

## **FLNRO Process Based Specification for CCA Treatment of Coastal Douglas-Fir Wood**

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### **PRESENTATION OUTLINE**

- FLNRO Engineering Branch – Overview
- Background for development of process based CCA treatment specification
- Description of CCA process specification for CCA treatment of Coastal Douglas-fir Wood
- Test results of penetration
- Ongoing work
- Q & A

### **FLNRO ENGINEERING BRANCH**

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRO)

- FLNRO has many responsibilities for activities on the Crown land base
- Key FLNRO mandate includes being the lead agency in BC responsible for administration of forest resource roads including Forest Service Roads (Crown owned roads)
- Engineering Branch (of FLNRO) is responsible for establishing engineering policy and standards for Forest
- Service Roads

## ENGINEERING BRANCH MISSION

- To provide a safe resource road network which balances public, community, First Nations, commercial and industrial use
- Engineering Branch – HQ
  - Establishes policy and standards for engineering works on Forest Service Roads (FSRs)
  - Establish design, material and construction standards for bridges on FSRs\



## ENGINEERING BRANCH MISSION

### Statistics on Resource Road Network in BC

- 600,000 km of resource roads provincially
- 60,000 km Forest Service roads (FSRs)
  - ~ 6,000 Bridges on FSRs
  - Treated wood components:
    - Timber decks
    - Glulam beams
    - Wood piles



## PHOTOS OF PRESERVATIVE TREATED BRIDGE COMPONENTS

### Timber Deck Systems







## PHOTOS OF PRESERVATIVE TREATED BRIDGE COMPONENTS



## PHOTOS OF PRESERVATIVE TREATED BRIDGE COMPONENTS

### Glulam Beams

(i.e., Glued laminated timber)



## PHOTOS OF PRESERVATIVE TREATED BRIDGE COMPONENTS

### Wood Piles & Ballast Walls





## **FLNRO DEVELOPMENT OF STANDARDS FOR LUMBER AND TREATED WOOD MATERIALS**

### **Challenges at the time (2009ish):**

- Limited reference to standards for lumber and for treated wood
- Referenced conformance to CAN/CSA-080 “Wood Preservation” as a general ‘catch-all’
  -
- No checks for quality assurance for lumber or for treated wood; no 3<sup>rd</sup> party verification of treatment results

Possibly received wood materials of questionable quality, and where preservative treatment was specified the treated wood supplied may have consisted of only ‘dip treatment’

### **Objectives to remedy challenges:**

- consistent quality timber materials; meet Canadian Lumber Standards
- industrial quality treated wood that will provide long term performance for the intended use
- conform to CSA-080 Series “Wood Preservation”, and Best Management Practices
- ensure quality assurance for lumber and for treated wood

To establish standards that provide for performance and service life expectancy, and to establish a level playing field for suppliers

- FSR bridge design and construction standards include standards for lumber and treated wood materials:
  - o Bridge Timbers & Lumber Material Standard
  - o Pressure Treated Wood Standard for Timber Deck Bridge Components
  - o Process Specification for CCA Treatment of Coastal Douglas-fir Wood

<https://www2.gov.bc.ca/gov/content/industry/natural-resource-use/resource-roads/engineering-standards-guidelines/bridge-design-construction/material-standards>

## **BACKGROUND HISTORY BEHIND DEVELOPMENT OF PROCESS BASED CCA TREATMENT SPECIFICATION**

- Engaged experts & practitioners in the timber & wood treatment industry
  - o Paul Morris, Ph.D. (FPInnovations) – involved in development of CSA- o8o Series
  - o David Reekie (Canadian Softwood Inspection Agency)
  - o Allan Miller (Stella Jones)
  - o Les Cool (Welco Lumber)
  - o Stuart Sing (Canadian Mill Services Association)
  - o Others

## **FLNRO BRIDGE TIMBERS & LUMBER MATERIAL STANDARD**

### **Key requirements for lumber:**

- Rough lumber material
- Conforming to various wood species depending on bridge component
- Graded in accordance with NLGA grading rules
  - o No. 1 grade for cross-ties and stringers
  - o No. 2 grade for all other timber components
- All rough lumber to be:
  - o Full sawn
  - o Trimmed for removal of sniped, splintered, or uneven lengths
  - o Trimmed full to length (tolerances specified), and double-end trimmed

