

Sampling and Analysis Study on Treated Wood



*California Department of
Toxic Substances Control*



Presented by-
Sherri Lehman, Chief
Toxics In Products Branch



Why did California regulate treated wood waste?

Wood Preservatives

Risk to



**human health and
the environment
(toxic or
carcinogenic)**

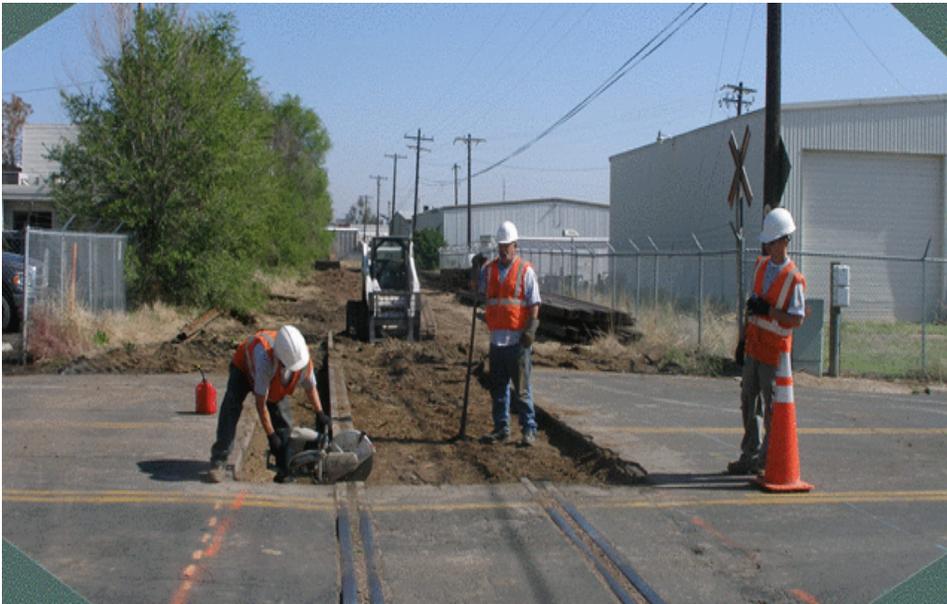
AB 1353

(2004, Matthews)

Health and Safety Code
§25150.7 and §25150.8



DTSC developed Alternative Management Standards (AMSs) for treated wood waste.



BACKGROUND

Categories of Preservatives

- ✿ **Organo/Organometallic** Creosote
- ✿ **Waterborne (acid-based)**
- ✿ **Waterborne (alkali-based)** CA-B, ACQ-C
- ✿ **Other Waterborne**
- ✿ **Fire-retardants**

Untreated



Treated by
different
preservatives

Why this study?

**Copper-based or
Creosote
Preservative**



**Hazardous
Waste ?**

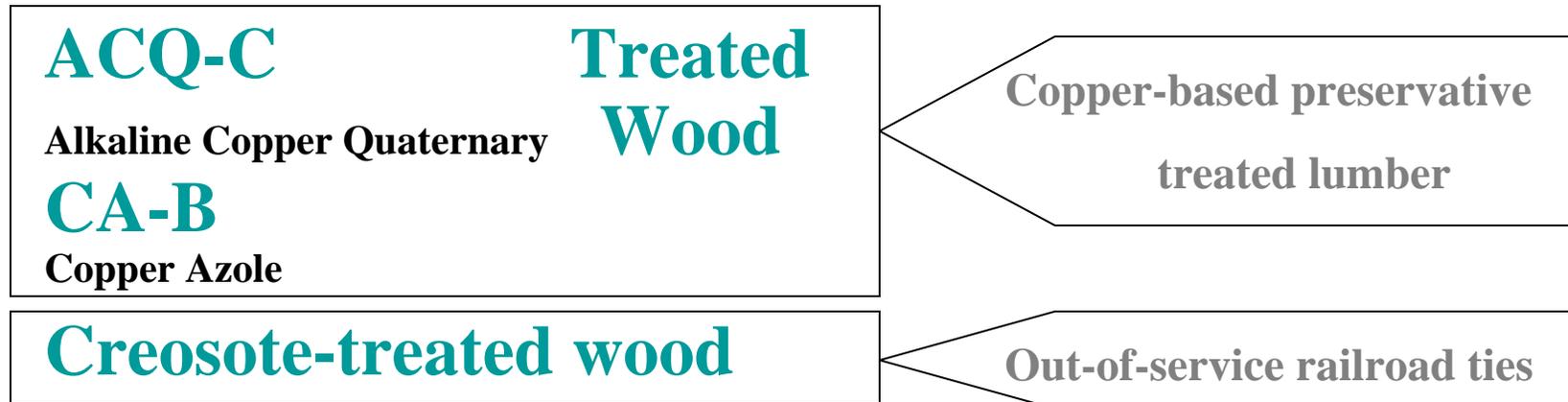


Objectives of the study

-  **Representative Samples in California.**
-  **Methods of preparation and analyses.**
-  **Toxicity characteristics of copper-based and creosote-treated wood.**



Sample Types:



* **Sample Collection:**

University of California Cooperative Extension
as a DTSC contractor.

* **Sample Analysis:**

DTSC's Environmental Chemistry Laboratory (ECL).

Study Results

The samples exceeded California hazardous waste criteria.

California Code of Regulations

Title 22

Division 4.5

Chapter 11.



It is the GENERATOR's
responsibility to determine
if copper- and creosote-
treated wood is
a hazardous waste.

Collection and initial processing of ACQ-C and CA-B preservative-treated lumber and creosote-treated railroad ties



Sampling and Analysis Study on Treated Wood

Steve Quarles
University of California Cooperative Extension
University of California Richmond Field Station
1301 S. 46th St., Bldg. 478
Richmond, CA 94804
(510) 665-3580

AWPA Standard M2 (Inspection of Wood Products Treated with Preservatives) was used to develop composite samples.

