath (3 Hour)
y = -0.0305x + 6.148
R² = 0.0849
Cu conc. (µg/ml)
0
5
10
15
20
25
0
20
40
60
80
100
120
140
Time (min)


Hem-Fir MCA (MP200): Room Temp Water Bath (1 Hour)
y = -0.4807x + 66.989
R² = 0.1247
Cu conc. (µg/ml)
0
50
100
150
200
250
300
350
0
20
40
60
80
100
120
140
Time (min)


Hem-Fir MCA (MP200): Ammonia Bath (1 Hour)
y = -0.0177x + 2.8732
R² = 0.2049
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

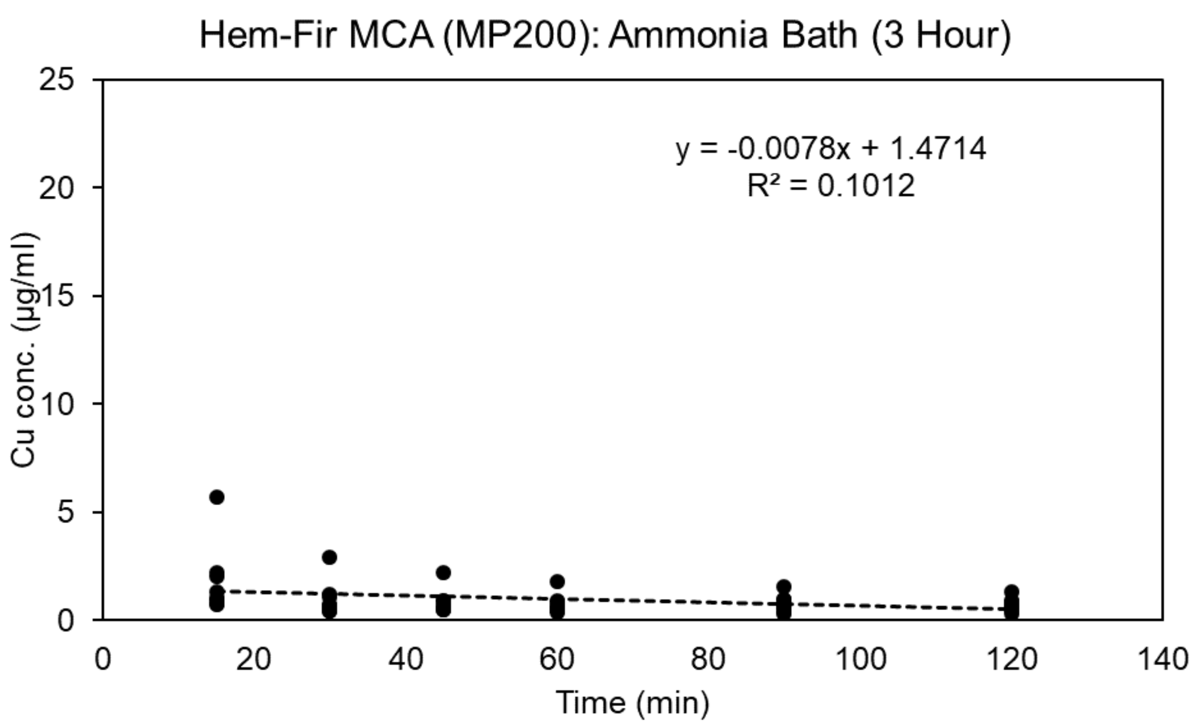
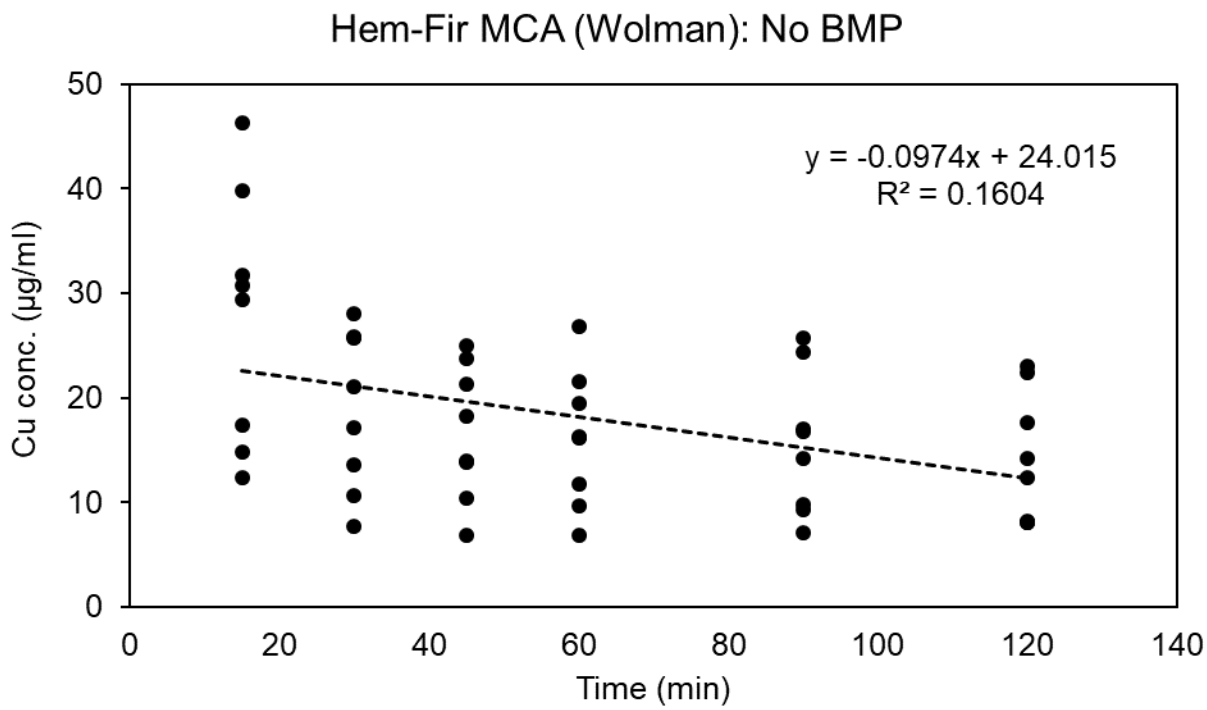
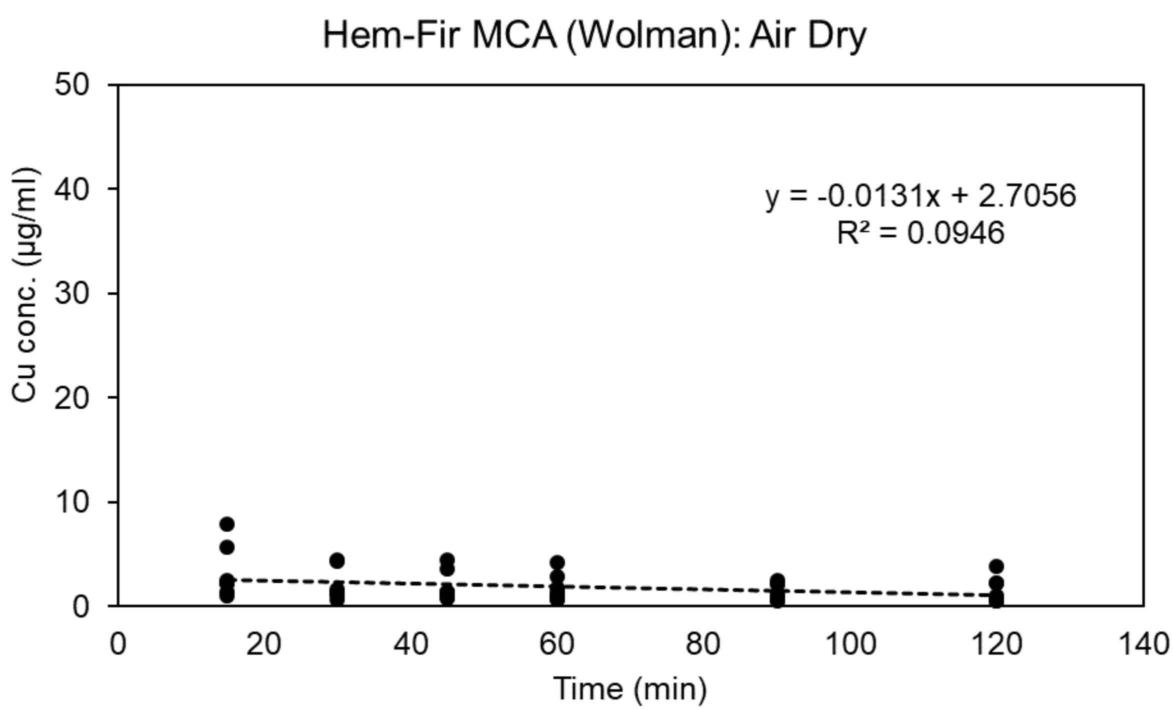
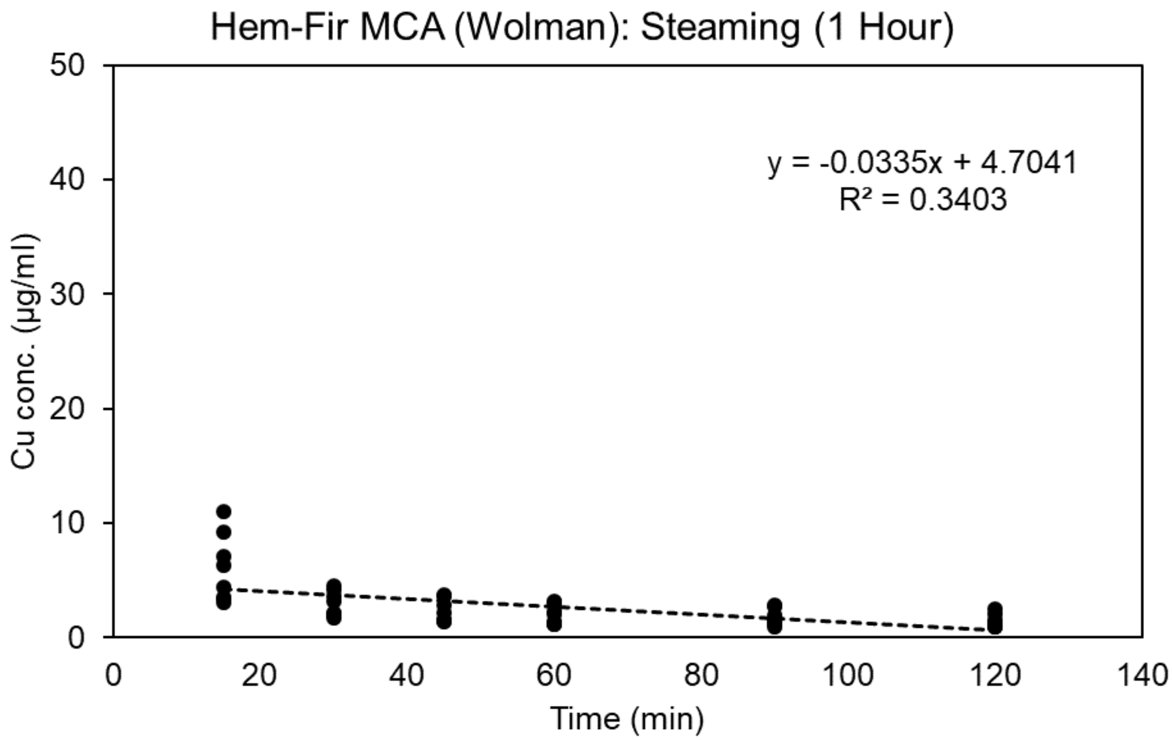
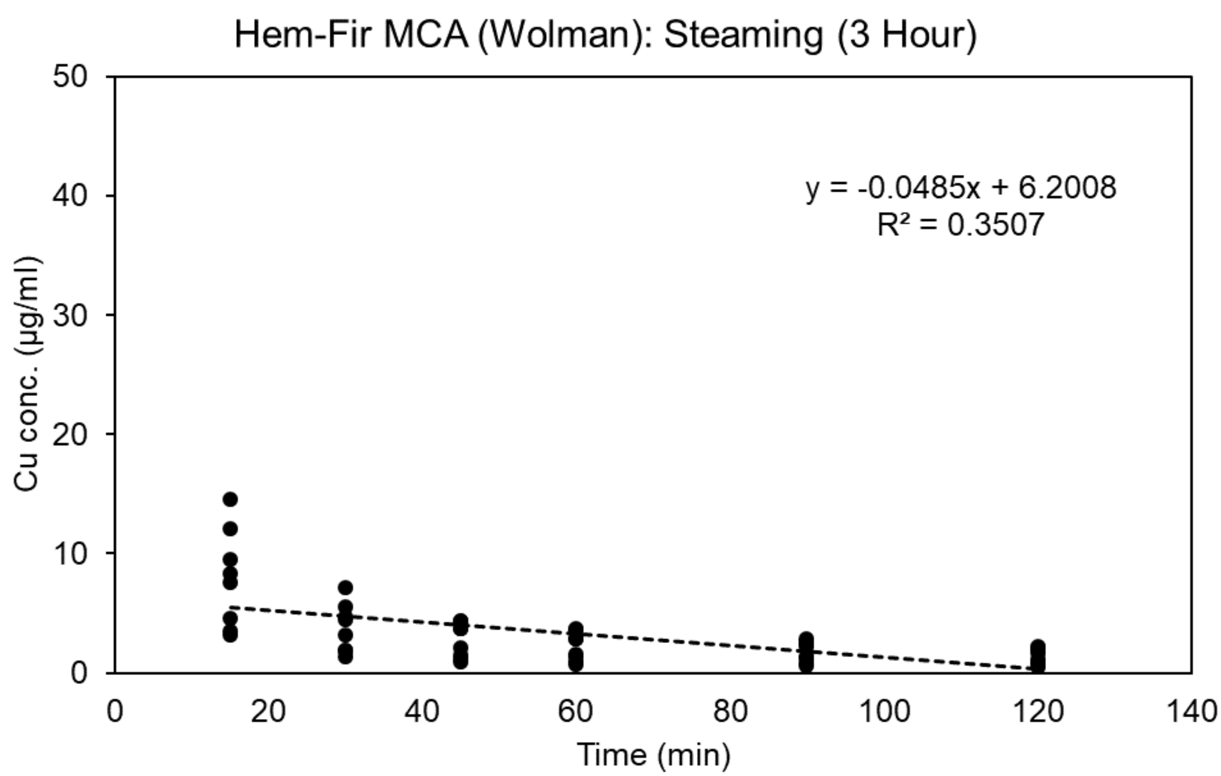

Hem-Fir MCA (MP200): Ammonia Bath (3 Hour)
y = -0.0078x + 1.4714
R² = 0.1012
Cu conc. (µg/ml)
Time (min)
0
5
10
15
20
25
0
20
40
60
80
100
120
140

