Marwood Ltd

NOTICE OF UNDERTAKING

Pressure Treated Lumber and Wood Manufacturing Facility

Community of Jamestown
Bonavista Bay, Newfoundland

Submitted By: Marwood Ltd
February 27, 2013

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NAME OF THE UNDERTAKING:

Pressure Treated Lumber and Wood Manufacturing Facility

PROPONENT:

(i) Name of Corporate Body:
Marwood Ltd.

(ii) Address:
PO Box 338 Fredericton, N.B. E3B 4Z9

(iii) Chief Executive Officer:
Name: Ross Creelman
Official Title: Managing Director
Telephone No: 506-459-7777

(iv) Principal Contact Person for Purposes of Environmental Assessment:
Name: Daniel Goodine
Official Title: V.P. Operations
Telephone No: 506-444-7137

THE UNDERTAKING

(i) Nature of the Undertaking:

The facility will be located on the site of the former Jamestown Lumber Company Ltd properties. The proposed Marwood facility will produce pressure treated lumber and manufactured wood products for customers throughout Newfoundland and abroad. The facility will integrate the treating plant as well as the wood handling, sorting and manufacturing plant with the existing Jamestown assets, buildings and infrastructure. The facility will produce pressure treated lumber and other manufactured products using lumber purchased from local sawmills and substitute with other supply when material is not locally available.

(ii) Purpose/ Rational/ Need for the Undertaking:

Marwood presently distributes lumber, lattice, fence panels, deck accessories and other pressure treated products to a number of customers throughout NL. Distribution is done through two Canwel/ Broadleaf facilities (Deer Lake and Mount Pearl), through the Taiga facility (Paradise) and/ or through direct shipments from it's treating plant in Brookfield, N.S.

The rational and need for this undertaking is primarily driven by the growing demand for pressure treated lumber and related products in Newfoundland. The continual escalation of the cost of transportation and the increased availability of high quality lumber in NL makes this an ideal time to invest in this facility.

The facility will primarily use lumber produced by local sawmills, significantly reduce handling and travel costs, reduce the volume of freight coming through Port aux Basque and Argentia, decrease greenhouse gas emissions, create and sustain a number of full time jobs and stimulate economic growth within the Province and surrounding area.

DESCRIPTION OF THE UNDERTAKING

(i) Geographical Location:

The plant will be located on the former Jamestown Lumber Company Ltd Site. Maps and figures are attached in Appendix 1.

(ii) Physical Features:

The major physical features of this site will not significantly change since the site, buildings and infrastructure was formerly used for the storage and handling of lumber and associated products.

There is no anticipated incremental impact on any of the physical or biological environments within or adjacent to the proposed site other than those that would typically be affected by normal site and construction activities and development.

(iii) Construction:

Site development and construction will begin immediately upon the issue of approvals with an estimated construction period of 4 months to complete all of the required work and have the facility fully operational. All work will be planned and completed to ensure that all building, environmental and construction codes are followed and industry best practices are utilized. Because most of the required buildings and infrastructure are already in place and there will only be a minimal amount of additional site work required. The Jamestown assets include several adjoining properties amounting to a total land area of approximately 12.5 Hectares. Included in these properties are crown Grant #'s 28150, 39378, 39364 and lease # 122610. Building assets include a 2200 sq ft dry kiln with shavings boiler, a 7470 sq ft sawmill building, a 9700 sq ft planer mill, a 1780 sq ft garage and a 1500 sq ft office. Some of the saw mill, planer mill, kiln and boiler equipment will be utilized to support our treating and wood handling operations as well as to support the development of our manufacturing operations. Excessive equipment that isn't required will be liquidated.

There are two drilled wells on the property that will be utilized as well as an existing septic system.

The treating plant will be built to comply with the *Recommendations for the Design and Operation of Wood Preservation Facilities, 2004 – Technical Recommendations Document (TRD)* attached in Appendix 4.

(iv) Operations:

The treating plant will utilize Copper Azole (CA-B) to treat various species and sizes of white lumber and manufactured products. A Material Safety Data Sheet for both the CA-B solution as well as the CA- B treated wood is provided in Appendix 2. The plant design will also allow for the incorporation and use of additional preservative systems should the need arise in the future.