- Four replications for ACQ-C and CA-B samples.**
- One composite sample for hardwood ties**
- Three composite samples for softwood ties**

Sample Locations

ACQ-C – Douglas-fir

- **Big Creek Lumber, Paso Robles**
- **Burgess Lumber, Santa Rosa**
- **Dixie Line Lumber, San Diego**
- **Dolan Lumber, Pinole**
- **Golden State Lumber, San Rafael**
- **Hayward Lumber, Paso Robles**
- **Meeks Lumber, Redding**
- **Mill Valley Lumber, Mill Valley**
- **Piedmont Lumber, Oakland**
- **Rafael Lumber, San Rafael**
- **Tahoe Lumber & Supply, Truckee**

Sample Locations

- **CA-B – Douglas-fir**
 - **Friedman's Lumber, Santa Rosa**
 - **Rafael Lumber, San Rafael**
 - **Truitt and White, Berkeley**
[three different times over the course of 10 months]
- **Control (untreated) Douglas-fir - purchased at same locations**

Sample Locations

- **CA-B – Hem-Fir:**

The following Home Depot locations-

- **Emeryville**

- **Richmond**

- **San Rafael**

- **Yuba City**

- **Control (untreated) white fir samples obtained from Mendocino Forest Products, Ukiah.**

Sample Location



**Creosote tie samples collected at the RTI
chipping facility in Flanigan, NV**

Sample Location



Used railroad ties, being transported to Flanigan

Processing ACQ-C and CA-B lumber



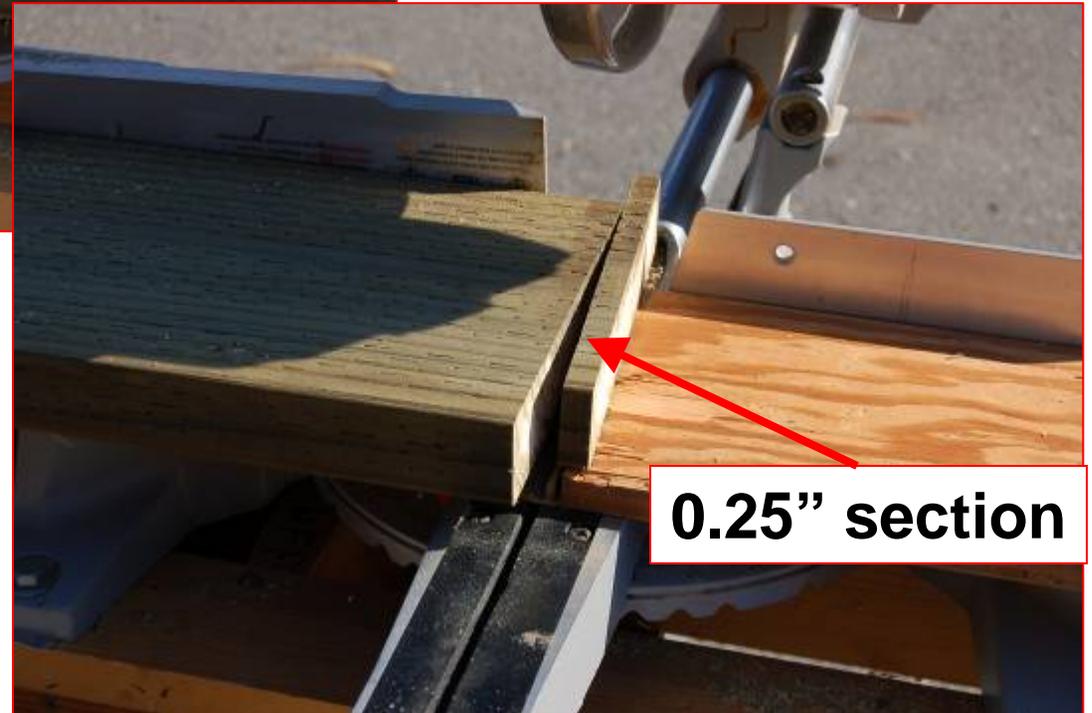
0.25- inch sections were removed from the full-length (8-foot) board. Location was determined by a random allocation process

Processing ACQ-C and CA-B lumber



Primary breakdown of all preservative-treated material using a cross cut saw

Processing ACQ-C and CA-B lumber



Processing ACQ-C and CA-B lumber



**Sample 15, Rep 1, 'Left' 2-foot section
[other options, 'Right' or 'Center' section].**

Processing ACQ-C and CA-B lumber



Temporary storage of reps 1 – 4

Processing ACQ-C and CA-B lumber



Storage of unused ACQ-C and CA-B lumber

Processing Treated Wood Samples



Band saw used to prepare smaller sub-sections.