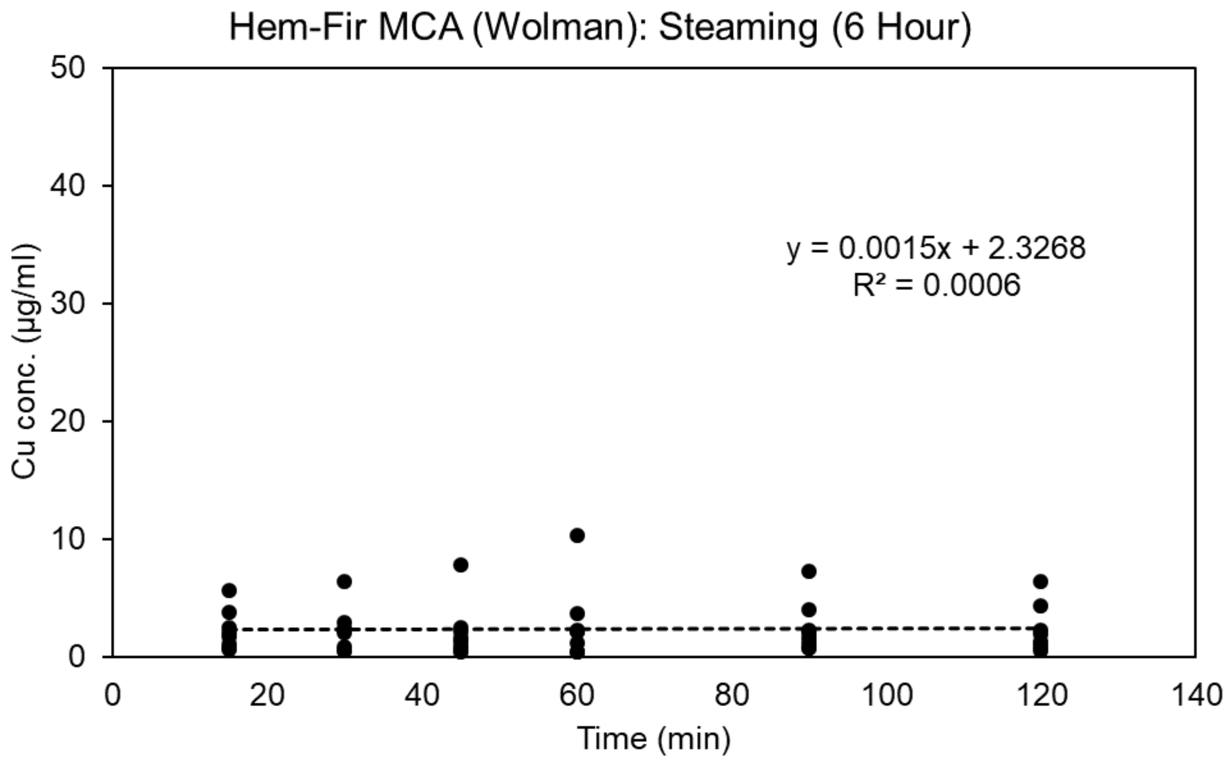
Figure 5. Effect of various BMP processes on copper losses from Wolman MCA-treated Hem-Fir lumber exposed to simulated rainfall. Note the difference in y-axis scale between 3 hour hot water bath BMP and all other treatments.