Drawings of the proposed plant layout and existing buildings are attached in Appendix 3.

The treating plant process design and operation will follow best practice and procedure as outlined in the TRD. The treating process is described in detail in the TRD Appendix 4, page CA-B-7.

Since 2005 all treating plants built and operated in Canada are required to have annual audits to ensure that they are complying with the original SOP and TRD requirements.

This auditing function is an industry led self certification program entitled "Canadian Wood Preservation Certification Authority" (CWPCA). These audits are conducted with

trained staff and an outside auditing firm approved and responsible for performing and overseeing all of the plant audits and certifications in Canada. Once a new plant is operational the auditing firm is required to do the initial plant audit to ensure compliance and to receive the CWPCA plant certification.

As indicated in the TRD the treating plant is built and designed to house, contain and reuse all liquids within the plant as part of the regular operation and in the event of a spill or leak.

Once the treated wood is removed from the cylinders it is left in the plant for a minimum period of 48 hours to allow for drying and stabilization to take place. Once the material has been stabilized it is wrapped and moved to an outside storage yard. There are minimal liquid discharges to the receiving environment as a result of the stabilization and material wrapping process.

As required by the TRD the site will be surveyed by a qualified Hydrogeologist and a network of ground monitoring stations will be installed to evaluate groundwater conditions before and during plant construction and operation. Monitoring parameters and frequency will be developed in consultation with the NL Department of Environment.

Site specific contingency plans will be developed detailing procedures, contacts (internal and external) and related reporting and other requirements in the unlikely event of a spill, fire, or other emergency.

The facility will have water supplied by way of the existing drilled wells. The estimated annual consumption is expected to be approximately 2 million liters.

(v) Occupations:

The 4 month site development and plant construction period will be predominantly completed through the use of contractors and the relevant trade's people within their contract expertise. The National Occupation Trade Classification that will apply for this project will be group 720 covering contractors, supervisors and related workers under the construction, industrial and electrical trades. An estimated 10 to 15 contractors working a total of 5000 man hours of work will be required during the construction period.

Once fully operational the plant will employ approximately 10 people in occupations within the Occupational structure subgroups 9215, 9241, 9434, 9437 and 9614.

Marwood Ltd. recognizes the fundamental principal that all persons are equal in dignity and human rights regardless of age, ancestry, color, disability, marital status, national origin, place of origin, political belief, race, religion, gender, sexual orientation and social condition.

Employees will be selected for available positions based upon qualifications (including security checks when required) and their ability to fulfill job related requirements, skill set (which may be validated by an employment/performance test), experience related to the position and availability.

(vi) Project-Related Documents

-Technical Recommendation Document – Appendix 4

APPROVAL OF THE UNDERTAKING:

Project Funding:

A project financing proposal has been submitted to the Department of Innovation, Trade and Rural Development through the Western Regional Directors office – Approval is pending.

SCHEDULE:

Assuming that all approvals are in place on or before May 1st, 2013 site work and construction will begin immediately. Given the size and complexity of this project involving multiple and concurrent procurement, contractor and construction requirements the project start date and project timelines are critical for this project to proceed on schedule. The Treating Plant start up is scheduled for September 1st and any delays will impact and jeopardize both the cost of the project as well as the completion date.