Processing ACQ-C and CA-B lumber



Cutting in half

Processing ACQ-C and CA-B lumber



Cutting into quarters

Processing creosote-treated ties



Bundles were randomly removed from containers

Processing creosote-treated ties



Checking ties for metal debris

Processing creosote-treated ties



Sections cut out of ties using a chain saw

Processing creosote-treated ties



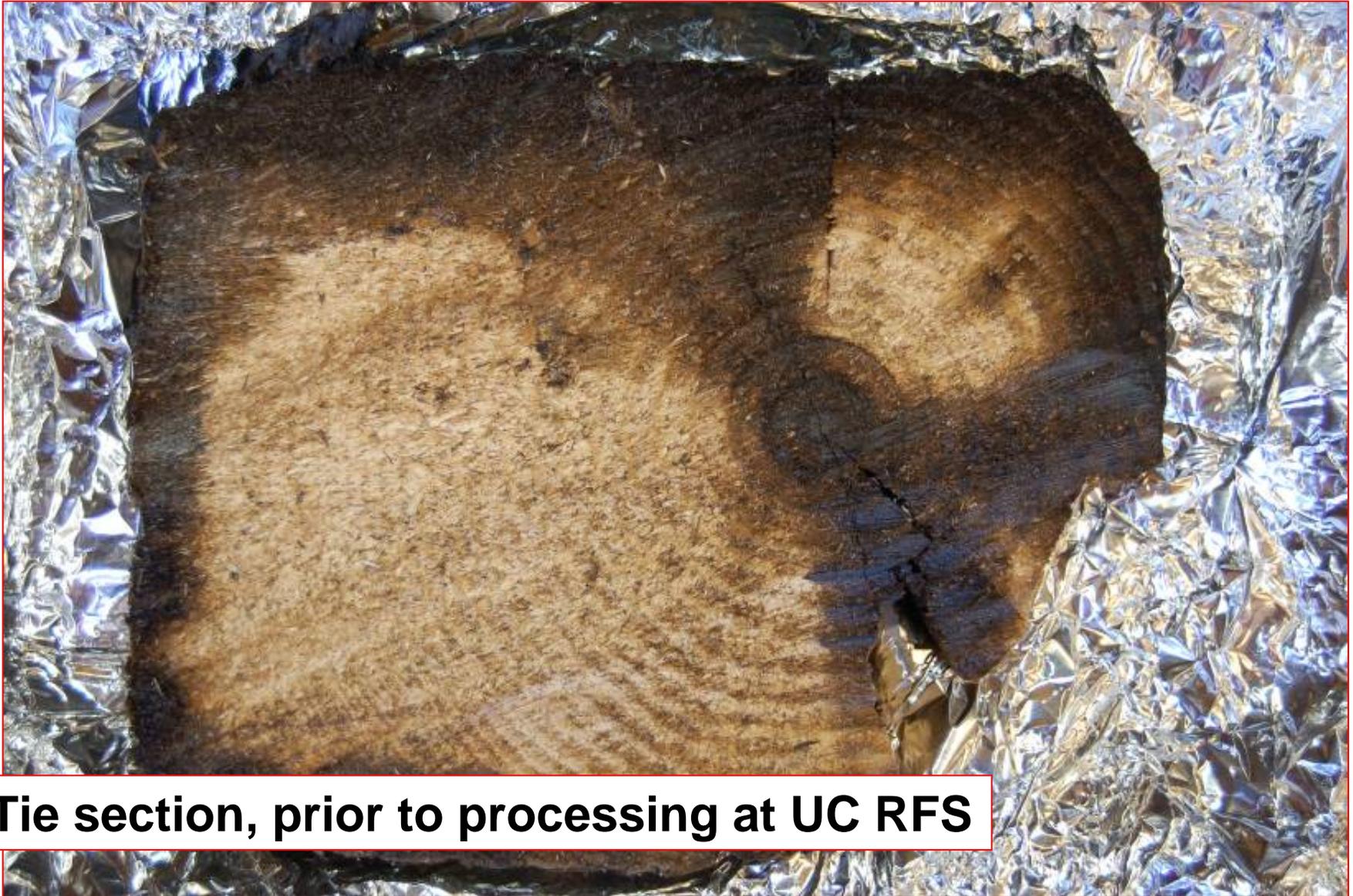
Tie sections, prior to aluminum foil wrap

Processing creosote-treated ties



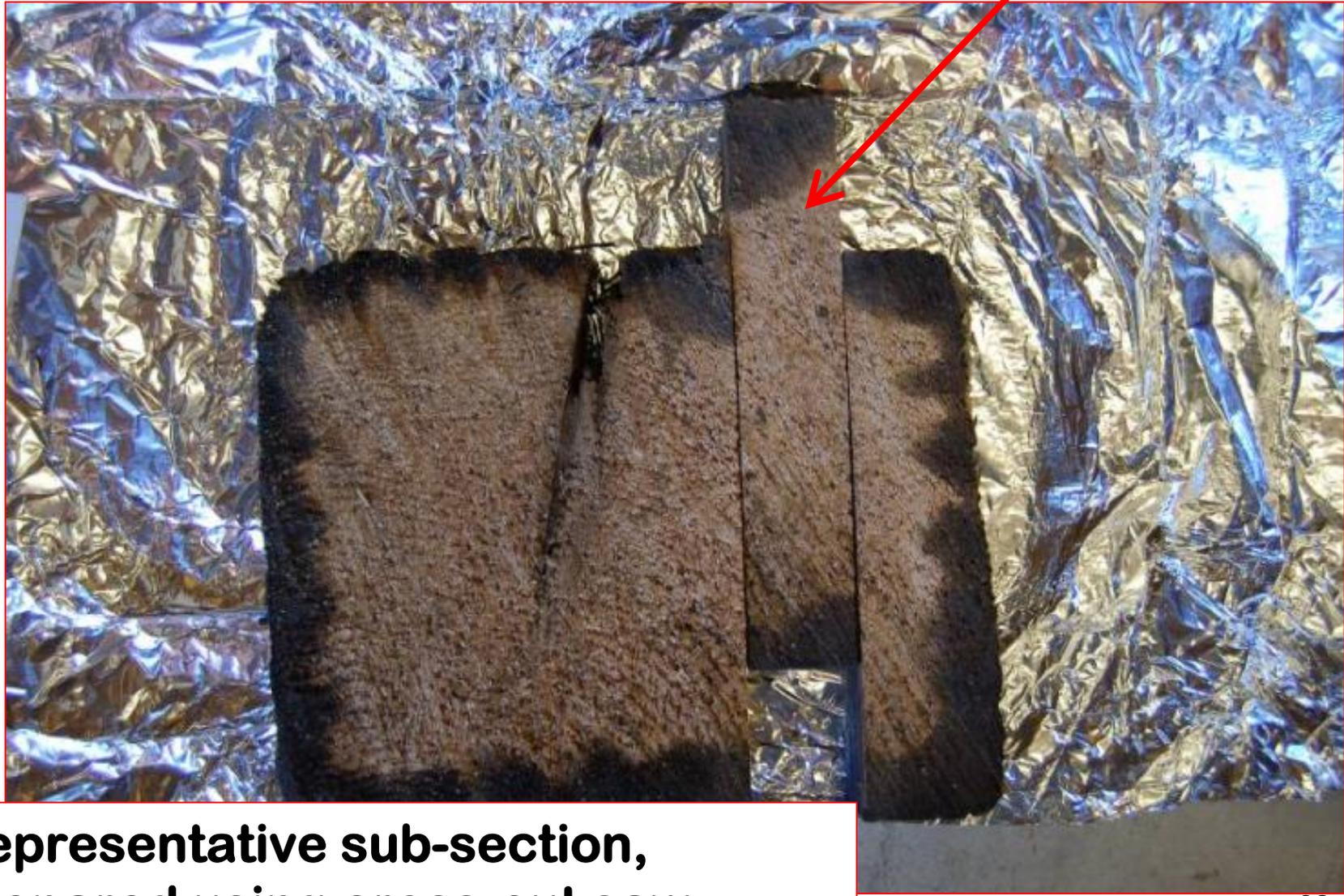
Boxed tie samples at UC Richmond Field Station