- Lumber quality verified by:
  - grade stamp or
  - Certificate of Inspection, prepared by Accredited Grading Agency

**Reference NLGA (National Lumber Grades Authority), as approved by Canadian Lumber Standards Accreditation Board, for required lumber grades**

**Allowable Species**

- Preferred wood species for structural characteristics (D-Fir-L)
  - Coastal D-Fir
  - Interior D-Fir
  - Western Larch
- Other wood species allowed dependent on treated or not, and bridge component



<b>Table 1</b> <b>Lumber species and grade requirements for standard timber deck bridges</b> (except components for 6.1 m span "All Timber Portable Bridge" as noted in attached Table 2)			
Bridge Component	Allowable Untreated Lumber Species	Allowable Lumber Species and Use Category <sup>3</sup> if Treated (Refer to <a href="#">Pressure Treated Wood Standard for Timber Deck Bridge Components</a> )	Required Lumber Grade <b>NLGA</b>
Timber guardrail, riser blocks and brackets (e.g., untreated 250 mm x 250 mm size)	<ul style="list-style-type: none"> <li>D Fir-L<sup>4</sup> (preferred)</li> <li>Hem-Fir North<sup>5</sup> or <b>SPF West</b><sup>6</sup> (if justified by life cycle cost analysis for site-specific crossing)</li> </ul>	<ul style="list-style-type: none"> <li>Coastal D-Fir</li> <li>Hem-Fir North</li> </ul>	<b>No. 2 or better</b> (e.g., NLGA Para. 131c – "No.2" – Structural Posts and Timbers for 250 mm x 250 mm size)
Timber deck running planks (wear planks) (e.g., untreated 75 mm x 250 mm size for wear planks to sub-deck; e.g., untreated 100 mm x 300 mm size for wear planks to cross-ties)	<ul style="list-style-type: none"> <li>D Fir-L (preferred)</li> <li>Hem-Fir North or <b>SPF West</b> (if justified by life cycle cost analysis for site specific crossing)</li> </ul>	Not treated (because mechanical wear is the life limiting factor rather than rot)	<b>No. 2 or better</b> (e.g., NLGA Para. 124c – "No.2" – Structural Joists & Planks for 75 mm x 250 mm size)
Timber sub-deck planks (e.g., 100 mm x 300 mm for sub-deck planks to cross-ties)	<ul style="list-style-type: none"> <li>D Fir-L</li> </ul>	<ul style="list-style-type: none"> <li>Coastal D-Fir</li> <li>Hem-Fir North</li> </ul>	<b>No. 2 or better</b> (e.g., NLGA Para. 124c – "No.2" – Structural Joists & Planks for 100 mm x 300 mm size)
Timber cross-ties (e.g., 200 mm x 200 mm, 200 mm x 250 mm, 200 mm x 300 mm, 250 mm x 300 mm size, etc.)	<ul style="list-style-type: none"> <li>D Fir-L</li> </ul>	<ul style="list-style-type: none"> <li>Coastal D-Fir</li> </ul>	<b>No. 1 or better</b> (e.g., NLGA Para. 131b – "No.1" – Structural Posts and Timbers for 200 mm x 200 mm size, 200 mm x 250 mm size or 250 mm x 300 mm size) (e.g., NLGA Para. 130b – "No.1" – Structural Beams and Stringers for 200 mm x 300 mm size)
Ballast wall timbers (e.g., treated 150 mm x 300 mm size)	None. Must treat ballast wall timbers→	<ul style="list-style-type: none"> <li>Coastal D-Fir</li> </ul>	<b>No. 2 or better</b> (e.g., NLGA Para. 130c – "No.2" – Structural Beams and Stringers for 150 mm x 300 mm size)
Timber sills (e.g., treated 200 mm x 400 mm; 305 mm x 305 mm, etc.)	None. Must treat timber sills→	<ul style="list-style-type: none"> <li>Coastal D-Fir</li> </ul>	<b>No. 2 or better</b> (e.g., NLGA Para. 130c – "No.2" – Structural Beams and Stringers for 200 mm x 400 mm size)