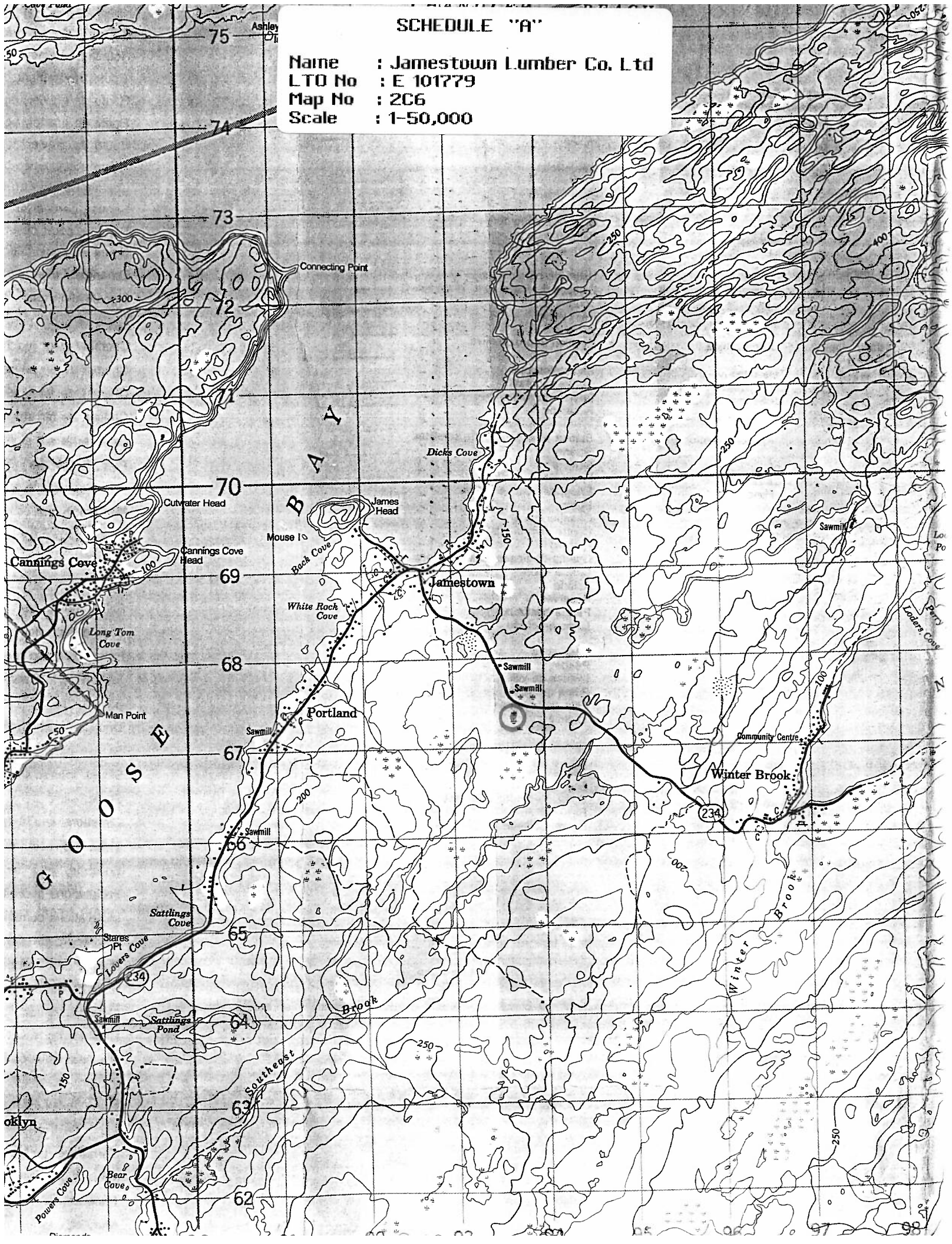
FUNDING:

A project financing proposal has been submitted to the Department of Innovation, Trade and Rural Development.