Processing creosote-treated ties



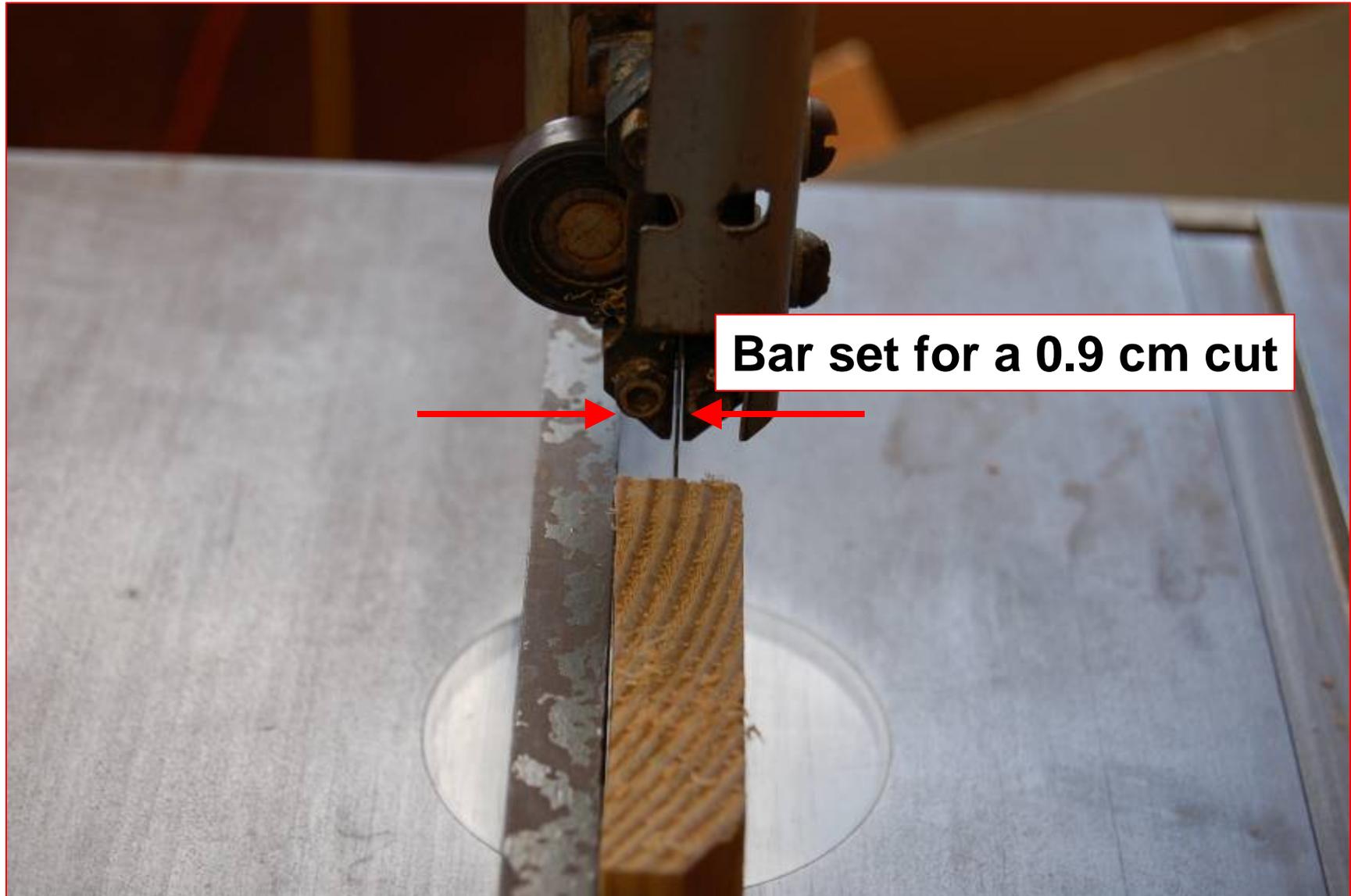
Tie section, prior to processing at UC RFS