## **BACKGROUND HISTORY BEHIND DEVELOPMENT OF PROCESS BASED CCA TREATMENT SPECIFICATION**

### **Evaluated wood treatment options:**

#### **Oil Borne:**

- Creosote (**CR**)
- Pentachlorophenol in Type A Oil (**PCP-A**)

#### **Water Based:**

- Ammoniacal Copper Zinc Arsenate (**ACZA**)
- Chromated Copper Arsenate, Type C (**CCA**)

#### **Desired criteria:**

- An economical waterborne preservative
- Treatment type readily available in BC
- Treatment to be effective with D-Fir
- 3<sup>rd</sup> party inspection

## FLNRO PRESSURE TREATED WOOD STANDARD FOR TIMBER DECK BRIDGE COMPONENTS

“CCA is considered an excellent treatment for most softwood species.  
Achieving the required penetrations in Douglas-fir may be extremely difficult.

CCA is not recommended ... for treatment of interior Douglas-fir.”

***Reference: Page 14 of Best Management Practices: For the use of treated wood in aquatic and wetland environments:***

***<http://preservedwood.org/portals/o/documents/BMP.pdf>***

Table 6 of CSA-o8o.1-15

<b>Table 6</b> <b>Wood species and associated use categories — Sawn products</b> (See Clauses 7.1, 7.2, and 8.1.1.)									
Species	UC1 and UC2	UC3	UC4.1	UC4.2	UC5A	Permanent wood foundations	Shakes and shin- gles	Sawn cross- arms	High- way bridges
Douglas fir*									
Coastal	X	X	X	X	X	X		X	X
Interior								X	

CCA is not recommended for treatment of Interior Douglas-fir

## **BACKGROUND HISTORY BEHIND DEVELOPMENT OF PROCESS BASED CCA TREATMENT SPECIFICATION**

Focused on CCA:

- Economical
- Less environmental “baggage”
- Fewer implications for handling
- Readily available within BC
- Best option considering alternatives
- Better than what we have
- Worth an attempt

Recognized that not likely to attain CSA-o8o Series results for penetration (and sometimes for retention) - thus

Ministry decision to move forward with development of a process based specification for CCA treatment of Coastal Douglas-fir



## DESCRIPTION OF FLNRO CCA PROCESS SPECIFICATION

- Prior to pressure treatment, carry out the following:
  - Dry wood to average Moisture Content of between 23 and 30%
  - Incise wood on all faces to improve the penetration of wood preservative into impermeable wood by making a series of small, shallow slits cut into the wood by an incising machine
    - Incise wood to depth of 10 mm, and density of 4,500 / m<sup>2</sup>



- Pre-frame / pre-cut wood to size and length, as much as possible, as this reduces breaches to the treated shell

## DESCRIPTION OF CCA PROCESS SPECIFICATION

Apply CCA treatment using processes and procedures (e.g., steam limits) that conform with CSA-o8o for Use Category UC4.1, and adhering to the following requirements:

- Apply heat treatment to kill any existing fungus infection to 56 degrees C for 30 minutes
- Use a CCA solution strength between 2 and 2.5% concentration
- Ensure the preservative solution temperature is between 20 and 25 degrees C
- Ensure initial vacuum time is a minimum of 30 minutes after reaching full vacuum as per CSA-o8o
- Apply a treatment pressure between 150 and 180 psi for a minimum of 6 hours

### Treating Cycle Data

- Cylinder #, and cylinder charge #
- Vacuum (initial), and time elapsed
- Solution strength & temperature
- Treatment pressure, and time elapsed
- Vacuum (final), and time elapsed
- Retention by gauge