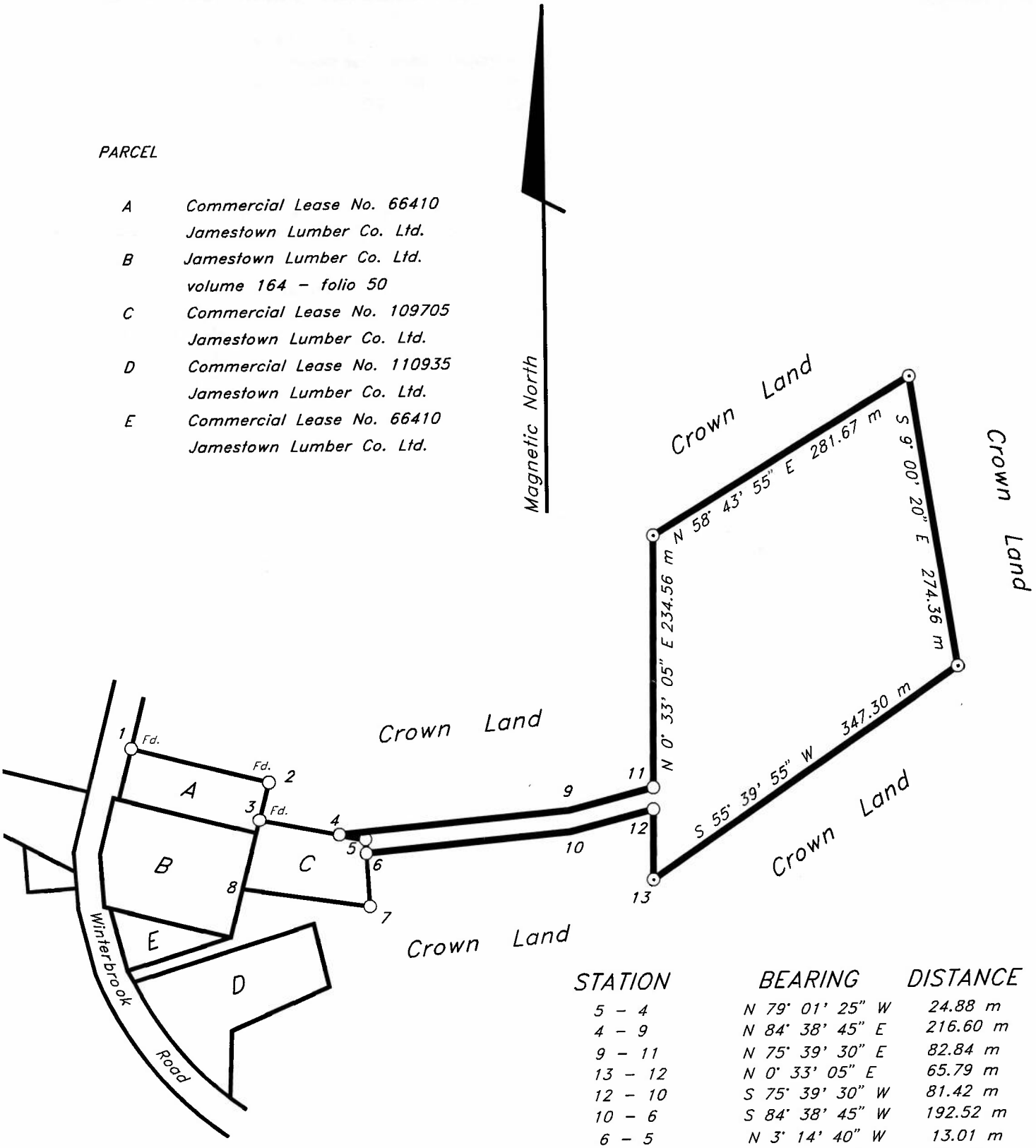
2/27/2013
Date

Harry Foreman
Signature of Chief Financial Officer

APPENDIX 1
Site Figures


SCHEDULE "A"
Name : Jamestown Lumber Co. Ltd
LTO No : E 101779
Map No : 2C6
Scale : 1-50,000
Connecting Point
Dicks Cove
James Head
Cutwater Head
Mouse I
Back Cove
Cannings Cove
Cannings Cove Head
Jamestown
White Rock Cove
Long Tom Cove
Man Point
Portland
Sawmill
Community Centre
Winter Brook
Winter Brook
Loaders Cove
Sattlings Cove
Stares Pt
Lovers Cove
Sattlings Pond
Southeast
Bear Cove
Powers Cove
234
B A Y
G O O S E
75
74
73
72
71
70
69
68
67
66
65
64
63
62
300
250
400
200
150
100
50

SCHEDULE "B"