Processing creosote-treated ties

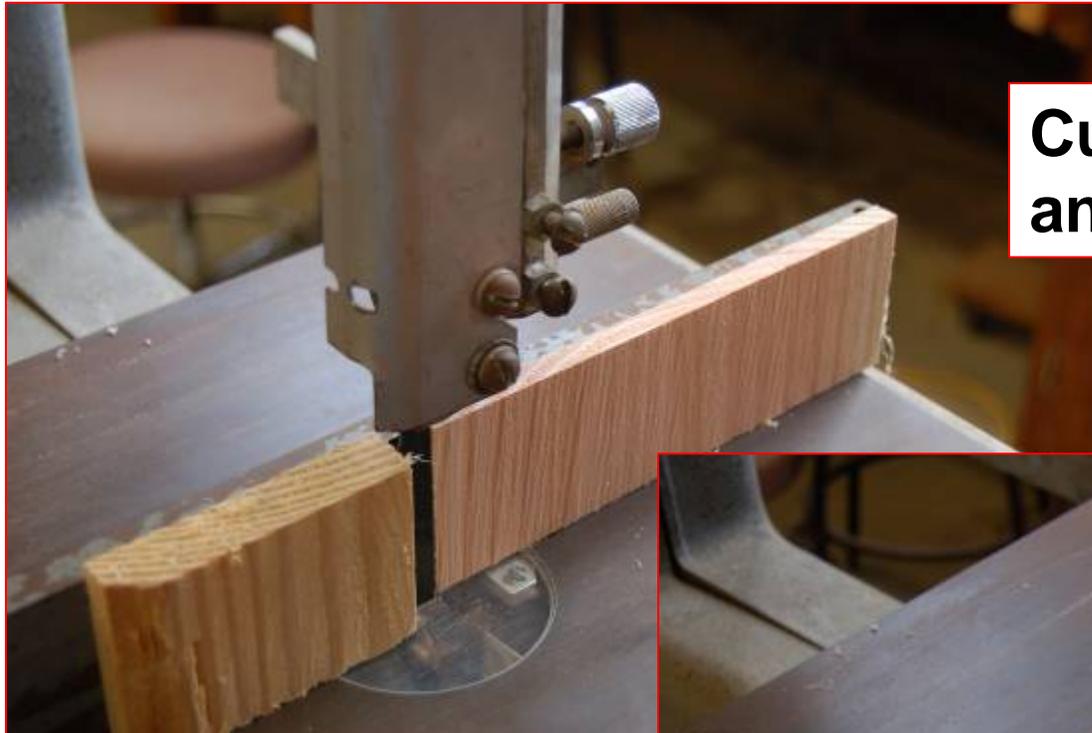


**Representative sub-section,
prepared using cross-cut saw**

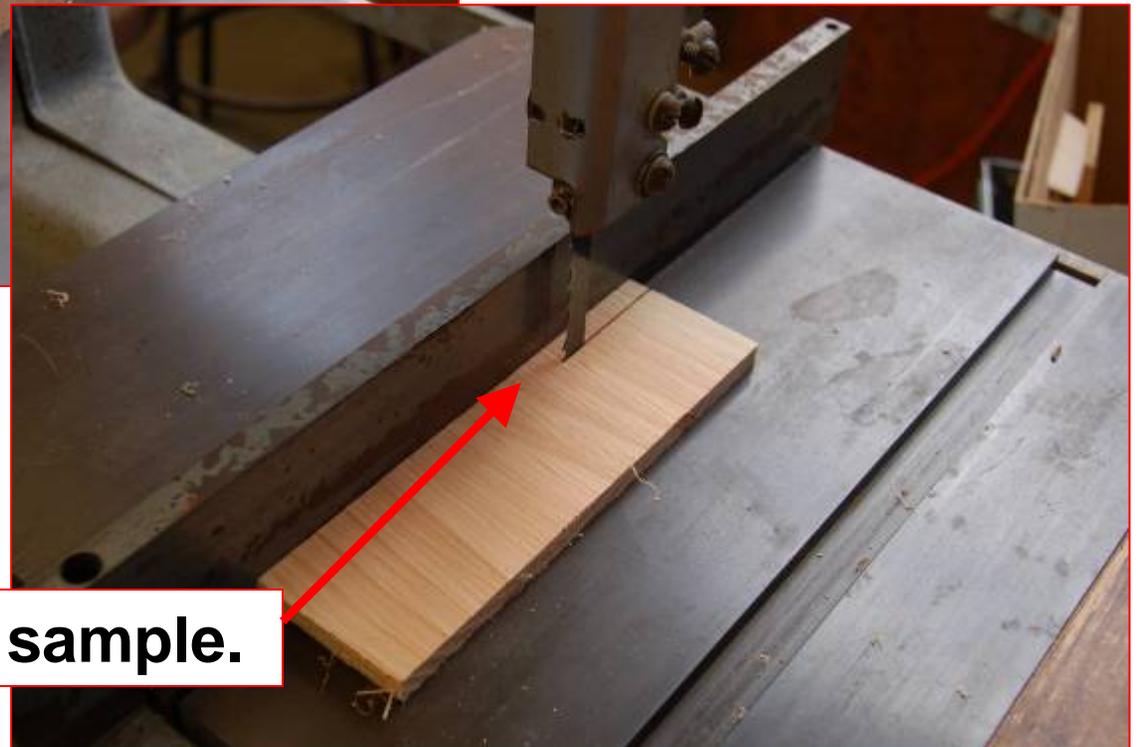
Processing cubes and grinding samples



Processing cubes and grinding samples



Cutting to thickness and width.



Stop here if 'grinding' sample.

Processing cubes samples



Processing all samples



Samples ready for DTSC processing and analysis

Questions?



Laboratory Analysis of Treated Wood

**California Department of Toxic Substances Control
Environmental Chemistry Laboratory, Berkeley, CA**

**Martin Snider
(510) 849-5258**

msnider@dtsc.ca.gov

Laboratory Study Objectives

- Determine if representative samples of new copper-based, preservative-treated 2x8s and used creosote-treated railroad ties exceed the California Title 22 Toxicity Characteristics. (22 CCR, Division 4.5, Chapter 11)
- Gain laboratory experience in the sample preparation and analysis of preservative-treated wood.