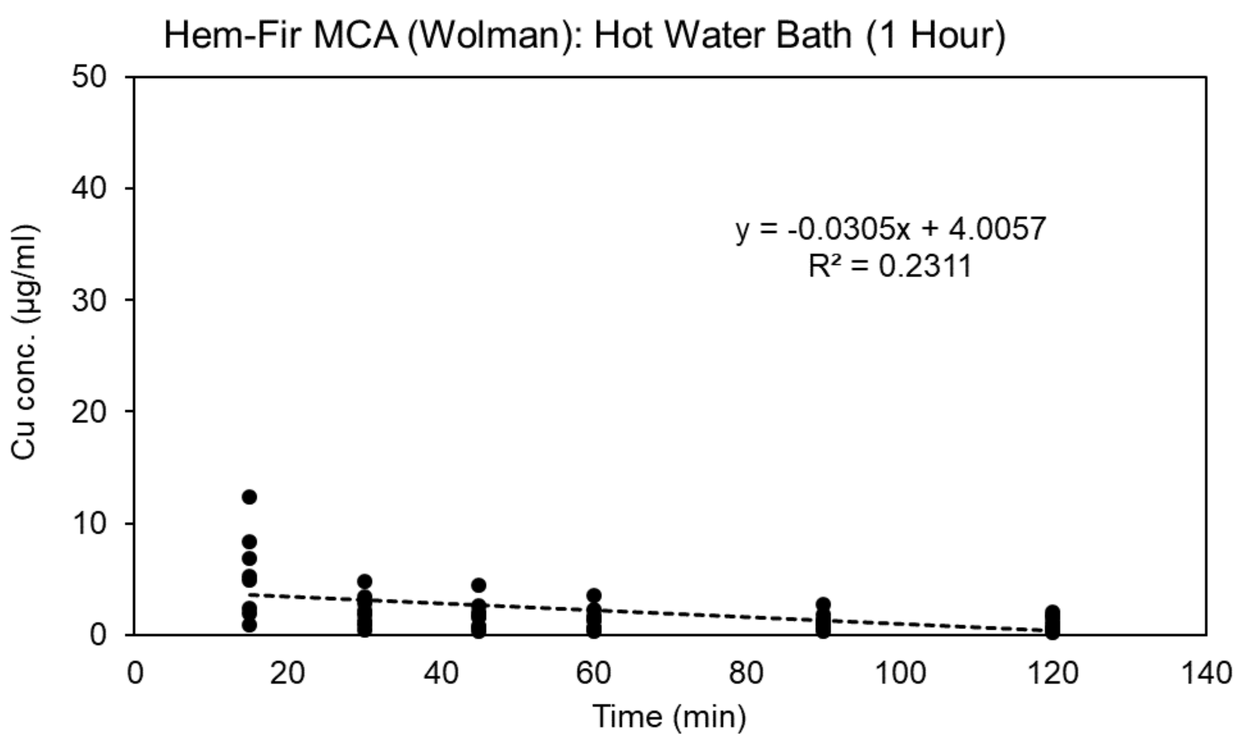


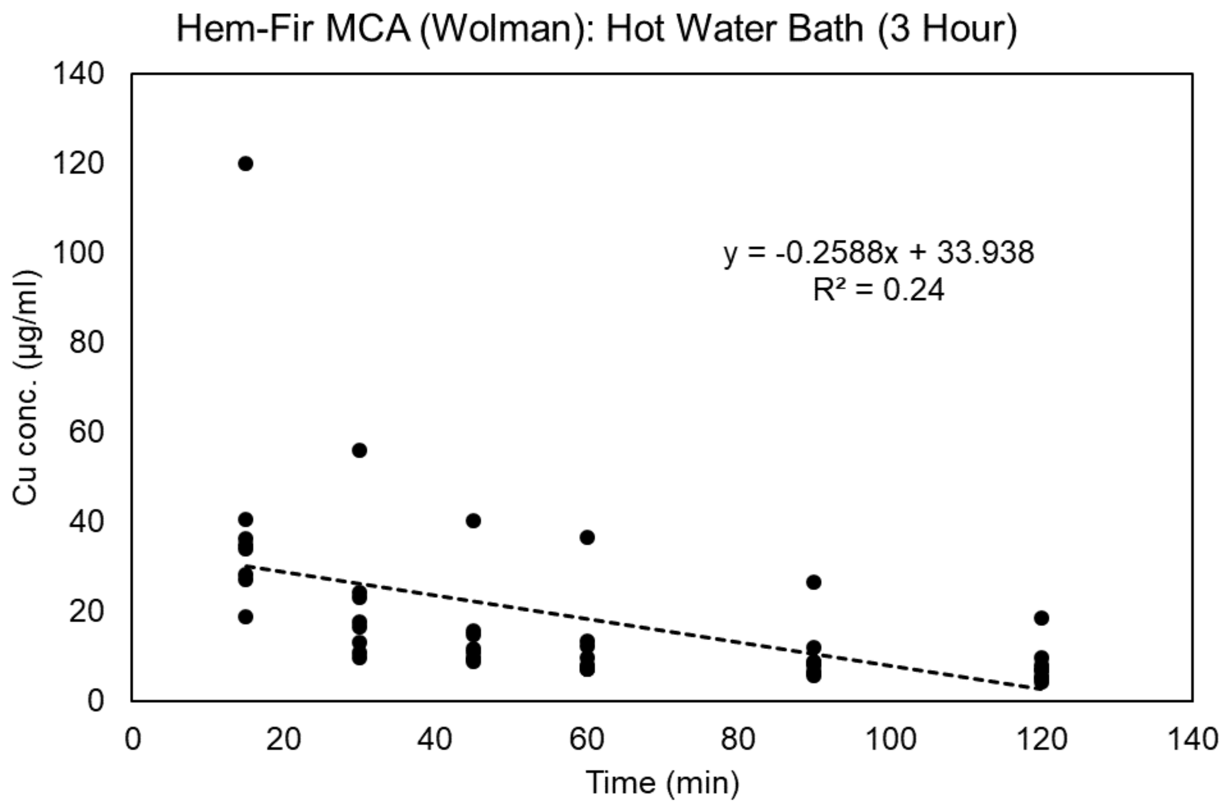


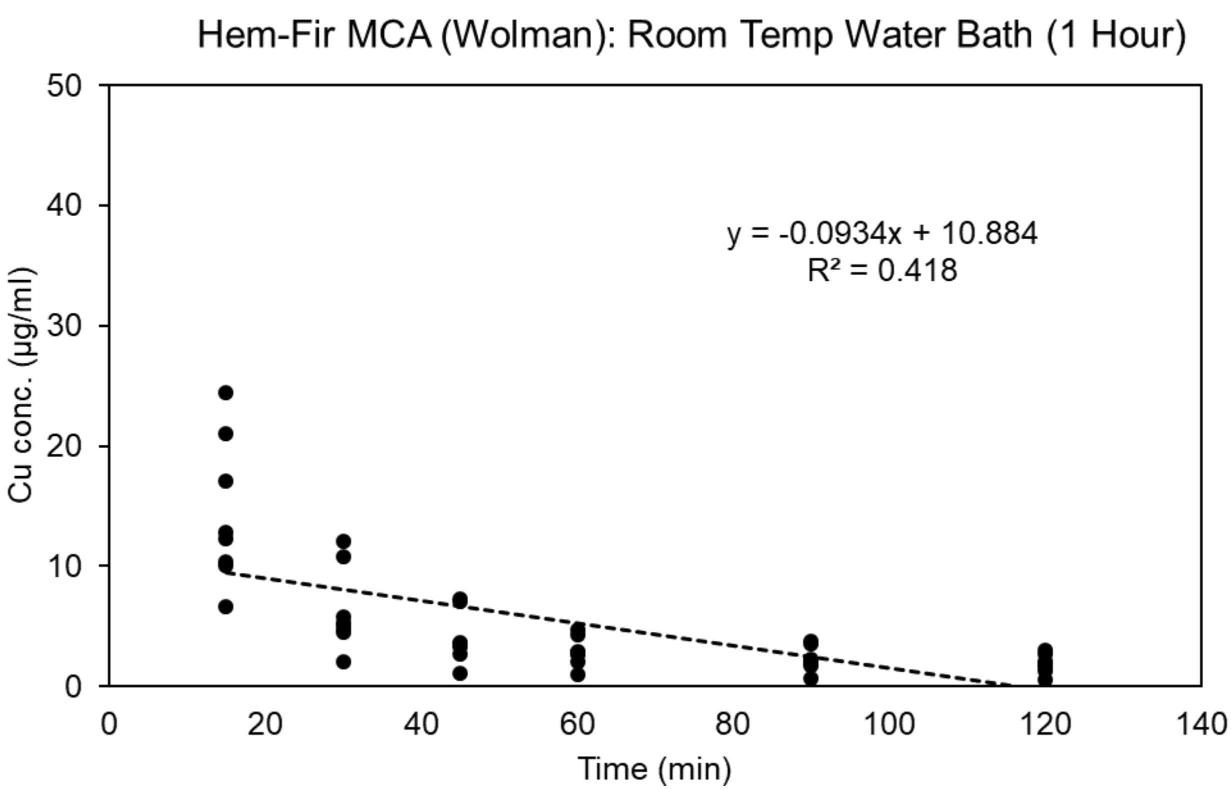

Hem-Fir MCA (Wolman): Steaming (1 Hour)
y = -0.0335x + 4.7041
R² = 0.3403
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140