STATION	BEARING	DISTANCE
5 - 4	N 79° 01' 25" W	24.88 m
4 - 9	N 84° 38' 45" E	216.60 m
9 - 11	N 75° 39' 30" E	82.84 m
13 - 12	N 0° 33' 05" E	65.79 m
12 - 10	S 75° 39' 30" W	81.42 m
10 - 6	S 84° 38' 45" W	192.52 m
6 - 5	N 3° 14' 40" W	13.01 m
6 - 7	S 3° 14' 40" E	49.42 m
3 - 4	S 79° 01' 25" E	75.62 m
3 - 5	S 79° 01' 25" E	100.50 m
5 - 7	S 3° 14' 40" E	62.43 m
7 - 8	N 81° 37' 50" W	119.73 m
8 - 3	N 14° 15' 00" E	66.07 m

Area = 8.6984 hectares

mestown Jamestown

Jamestown Site

Winter Brook Wint

N

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
© 2013 Cnes/Spot Image
Image © 2013 DigitalGlobe

© 2007 Google™

Pointer 48°25'47.83" N 53°46'28.33" W elev 74 m

Streaming 100%

Eye alt 4.21 km

APPENDIX 2
CA-B Material Safety Data Sheets

FOR ANY EMERGENCY, 24 HOURS / 7 DAYS, CALL:	1-800-654-6911 (OUTSIDE USA: 1-423-780-2970)
FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC®:	1-800-424-9300 (OUTSIDE USA: 1-703-527-3887)
FOR ALL MSDS QUESTIONS & REQUESTS, CALL:	1-800-511-MSDS (OUTSIDE USA: 1-423-780-2347)

PRODUCT NAME: Wolman® E (CA-B) Treating Solution or Wolman® NB (CA-B) Treating Solution

1. PRODUCT AND COMPANY IDENTIFICATION

Arch Treatment Technologies, Inc.
5660 New Northside Drive, NW
Suite 1100
Atlanta, GA 30328

REVISION DATE:	09/19/2012
SUPERCEDES:	
MSDS Number:	000000011105
SYNONYMS:	Wolman® NB
CHEMICAL FAMILY:	Aqueous solution
DESCRIPTION / USE	For pressure treatment of wood and wood products
FORMULA:	None established

2. HAZARDS IDENTIFICATION

OSHA Hazard Classification:	**Respiratory irritant., Eye irritant, Skin irritant**

Routes of Entry:	Inhalation, skin, eyes, ingestion
Chemical Interactions:	No known interactions
Medical Conditions Aggravated:	No data available

Human Threshold Response Data

Odor Threshold	Not established for product.	
Ethanolamine		2.6 ppm
Irritation Threshold	Not established for product.	
Ethanolamine		> 5.0 ppm

Hazardous Materials Identification System / National Fire Protection Association Classifications

Hazard Ratings :	Health	Flammability	Physical / Instability	PPI / Special hazard.
HMIS	2	0	0	
NFPA	2	0	0	

Immediate (Acute) Health Effects

Inhalation Toxicity:	High concentrations are moderately irritating to the eyes, nose, throat, and lungs. Not expected to be toxic by inhalation.
Skin Toxicity:	Skin contact may cause moderate irritation consisting of transient redness and swelling. This irritant effect would not be expected to result in permanent damage. Not expected to be toxic from dermal contact.
Eye Toxicity:	Contact may cause moderate irritation consisting of transient redness, swelling, and mucous membrane discharge to the conjunctiva. No corneal involvement or visual impairment is expected.
Ingestion Toxicity:	Ingestion may cause irritation of the gastrointestinal tract and gastrointestinal discomfort with any or all of the following symptoms: nausea, vomiting or diarrhea. Not expected to be toxic by ingestion.
Acute Target Organ Toxicity:	May cause skin, eye and mucous membrane irritation (includes upper respiratory tract). Ingestion may cause gastrointestinal discomfort.

Prolonged (Chronic) Health Effects

Carcinogenicity:	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.
Reproductive and Developmental Toxicity:	Not known or reported to cause reproductive or developmental toxicity.
Inhalation:	There are no known or reported effects from chronic exposure except for effects similar to those experienced from acute exposure.
Skin Contact:	There are no known or reported effects from chronic exposure except for effects (if any) similar to those experienced from acute exposure.
Ingestion:	There are no known or reported effects from chronic ingestion except for effects similar to those experienced from single exposure.
Sensitization:	This material is not known or reported to be a skin or respiratory sensitizer.
Chronic Target Organ Toxicity:	There are no known or reported effects to humans from repeated exposure to this product.
Supplemental Health Hazard Information :	No additional health information available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS OR CHEMICAL NAME	CAS #	% RANGE
COPPER COMPOUNDS	MIXTURE	0.1 - 2.0
Ethanolamine	141-43-5	0.333 - 6.66

4. FIRST AID MEASURES

Inhalation: IF INHALED: Remove individual to fresh air. Seek medical attention if breathing becomes difficult or if respiratory irritation develops. If not breathing, give artificial respiration. Call for medical assistance.