Analysis Plan for New CA-B and ACQ-C Treated Lumber

- Total Metals by U.S. EPA SW-846 Methods 3050B/6010B, acid digestion/ICP-AES (TTLC-Cu) (ECL, Berkeley)
- California Waste Extraction Test (WET) Metals (STLC-Cu) (ECL, Berkeley)
- Acute Aquatic Bioassay, 96-hr. LC₅₀ (DFG) (Associated Labs, Orange, CA)

Analysis Plan for Used Creosote Treated Railroad Ties

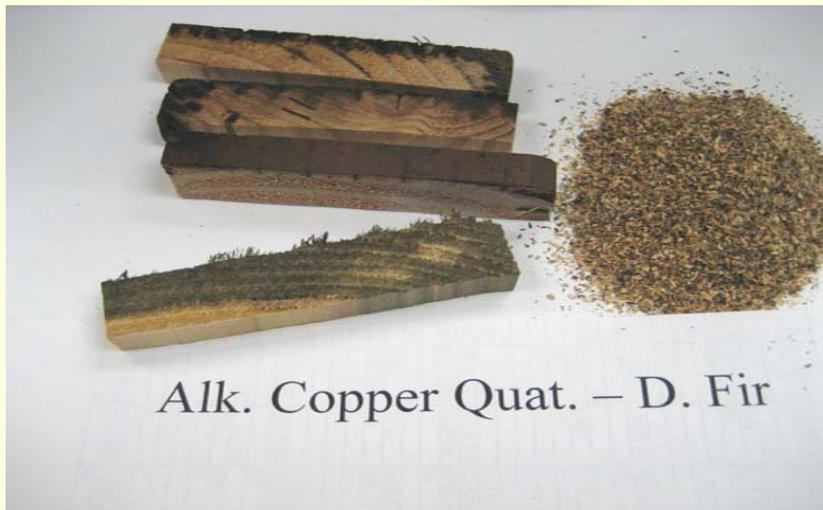
- Total SVOCs (TTLC-pentachlorophenol) by U.S. EPA Methods 3540/3640/8270C, soxhlet ext., GPC cleanup, GC/MS SVOCs (ECL-Los Angeles)
- TCLP SVOCs (TC-chlorophenols & cresols) by Methods 1311, TCLP (ECL-Berkeley)/3510 liq.-liq. extraction/8270C GC/MS (ECL-Los Angeles)
- Acute Aquatic Bioassay, 96-hr LC₅₀ (DFG) (Associated Labs)

Sample Milling

- Mill wood to $< 2\text{mm}$ for all tests except TCLP
- Blend milled wood well for composite
- Sub-sample into jars, distribute for analysis
- Between composites, clean mill, wipe with acetone, grind control wood and mill blank