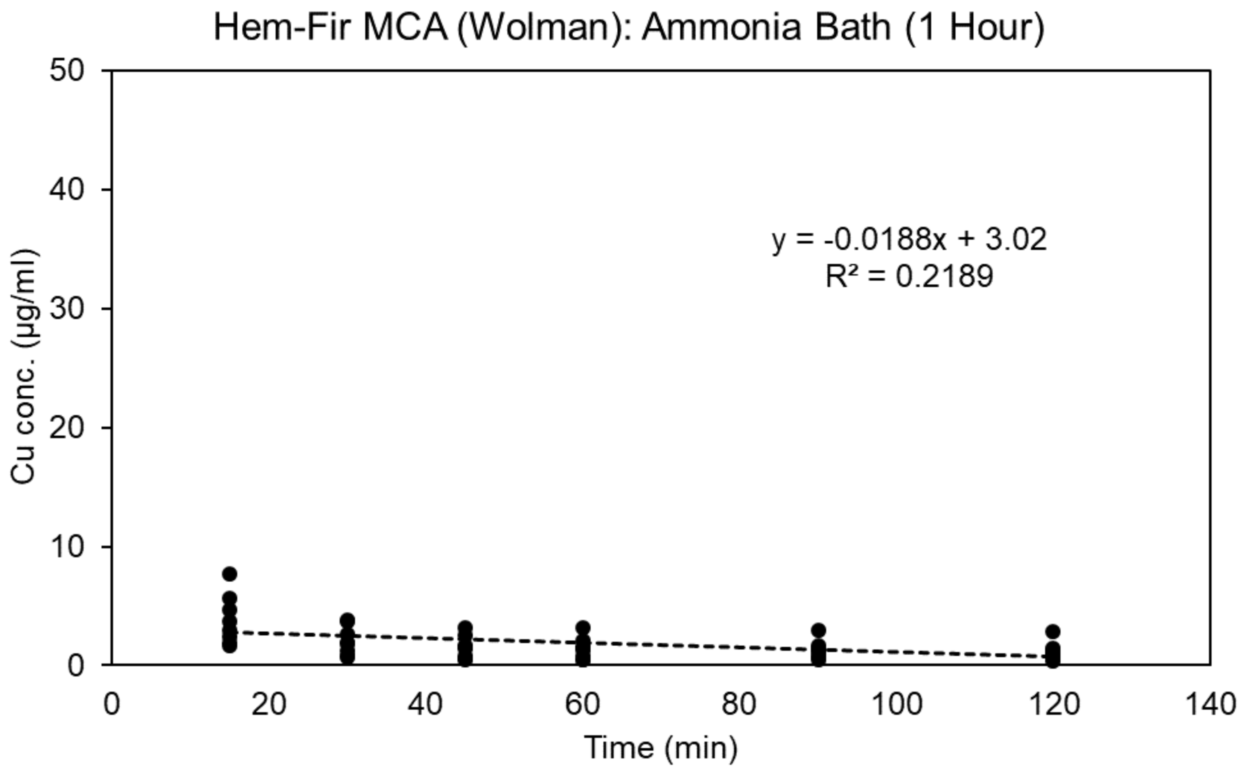

Hem-Fir MCA (Wolman): Steaming (3 Hour)
y = -0.0485x + 6.2008
R² = 0.3507
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140


Hem-Fir MCA (Wolman): Steaming (6 Hour)
y = 0.0015x + 2.3268
R² = 0.0006
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140


Hem-Fir MCA (Wolman): Hot Water Bath (1 Hour)
y = -0.0305x + 4.0057
R² = 0.2311
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140


Hem-Fir MCA (Wolman): Hot Water Bath (3 Hour)
y = -0.2588x + 33.938
R² = 0.24
Cu conc. (μg/ml)
Time (min)
0
20
40
60
80
100
120
140


Hem-Fir MCA (Wolman): Room Temp Water Bath (1 Hour)
y = -0.0934x + 10.884
R² = 0.418
Cu conc. (μg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140


Hem-Fir MCA (Wolman): Ammonia Bath (1 Hour)
y = -0.0188x + 3.02
R² = 0.2189
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140

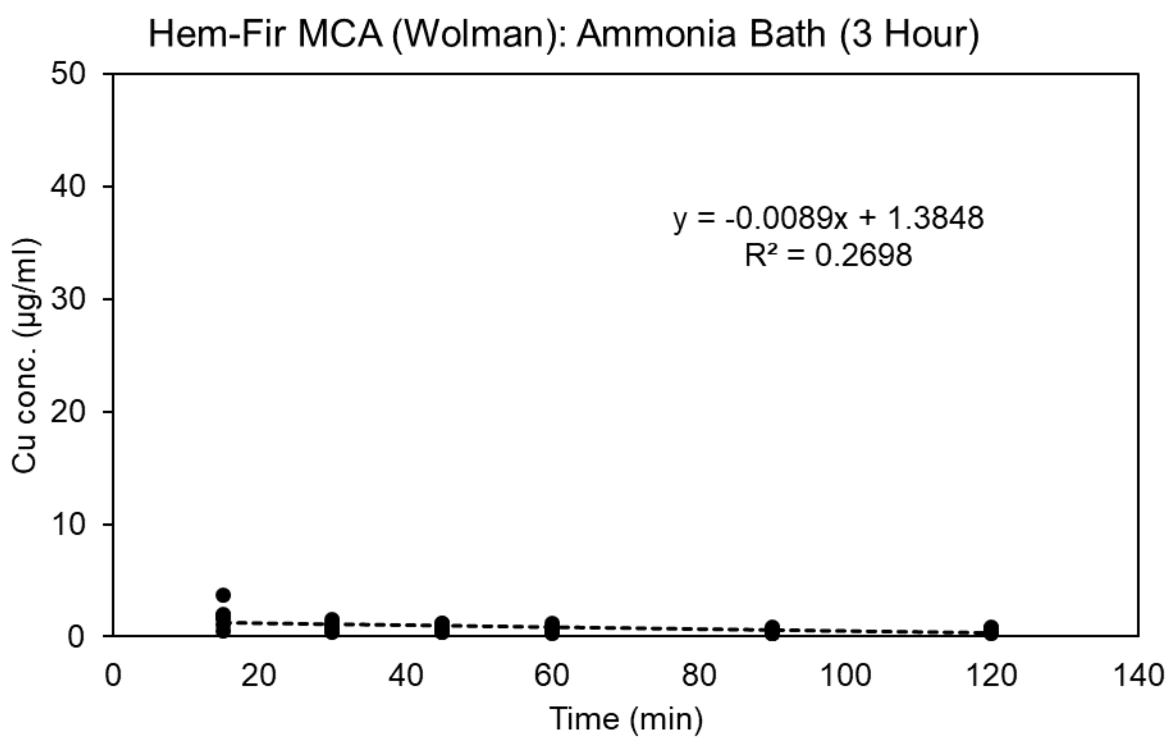

Hem-Fir MCA (Wolman): Ammonia Bath (3 Hour)
y = -0.0089x + 1.3848
R² = 0.2698
Cu conc. (µg/ml)
Time (min)
0
10
20
30
40
50
0
20
40
60
80
100
120
140

Table 2: Average Copper concentrations in simulated rainfall runoff from MCA-treated SYP and Hem-fir lumber treated with various post-treatment best management practices.

BMP Treatment	Time (min.)	MP200				Wolman			
		SYP		HF		SYP		HF	
		Ave. Cu (ug/mL)	Std Dev (ug/mL)	Ave. Cu (ug/mL)	Std Dev (ug/mL)	Ave. Cu (ug/mL)	Std Dev (ug/mL)	Ave. Cu (ug/mL)	Std Dev (ug/mL)
No BMP	15	28.90	12.07	153.83	82.51	7.08	6.44	27.84	12.11
	30	14.77	6.43	72.25	36.78	2.23	1.37	18.71	7.64
	45	14.20	7.50	53.61	25.98	1.74	0.82	16.67	6.48
	60	15.69	7.55	43.54	20.98	1.48	0.55	16.07	6.58
	90	14.66	7.35	39.02	19.03	1.34	0.49	15.51	6.89
	120	14.51	6.95	31.13	13.70	1.23	0.41	14.23	6.22
Air Drying	15	2.48	1.48	4.96	4.83	4.44	3.10	3.14	2.38
	30	1.41	0.94	3.12	2.83	3.45	2.22	2.02	1.50
	45	1.22	0.80	2.83	2.49	3.00	1.37	1.84	1.37
	60	1.14	0.72	2.89	2.46	2.51	1.09	1.69	1.25
	90	1.04	0.69	2.97	2.44	2.05	0.82	1.35	0.81
	120	0.99	0.59	3.19	2.63	1.63	0.59	1.48	1.20
Ammonia Bath (1hr)	15	8.41	3.77	3.78	2.30	1.21	0.35	3.81	2.07
	30	4.58	3.07	2.58	1.19	0.90	0.50	2.06	1.19
	45	3.21	2.28	1.57	0.44	0.89	0.53	1.54	0.93
	60	2.34	1.63	1.57	0.86	0.77	0.38	1.41	0.90
	90	2.26	1.61	2.23	0.78	0.73	0.31	1.32	0.78
	120	2.33	1.83	1.33	1.04	0.67	0.26	1.21	0.76
Ammonia Bath (3hr)	15	4.06	1.77	1.86	1.64	1.33	1.28	1.81	0.92
	30	2.01	1.39	1.02	0.83	0.71	0.55	0.86	0.35
	45	1.63	0.97	0.86	0.57	0.62	0.44	0.74	0.33
	60	1.49	0.79	0.78	0.46	0.54	0.38	0.63	0.30
	90	1.44	0.83	0.77	0.40	0.53	0.38	0.48	0.20
	120	1.78	1.47	0.74	0.32	0.49	0.32	0.59	0.18
Hot Water Bath (1hr)	15	4.56	2.86	1.51	0.81	2.75	1.35	5.35	3.78
	30	2.62	1.63	0.97	0.46	1.17	0.47	2.19	1.46
	45	2.43	1.54	0.93	0.47	0.99	0.43	1.79	1.34
	60	2.55	1.54	0.87	0.46	0.89	0.39	1.46	1.06
	90	2.56	1.58	0.88	0.43	0.77	0.29	1.22	0.76
	120	1.95	1.33	0.93	0.54	0.70	0.26	1.07	0.65
Hot Water Bath (3hr)	15	17.32	7.19	7.94	5.99	2.58	2.46	42.47	32.08
	30	8.42	4.36	4.24	3.43	1.03	0.88	21.43	14.95
	45	6.55	3.37	3.67	3.00	0.86	0.74	15.22	10.50
	60	5.55	2.72	3.30	2.68	0.74	0.60	12.79	9.89
	90	4.69	2.32	3.29	2.45	0.64	0.49	10.32	6.84
	120	4.28	1.82	3.45	2.72	0.60	0.46	8.21	4.50
	15	12.08	11.70	4.32	2.57	2.73	0.85	5.99	2.96