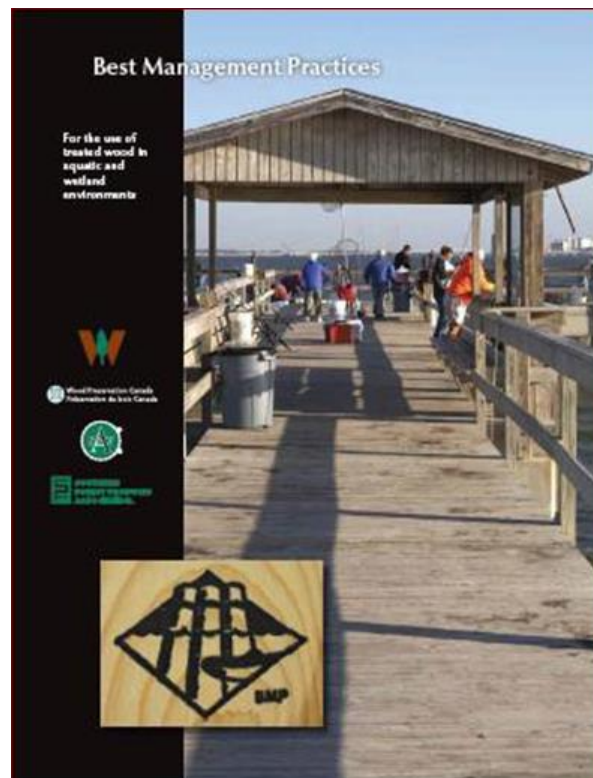


## DESCRIPTION OF FLNRO CCA PROCESS SPECIFICATION

- To minimize preservative migration (loss) from CCA treated wood for bridge installations across water, the supplier must:
  - Produce treated wood in accordance with the *Best Management Practices: For the use of treated wood in aquatic and wetland environments*

The BMPs provide:

- quality assurance procedures
- specific recommendations for each preservative type
- processes to minimize mobility of preservative (e.g., CCA fixation)
- processes to maximize cleanliness of wood surface
- guidelines for installation and maintenance of treated wood



<http://preservedwood.org/portals/o/documents/BMP.pdf>

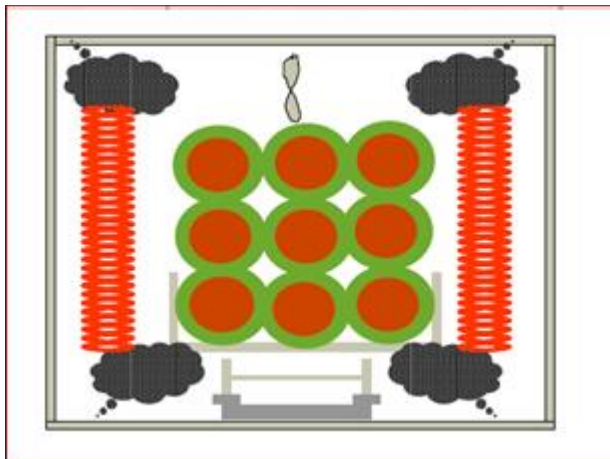
## DESCRIPTION OF FLNRO CCA PROCESS SPECIFICATION

### Post-treatment Preservative Fixation

- To minimize preservative migration (loss) from CCA treated wood for bridge installations across water, the supplier must:
  - After treatment, apply appropriate procedures to maximize preservative fixation in accordance with CSA-o8o

**As per CSA-o8o.2-15 (Clause 5.5):** “A fixation process shall be used after CCA treatment to ensure the chemical reduction of soluble hexavalent chromium and substantially immobilize CCA components in the wood before removal from protected storage

- The fixation process for CCA treated wood can be achieved by one of the following chosen as a function of time:
  - kiln drying
  - steam conditioning
  - hot water batch



Graphic Source: FPIInnovations



## DESCRIPTION OF FLNRO CCA PROCESS SPECIFICATION

- 3<sup>rd</sup> party Quality Assurance (QA) inspection required
  - Inspections at the treatment plant to verify conformance with process specification
  - Tests of preservative retention and penetration
- Documentation requirements:
  - Inspection reports of CCA Process
    - record of pressure treatment and treating cycle summary
    - record of retention and penetration test results
  - Statement of CCA Treatment Process Conformance


[illegible]