CA and ACQ Lumber as Received at ECL and After Milling

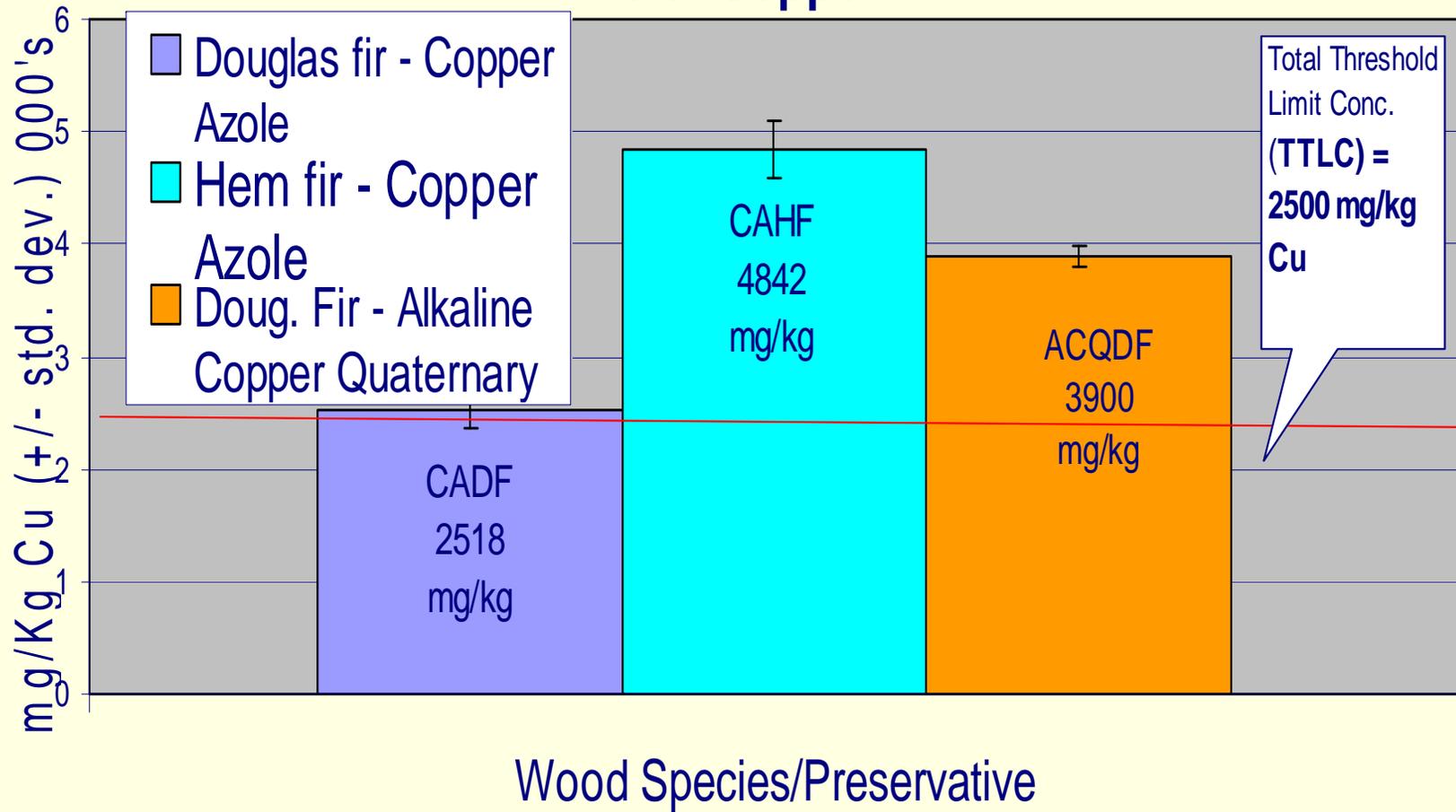


Creosote Railroad Ties as Received at ECL and After Milling

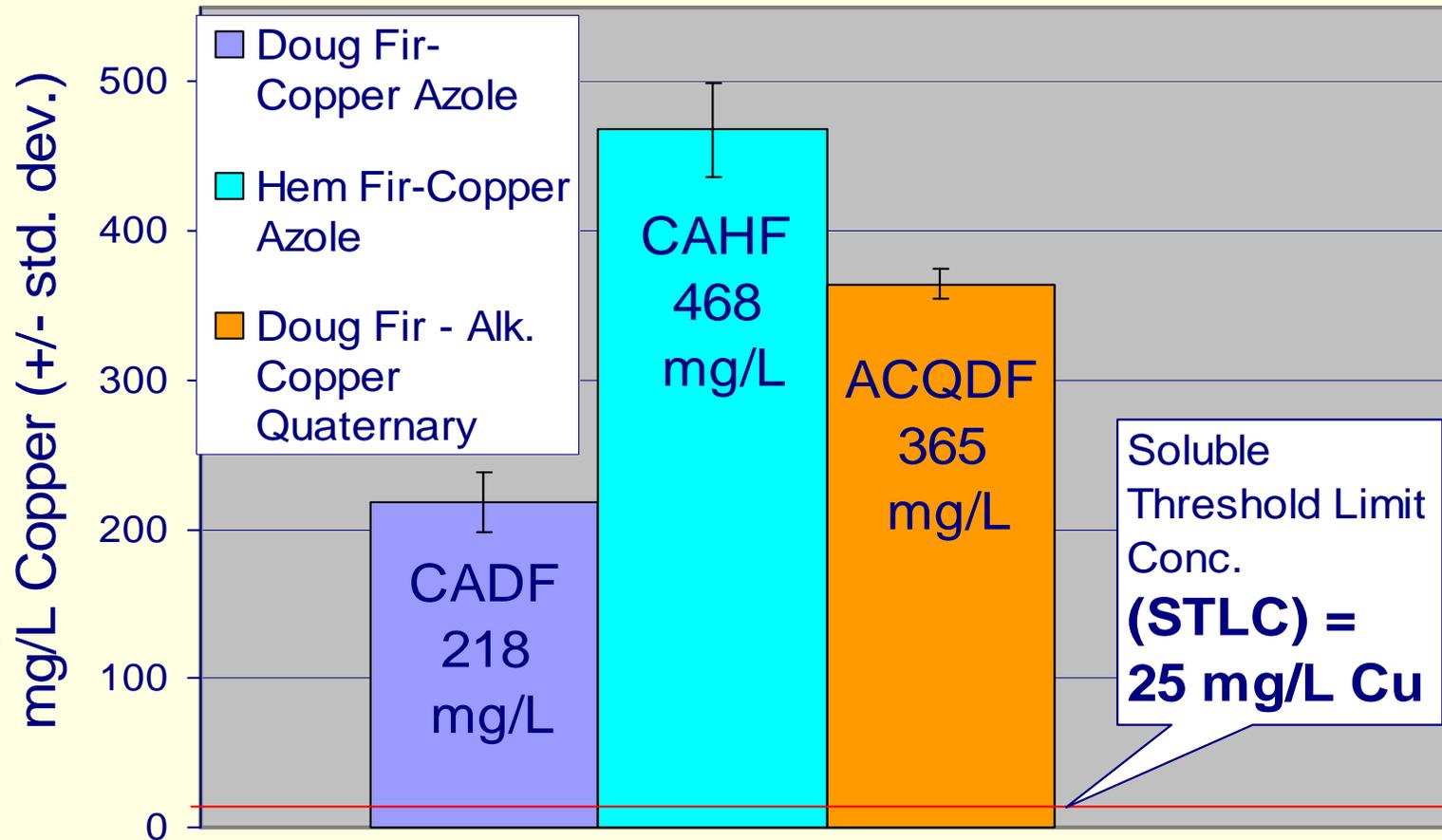


CA and ACQ Treated Wood

Total Copper



CA-B and ACQ-C Treated Wood Waste Extraction Test - Copper

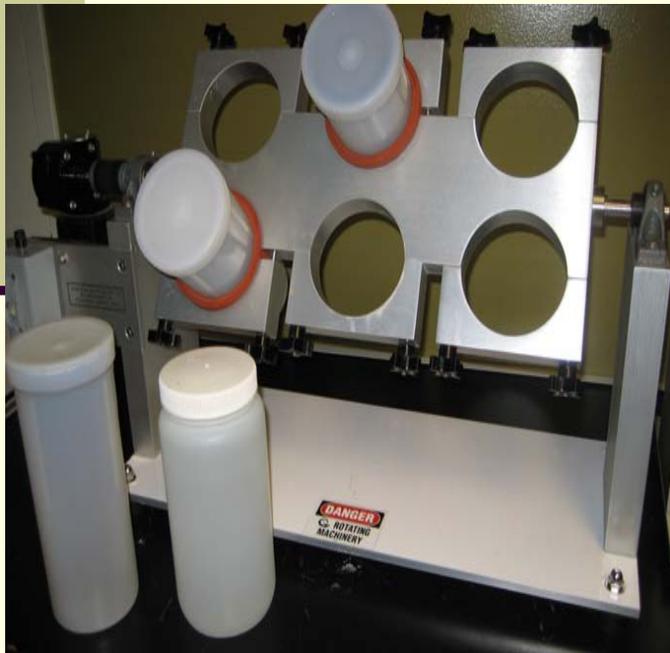


Wood Species/Preservative

TCLP Extraction and Filtration

Creosote-Treated Railroad Ties

- 100 g sample (0.9 cm cubes), 2 L acetate buffer pH 4.9
- Within 14 days, extract 18 hrs & filter using 0.6 μm GFF
- Extract sample duplicates and TCLP blank in each batch
- Solvent-extract TCLP filtrate for SVOCs within 7 days



Creosote-Treated Railroad Ties

TCLP Semivolatile Organics

mg/L	TCLP Blank	DF CTRL	Oak CTRL	Oak Creo	DF Creo 1	DF Creo 2	DF Creo 3
PCP TC = 100 mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cresols TC = 200 mg/L	<0.04	<0.04	<0.04	0.42	1.40	<0.04	<0.04
PAHs (sum)	<0.04	<0.04	<0.04	3.1	3.3	4.0	4.3

Creosote-Treated Railroad Ties

Total Semivolatile Organics

mg/kg	DF CTRL	Oak CTRL	Oak Creo	DF Creo 1	DF Creo 2	DF Creo 3
PCP TTLC = 17 mg/kg	<10	<10	<10	<10	<10	<10
Cresols	<2	<2	43	69	120	130
PAHs (sum)	<2	<2	8100	12000	19000	17000

Acute Aquatic Screening Bioassay

Untreated Controls

Species/ Treatment	Douglas fir <u>Controls*</u>	White fir <u>Control</u>	Oak <u>Control</u>
LC ₅₀ (mg/L)	>750	>750	>750
% fish survival at 500 mg/L, duplicates	100,100	100,100	100,100

* Four composite replicates assayed; all results were the same.

Acute Aquatic Screening Bioassay

CA-B and ACQ-C Treated Lumber

Species/ Treatment	Douglas fir <u>CA-B*</u>	Douglas fir <u>ACQ-C*</u>	Hem-fir <u>CA-B*</u>
LC ₅₀ (mg/L)	>750	>750	<250
% fish survival at 500 mg/L, duplicates	100,100	100,100	0,0

* Four composite replicates assayed; all results were the same.

Acute Aquatic Screening Bioassay

Creosote-Treated Oak and Douglas Fir Railroad Ties

Species/ Treatment	Oak	Douglas fir		
	<u>Creosote Composite</u>	<u>Creosote Comp.-1</u>	<u>Creosote Comp.-2</u>	<u>Creosote Comp.-3</u>
LC ₅₀ (mg/L)	>500	<250	<250	<250
% fish survival at 500 mg/L, duplicates	60,70	20,10	20,10	10,0

Summary: Copper-based Treatments