Steaming (1hr)	30	4.42	3.43	3.20	2.07	1.54	0.49	2.90	1.10
	45	3.54	2.47	3.37	2.47	1.33	0.45	2.27	1.00
	60	3.21	2.15	3.30	2.49	1.20	0.33	1.92	0.80
	90	3.02	2.07	3.82	2.98	1.12	0.32	1.67	0.72
	120	2.28	1.44	3.85	3.12	1.03	0.29	1.40	0.56
Steaming (3hr)	15	10.45	7.06	4.99	1.49	2.70	0.95	7.90	4.10
	30	5.20	3.39	2.64	1.07	1.72	0.64	3.76	2.05
	45	4.15	2.76	2.78	1.56	1.36	0.56	2.71	1.47
	60	3.79	2.17	2.56	1.50	1.22	0.47	2.20	1.20
	90	3.39	1.82	2.57	1.86	1.14	0.43	1.76	0.88
	120	2.99	1.71	2.44	1.76	1.14	0.45	1.41	0.64
Steaming (6hr)	15	12.73	9.20	3.10	1.94	3.95	4.93	2.30	1.72
	30	6.16	3.97	2.02	1.65	2.40	2.64	2.29	1.93
	45	6.21	4.82	1.79	1.21	2.34	2.45	2.19	2.40
	60	4.85	3.87	1.73	1.11	2.28	2.63	2.84	3.20
	90	4.46	3.29	1.64	1.02	2.00	2.18	2.52	2.20
	120	3.75	2.69	1.69	1.05	1.67	1.65	2.35	2.04
Room Temp Water Bath (1 Hour)	15	-	-	80.04	88.56	1.85	1.39	14.34	6.04
	30	-	-	45.30	47.56	0.91	0.65	6.28	3.40
	45	-	-	33.93	35.86	0.68	0.43	4.04	2.12
	60	-	-	27.81	28.88	0.58	0.31	2.88	1.18
	90	-	-	23.89	27.04	0.54	0.29	2.27	0.97
	120	-	-	17.93	18.50	0.50	0.27	1.86	0.78

B. Effect of Damage to Polyurea Coatings on Metal Losses from Ammoniacal Copper Zinc Arsenate Treated Douglas-fir Pile Sections

This test was completed in 2018. However, we have twenty five smaller polyurea coated posts at the university. If there is further studies you would like to see with polyurea coated material we can initiate a study with this material. One possible use for this material is to set up a field trial in our experimental freshwater pond west of Corvallis to monitor the performance of polyurea coatings in a field-scale trial. We would monitor the migration of preservatives into defined soil sachets of sediment from coated poles with varying degrees of damage.

C. Minnesota Field Monitoring Sites: First Year of Sampling 10 Bridge Sites

While there have been a few false starts identifying suitable structures, we have now begun to sample several bridge sites on the outskirts of Minneapolis, MN. The structures are located in the town of Chaska which has installed a number of bridges over the years, treated with either penta or CuNaph. In previous tests, we periodically set up a water collection system to capture rainwater runoff from a structure. That will not be possible in Chaska. Instead, we will collect sediment samples upstream, underneath, and downstream of a given structure from both banks of the water body that is spanned. These samples will be analyzed for either penta or copper as described earlier depending on which preservative was used to treat a given bridge. The first samples were taken in May of 2019 from 10 bridges outside of Chaska, MN. Five bridges were treated with penta and five were treated with copper. We will return 1, 2, and 3 years thereafter for additional samplings.

At the first year's sampling there was no penta detectable in sediments or water collected from any locations around the 5 penta-treated bridges. This indicated that there was no detectable penta accumulation originating from the treated structure.

The first year of sampling around copper naphthenate-treated bridges showed that all but one water sample taken from any location (upstream, downstream, or underneath) had copper levels below the detection limit of our analysis. The one measureable sample had 0.45 ppm copper and was taken from water upstream of the bridge. These data indicate that we can detect no copper inputs in the water that are likely to originate from any of the copper naphthenate-treated bridges tested.

Analysis of the sediment levels showed there was no significant difference in the average copper levels in sediment taken upstream, downstream, or directly under the bridge (Figure 6). This suggests that the runoff from the bridge is not large enough to impact copper levels in sediment l when viewed in aggregate, at the time of our sampling. However, there was considerable variability in sediment copper levels across bridges which was primarily driven by one site, bridge 4, which showed somewhat elevated copper levels directly under the bridge in one of three samples taken at different locations under the bridge (Table 2). Copper levels found in the elevated sample taken from under bridge 4 exceeded the Washington State freshwater sediment quality criterion (80 ppm) by about 12%. Interestingly, the other two samples taken from the under bridge 4 had copper levels that were less than 50% of the high-copper sample and well under the Washington State benchmark level. The high variability under bridge 4 likely is a result of differences in the wetting frequency at difference locations under the bridge, resulting in less frequent copper removal into the stream. We will continue to monitor copper levels at this location to determine if the elevated copper levels are an anomaly due to other environmental variables or are part of a pattern.

Interestingly, elevated copper levels were not seen in sediments taken downstream from any of the bridges including bridge 4, which indicates if the source of the copper in the concentration sediment sample under bridge 4 is copper naphthenate, then it is not being widely dispersed into downstream sediments. Bridge 4 also had some unique sight characteristics that may have contributed to the elevated copper levels directly under the bridge. It was located next to a golf course whereas the other structures were not and external copper inputs may be a factor. The water body under bridge 4 was also noticeably more stagnant than the other bridges which may have contributed to the higher copper levels in the sediment. However, we do not have streamflow data at these locale to compare water flow rates. Overall, elevated copper levels were the exception and not the rule in sediments around copper naphthenate-treated bridges and these sites require further sampling to draw any conclusions. We will continue to seek more sampling locations to expand this dataset.

Figure 6: Copper levels in sediments taken from around 5 copper naphthenate-treated bridges grouped by bridge and location.