<b>Ministry of Forests, Lands and Natural Resource Operations</b> <b>Statement of CCA Treatment Process Conformance</b>													
Description of CCA Wood Treatment Order:													
Producer of CCA Treated Wood (give company name and location):													
Ministry Office	Required Delivery Location												
Ministry Purchase Order No. or Contract No.	Name of ministry Bridge Engineer (name provided in the purchase order or contract documents)												
<p>This is to advise that I am the qualified inspector for this CCA wood treatment order, and I am (check one as appropriate):</p> <p><input type="checkbox"/> an accredited inspector by <b>INSERT AGENCY NAME</b></p> <p style="text-align: center;">OR</p> <p><input type="checkbox"/> not an accredited inspector, but qualified by experience and having the minimum qualifications in accordance with the requirements of the Ministry of Forests, Lands and Natural Resource Operations Process Specification for CCA Treatment of Coastal Douglas-fir Wood.</p> <p>I have personally inspected <b>STATE NUMBER</b> treated wood pieces containing <b>STATE NUMBER</b> Foot Board Measure (FBM) as manifested in the attached supporting documentation.</p> <p>I have carried out my inspections of the treatment procedures and processes considered necessary to verify compliance with the requirements of the Ministry of Forests, Lands and Natural Resource Operations Process Specification for CCA Treatment of Coastal Douglas-fir Wood. Based on these inspections, I hereby give my assurance<sup>1</sup> that, in my opinion the significant aspects of the wood treatment have been carried out in general conformance with clauses 1 and 2 of the ministry's CCA process specification.</p> <p>I have undertaken the required penetration and retention testing, and I confirm the results of the testing are representative of the CCA treated wood order.</p> <p>I have attached copies of the following documentation to this statement: <b>(1)</b> all process inspection reports; <b>(2)</b> all penetration and retention test results and other relevant documentation in order to confirm the supplier's adherence to the specifications; and <b>(3)</b> the <u>supplier's evidence</u> demonstrating that the treated wood is Coastal Douglas-fir.</p>													
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 5px;">Signature of Qualified Inspector</td> </tr> <tr> <td style="width: 50%; padding: 5px;">Name of Qualified Inspector (please print)</td> <td style="width: 20%; padding: 5px;">DATE SIGNED YYYY MM DD</td> <td rowspan="3" style="width: 30%; padding: 5px; vertical-align: top;">(If an "accredited inspector," identify credentials here)</td> </tr> <tr> <td colspan="2" style="padding: 5px;">EMPLOYER'S NAME AND ADDRESS (please print)</td> </tr> <tr> <td style="padding: 5px;">PHONE NO.</td> <td style="padding: 5px;">FAX NO.</td> <td style="padding: 5px;">E-MAIL ADDRESS</td> </tr> </table>			Signature of Qualified Inspector			Name of Qualified Inspector (please print)	DATE SIGNED YYYY MM DD	(If an "accredited inspector," identify credentials here)	EMPLOYER'S NAME AND ADDRESS (please print)		PHONE NO.	FAX NO.	E-MAIL ADDRESS
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## CSA-o8o Compared to Retention Results

- **Ref. CSA-o8o.1-15 (Table 10)**
- Preservative retention requirements depend on:
  - Preservative type
  - UC#
  - Wood species
- Coastal D-Fir, UC4.1, CCA

**Table 10 (Continued)**



Preservative	Eastern white, ponderosa, and red pine	Jack and lodgepole pine	Southern pine	Western white pine	Hem-Fir North, eastern and western hemlock, and true firs	Spruce-Pine-Fir and Spruce-Pine-Fir West	Engelmann and western white spruce	Coastal Douglas fir	Western larch	Western red cedar	Yellow cypress
UC4.1 (Residential Product Group D only) (continued)											
MCA	3.3	3.3	3.3	3.3	3.3						
MCQ	6.4	6.4	6.4	6.4	6.4						
UC4.1 (All other uses)											
ACQ-C	6.4	6.4	6.4	6.4	6.4	6.4†††	6.4	6.4			
ACQ-D	6.4	6.4	6.4	6.4	6.4	6.4†††	6.4	6.4			
ACZA	6.4	6.4	6.4		6.4			6.4	6.4	6.4	
CA-B	3.3	3.3	3.3	3.3	3.3	3.3†††	3.3	3.3			
CCA§§	6.4	6.4	6.4		6.4			6.4	6.4	6.4	
CR	128	128	128	128	160††	120††	128	128	160††	120††	128
CR-S	128	128	128	128	160††	120††	128	128	160††	120††	128
CuN			0.8					0.8			
MCA	3.3	3.3††	3.3	3.3	3.3††						