- CA-B & ACQ-C treated 2x8s exceeded the copper STLC & TTLC hazardous waste Toxicity Characteristic levels.
- Douglas-fir CA-B and ACQ-C 2x8s had an acute aquatic bioassay $LC_{50} > 500$ mg/L, but...
- Hemlock-fir CA-B 2x8s had $LC_{50} < 500$ mg/L TC level.
- Douglas-fir and Hem.-fir controls did not exhibit fish toxicity.

Summary: Creosote Treatments

- TCLP PCP & cresols in used RR ties were well below the Toxicity Characteristic level.
- PCP (total) was not detected in the used ties.
- Oak-creosote RR ties had $LC_{50} > 500$ mg/L TC level, but...
- DF-creosote RR ties had $LC_{50} < 500$ mg/L.
- Douglas-fir and oak controls did not exhibit fish toxicity.

CONCLUSION

- ★ Wood products treated by ACQ-C and CA-B contain **high level of copper**, which exceeds California TTLC and STLC regulatory criteria.

Therefore:

- ★ Wood products treated by ACQ-C and CA-B have the potential to be a **non-RCRA hazardous** waste when disposed.



CONCLUSION (Continued)

★ **Untreated wood samples were not toxic to fish.**

Fish Survival Rate = 100%

96-hour bioassay

500 mg/l dosage

CONCLUSION (Continued)

- ★ Out-of-service creosote-treated railroad ties have the potential to fail the California regulated acute aquatic 96-hr LC₅₀ bioassay.

Creosote-treated
railroad ties



toxic to fish



- ★ Out-of-service creosote-treated railroad ties have the potential to be a **non-RCRA hazardous waste** when disposed.

CONCLUSION (Continued)

- It is the Generator's responsibility to determine waste classification.

DTSC Web Site

Report and Fact Sheet are available at:

http://www.dtsc.ca.gov/HazardousWaste/Treated_Wood_Waste.cfm

- **Fact Sheet: Requirements for Generators of Treated Wood**
(Amended August 2008)

- **Sampling and Analysis Study of Treated Wood (Draft Report)**

Appendix I	Retention Required by AWPA
Appendix II	Sampling Locations and Allocations
Appendix III	Sampling Preparation Photographs
Appendix IV	Laboratory Reports



Contact Persons

- Xiaoying Zhou: (916)323-3527, XZhou@dtsc.ca.gov
- Li Tang: (916) 322-2505, LTang@dtsc.ca.gov
OR TTW_help@dtsc.ca.gov

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