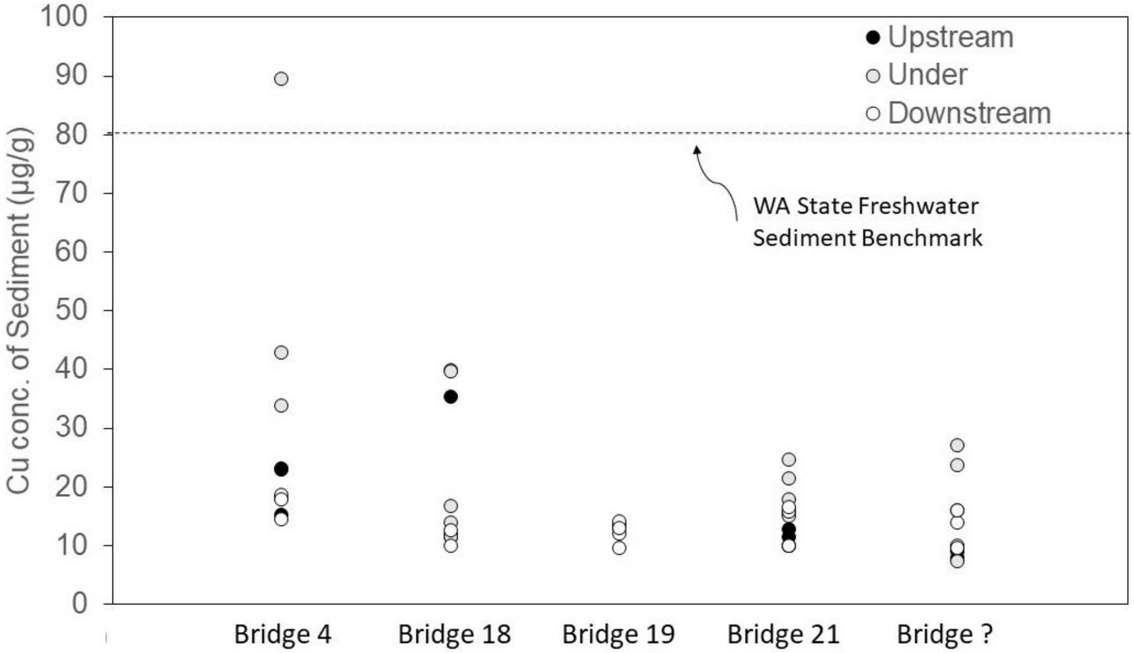


Table 2: Copper concentration of sediment samples taken from different locations around 5 copper-naphthenate-treated bridges in Minnesota.

Bridge #	Location from bridge	Location in river	Sediment depth (in)	Cu (ug/g)
4	Downstream	Right	0-2	18.5
4	Downstream	Left	0-2	14.3
4	Downstream	Left	2-4	17.6
4	Under	Right	0-2	89.4
4	Under	Left	0-2	33.7
4	Under	Left	2-4	42.8
4	Upstream	Left	0-2	18.0
4	Upstream	Right	0-2	23.0
4	Upstream	Left	2-4	15.0
4	Upstream	Right	2-4	22.8
18	Downstream	Right	0-2	12.4
18	Downstream	Left	0-2	9.7
18	Under	Right	0-2	13.8
18	Under	Left	0-2	39.7
18	Under	Middle	0-2	11.4
18	Under	Right	2-4	16.5
18	Under	Left	2-4	39.6
18	Upstream	Right	0-2	11.4
18	Upstream	Left	0-2	11.8
18	Upstream	Right	2-4	35.3
19	Downstream	Left	0-2	12.0
19	Downstream	Right	0-2	13.9
19	Downstream	Left	2-4	12.8
19	Downstream	Right	2-4	9.4
19	Upstream	Left	0-2	12.8
19	Upstream	Right	0-2	13.4
21	Downstream	Left	0-2	9.7
21	Downstream	Right	0-2	15.7
21	Downstream	Right	2-4	16.5
21	Under	Middle	0-2	15.4
21	Under	Left	0-2	24.5
21	Under	Right	0-2	21.3
21	Under	Middle	2-4	9.8
21	Under	Left	2-4	17.8
21	Under	Right	2-4	14.9
21	Upstream	Left	0-2	9.8
21	Upstream	Right	0-2	12.6
21	Upstream	Left	2-4	9.8
21	Upstream	Right	2-4	11.3
?	Downstream	Left	0-2	13.7
?	Downstream	Middle	0-2	9.9
?	Downstream	Right	0-2	15.8

?	Downstream	Right	2-4	9.5
?	Under	Left	0-2	26.9
?	Under	Right	0-2	23.6
?	Under	Middle	0-2	7.1
?	Under	Middle	0-2	9.6
?	Under	Left	2-4	9.4
?	Under	Right	2-4	15.9
?	Under	Middle	2-4	9.5
?	Upstream	Left	0-2	9.4
?	Upstream	Right	0-2	9.0
?	Upstream	Left	2-4	7.6
?	Upstream	Right	2-4	9.2

[a]Left and right refer to left and right bank

Establish Additional Field Monitoring Sites at Recently Installed Treated Structures

While controlled BMP tests are useful, they need to be accompanied by field monitoring of sites with different preservative treatments and environmental conditions. We have been fortunate enough to monitor Jackson Frazier Wetland decking and the Santiam Bridge, but these sites are all located in Oregon. There is a need to identify other treated structures so we can begin to build a series of case studies.

To do this we are currently working with Wood Preservation Canada to get a bridge monitoring test established in Canada. We have submitted a proposal and are waiting to hear about the outcome. If all is approved this would allow us to establish a long-term monitoring program on preserved bridges to establish further data on preservative leaching in the field. We may also have the opportunity to sample around more bridges courtesy of Wheeler Lumber. They have notified us of many more locations that we can sample in addition to the Minnesota sites.

D. Effect of Abrasion on Metal Levels in Aquatic Applications of Treated Wood

Over the past five years we have worked to evaluate the effects of various BMPs on subsequent migration of preservatives from treated wood. One subject that keeps arising is the contribution of surface abrasion. While wood is a reasonably abrasion-resistant material, repeated pedestrian or vehicle traffic can result in the loss of wood particles. These particles have very high surface to volume ratios that could potentially result in disproportionate preservative releases over time, especially in high traffic areas. However, it is important to note that the chemicals in these particles are largely immobilized and should therefore be less susceptible to migration. There are no realistic data that exclusively examine the contribution of particle abrasion on total preservative losses from a given structure.

We have been working to develop realistic tests examining the potential contribution treated wood particles have on preservative losses. Previously, sawdust from preservative treated lumber was immersed in several treatments: deionized and tap water, pH 6, 7, and 8 water, and hard and soft water. The results were as expected; the particles lost substantial quantities of copper. However, our sawdust was fragmented and that often exposes interior lumens to possible leaching, while naturally abraded fibres will retain more of their original cell geometry. These differences could markedly alter the resistance of a preservative to migrate.

Due to the difficulty of creating representative particles, we also established a field trial to assess the rate of wear on treated wood decking. Collecting fibres from bridges is problematic because they sluff off slowly and mix with the ground below, making them difficult to recover. Setting up fibre collection systems beneath a structure might be functional but we chose, instead, to use changes in conditioned mass of full scale test samples installed on a bridge as the measure of wear.

A trail bridge located in the McDonald-Dunn Research Forest of Oregon State University was selected for study. The bridge is located immediately adjacent to the Peavy Arboretum Starker Post Farm. It is heavily used by various school groups and visitors. The bridge is constructed using nominal 2 by 6 inch by 6 foot long Penta-treated decking and has been in place for at least a decade. The bridge crosses a seasonal wetland.