Test results from ministry orders indicate that process specification results in meeting or exceeding the retention requirements of CSA-8o

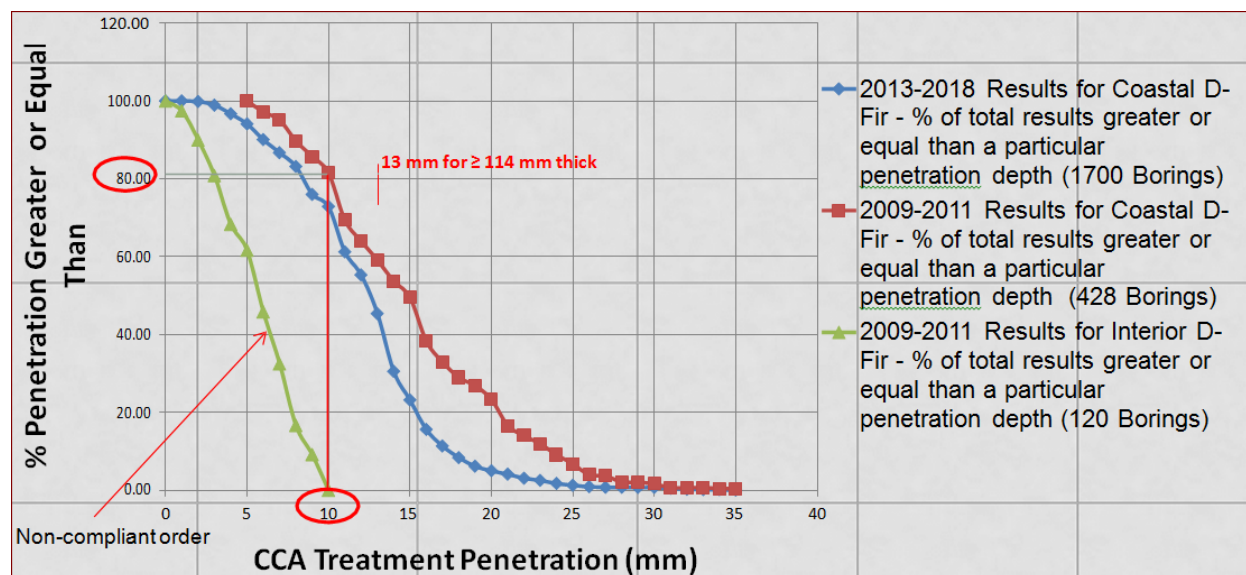
## CSA-o8o Compared to Penetration Results

### Ref. CSA-o8o.2-15 (Table 5)

- # required test borings depend on - wood species, product thickness & preservative type
- CCA treated Coastal D-Fir need:
  - minimum of 20 boring samples per charge
  - 80% of boring penetration test results must meet penetration requirement

Species	Incising‡	Penetration depth†		Number of borings required		Percentage of borings required to meet penetration requirement	
		Products < 114 mm thick	Products ≥ 114 mm thick	Products All Marine (UC5A)	CR, CR-S, and CR-PS		All other preservatives
Coastal Douglas fir	Required	10 mm and 90%	13 mm and 90%	13 mm and 90%	48	20	80

## PENETRATION TEST RESULTS USING FLNRO CCA PROCESS SPECIFICATION FOR COASTAL D-FIR



## **ONGOING WORK**

### **Considerations to Address Past and Ongoing Delivery Concerns of Treated Wood Orders**

1. Continue to work with contract timber and treatment suppliers to make sure they understand the standards and expectations
2. Encourage ordering of treated timber deck / misc. wood well in advance because:
  - there are no stock piles of industrial treated wood, and
  - wood has to be ordered, then fitted into a treatment schedule at the treating plant
3. Possibly pre-order Coastal D-Fir, get it treated locally by a treater that can meet the FLNRO treatment standards, store in ministry yard, ready as a source of material for assembly or use in the future
4. Possibly pre-order fully assembled, treated timber deck modules, and store in yard
5. Possibly combine bulk orders from various business areas
6. Continue to monitor results