Copper azole treated DF lumber was purchased locally and cut to length. Samples were retained for later analysis, if needed. The lumber was conditioned to constant weight at 23 °C and 65% relative humidity before being weighed. The samples were then installed as replacement boards on the bridge (Figure 7). We expect that this project will take an extended period to show any measureable results, particularly because the boards must by weighed on a scale large enough to handle their size, which necessitates a loss in sensitivity. Because of this, the first sampling of this project will occur after a four-year period and weighed at four-year intervals after that. Boards will be reconditioned prior to weighing to determine mass loss. One other aspect of this project will be a need to determine the number of pedestrians crossing the structure. We intend to estimate potential foot traffic over this structure by acquiring estimates of the total number of visitors to the Peavy arboretum on an annual basis.

Figure 7. Deck boards used to assess abrasion rates in the bridge at Peavy Arboretum.

E. Preservative Migration into Plant Biomass from Treated Wood-based Trellising Systems

Organic farming practices are rapidly gaining popularity in many types of agriculture due to consumer demand. Currently due to either regulation or negative sentiments held by the growers themselves, treated wood is excluded from applications in organic farming. Instead these growers may opt to use metal posts in place of treated wood posts to support trellising systems for crops like wine grapes, raspberries, or blackberries. We would like to test the suitability of treated wood for organic farming applications by monitoring the migration of wood preservatives from posts in various commercial-scale trellising systems into soil, vegetative plant biomass (vines, leaves), and final products (fruit, hop cones). By tracking whether accumulation occurs in the end product we will produce baseline data for regulators and farmers to use in deciding if treated wood is suitable for organic operations.

We have identified several experimental farms owned by OSU and the United States Department of Agriculture (USDA) near the OSU campus that are amenable to the installation of this type of experiment. In the spring of 2020, we will have access to three, 250-ft rows at the Lewis Brown Horticultural Farm (LBHF) to install treated wood trellising for a study on migration into wine grapes. This will allow us to compare several types of waterborne preservatives for their capacity to accumulate in plant biomass. We envision installing the commonly-used chromated copper arsenate (CCA)-treated pine posts at two different retentions (0.4 and 0.6 pcf) along with ACZA-treated Douglas-fir posts. We would also like to test sleeves designed to prevent preservative migration in this study. In addition to wine grapes, there is sufficient space to test other plant species that require trellising systems such as raspberries or blackberries.

The LBHF also has a site with fully contained soil posts sunk in the ground. These sites can be used to test preservative migration from posts treated with preservatives not approved for horticultural applications. If the cooperative should express interest, we could use this site in the future to develop baseline migration data on other preservatives including oil-bornes with the aim of determining whether these products are appropriate for conventional or organic agriculture uses.

In addition to wine grapes, we have also contacted the USDA experimental hop farm just outside of Corvallis and they are willing to collaborate with us and allow us to place poles in their trellising system. Hop trellises consist of a grid of 21’ CCA-treated poles with wiring strung across each to support guide strings on which the vines grow. The outer edges of the grid is made up of 24’ CCA-treated anchor poles that provide tension to the supports. We have been notified that in Oregon, there are very few organic hop growers because downy and powdery mildew pressure is very high in our climate. Conventional operations spray their plants with a copper-based fungicide that would likely wash out any accumulative copper signal from the wood preservatives anyway. However, it may still be useful to measure whether preservatives have any impact above background levels in this application, especially in vines that make direct contact with treated poles.

We invite commentary from our members on these proposed projects and would like to know what treatments, barriers, and crops you would like to see tested.

OBJECTIVE II

DEVELOP STANDARDIZED ACCELERATED METHODOLOGIES FOR ASSESSING TREATED WOOD RISKS

We are working to develop a number of standardized methodologies that can be used to assess preservative mobility under varying regimes. These include small-scale BMP verification procedures, sachets used to detect preservative migration in aquatic environments, and our efforts to quantify preservative levels in the water column. Our intent is to publish the results of these tests in peer-reviewed journals and, once accepted, move to standardize these methods under the appropriate organizations.

OBJECTIVE III

WORK COOPERATIVELY TO DEVELOP AND IMPROVE MODELS TO PREDCT THE RISK OF USING TREATED WOOD IN VARIOUS APPLICATIONS

Along with the Environmental Assessment Modeling Tool hosted on our website we will also begin hosting the Railroad Tie Association SelecTie model. Please visit our website for further information as we have recently updated it (http://eptw.forestry.oregonstate.edu/).

OBJECTIVE IV

IDENTIFY IMPROVED METHODS FOR REDUCING THE POTENTIAL FOR MIGRATION

As part of our study to monitor the migration of preservative chemicals into plant tissue, we will include post sleeves in this study to determine if barriers below groundline reduce the migration of preservatives into soil and plant tissue. We also plan on initiating a field study of polyurea-coated ACZA posts at a freshwater pond site to measure the impact of coating damage on preservative migration into the water column. If the barriers are economical compared to steel, concrete, and untreated wood, it could be a good avenue for this new market we are trying to get established in. We hope this research can provide some reference data for regulators and organic farmers weighing the benefits/drawbacks of using wood versus wood alternatives in agriculture and freshwater applications.

OBJECTIVE V

EVALUATE THE ENVIRONMETNAL IMPACTS AND IDENTIFY METHODS FOR REUSE, RECYCLING, AND/OR DISPOSAL OF PRESERVED WOOD THAT IS REMOVED FROM SERVICE

Matthew Konkler attended the Railroad Tie Association meeting this year in Tucson, AZ at this conference many railroad companies were commenting that they need better methods for disposal of used railroad ties. While this is an area we have never ventured into there does seem to be a need for it. We would appreciate input from our members as to whether this is a valuable area of research that they would like us to pursue.

OBJECTIVE VI

DELIVER EDUCATIONAL OUTREACH PROGRAMS ON THE PROPER USE OF TREATED WOOD IN RELATION TO THE BEST MANAGEMENT PRACTICES (BMPs)

We recently traveled to Olympia, WA for a meeting with WWPI and representatives from several Washington State departments on the regulatory status of oil borne preservatives in that state. We utilized the WWPI environmental assessment modelling tool to help educate the attendees about environmental risk mitigation for preservative treated wood structures. A summary of our prior research related to creosote will be featured in Crossties Magazine. This dissemination also highlights our hosting the SelecTie Modelling Tool which we plan to use to incorporate more economic cost-benefit analysis into our future environmental impacts research on creosote-treated wood. We will continue to seek out opportunities to use our extensive background in environmental chemistry and wood protection to explain the function of the EPTW and how to use treated wood as opportunities arise.

Literature Cited

American Wood Protection Association (AWPA). 2017. Book of Standards. AWPA, Birmingham, AL. 644 p.

Brooks, K.M. 2011. Chapter 5. Fate and Effects of Contaminant Released into Aquatic Environments. In: Managing Treated Wood in Aquatic Environments (J.J. Morrell, K.M. Brooks, and C.M. Davis, Ed.). Forest Products Society, Madison, WI. Pages 59-152.

Simonsen, J., Chen, H., Morrell, J.J., Freitag, C., Clauson, M. 2008. Pentachlorophenol migration from treated wood exposed to simulated rainfall. Hölzforschung, 62: 608-612.

Western Wood Preservers Institute. 2014. Aquatic Risk Model. WWPI, Vancouver, WA

Western Wood Preservers Institute. 2012. Best Management Practices for the use of treated wood in aquatic or wetland environments. WWPI, Vancouver, WA. 36 p.