Skin Contact: IF ON SKIN: Immediately flush skin with plenty of water for 15 minutes. If clothing comes in contact with the product, the clothing should be removed immediately and laundered before re-use. Seek medical attention if irritation develops.

Eye Contact: IF IN EYES: Immediately flush eyes with plenty of water for at least 15 minutes. Seek medical attention immediately.

Ingestion: IF SWALLOWED: Call a physician immediately. DO NOT induce vomiting unless directed to do so by a physician. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA): Product is not known to be flammable, combustible, pyrophoric or explosive.

Flammable Properties

Flash Point: Not applicable

Autoignition Temperature: Not applicable

Fire / Explosion Hazards: Material will not ignite or burn.

Extinguishing Media: Choose extinguishing media suitable for surrounding materials.

Fire Fighting Instructions: In case of fire, use normal fire-fighting equipment and the personal protective equipment recommended in Section 8 to include a NIOSH approved self-contained breathing apparatus.

Hazardous Combustion Products: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion., Hazardous combustion/decomposition products may include but are not limited to:, Carbon monoxide, Carbon dioxide, Oxides of nitrogen, Copper metal and copper oxides

Upper Flammable / Explosive Limit, % in air: Not applicable

Lower Flammable / Explosive Limit, % in air: Not applicable

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:	Use the personal protective equipment recommended in Section 8 and a NIOSH approved self-contained breathing apparatus.
Spill Mitigation Procedures	
Air Release:	Hazardous concentrations in air may be found in local spill area and immediately downwind. Vapors may be suppressed by the use of water fog. Contain all liquids for treatment or disposal.
Water Release:	This material is dispersible in water. Notify all downstream users of possible contamination. Divert water flow around spill if possible and safe to do so. Contain all liquids for treatment or disposal.
Land Release:	Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, clay, earth or commercial absorbent), then place in a chemical waste container. Avoid runoff into storm sewers and ditches which lead to waterways. Contain all liquids for treatment or disposal.
Additional Spill Information :	Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section 13, Disposal Consideration.

7. HANDLING AND STORAGE

Handling:	An eye wash and safety shower should be provided in the immediate work area. Avoid contact with material, avoid breathing dusts or fumes, use only in a well ventilated area. Do not take internally. Avoid contact with skin, eyes and clothing by wearing proper protective equipment. Upon contact with skin or eyes, wash off with water. Label containers and keep them tightly closed when not in use. Wash hands thoroughly before eating, drinking, using tobacco products, and/or using restrooms.
Storage:	Store in a cool dry ventilated location, away from oxidizers, heat, flame, or other incompatible conditions. Keep container(s) closed. Do not store near feed, food, or within the reach of children. Do not freeze. Keep product tightly sealed in original containers.
Incompatible Materials for Storage:	strong acids and bases Strong oxidizing agents

Empty Container Warning:	Empty containers that retain product residue (liquid, solid/sludge, or vapor) can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose container to heat, flame, sparks, static electricity, or other sources of ignition. Any of these actions can potentially cause an explosion that may lead to injury or death.Offer empty container for recycling or dispose of in accordance with all federal, state, or local requirements.If empty containers are disposed (not recycled), containers must be triple rinsed to ensure removal of all product. All rinse water should always be directed into a sump or pit that is pumped back to the makeup water tank. All product labels should be removed.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation:	Local exhaust ventilation or other engineering controls are normally required when handling or using this product to keep airborne exposures below the TLV, PEL or other recommended exposure limit.

Protective Equipment for Routine Use of Product

Respiratory Protection :	Wear a NIOSH approved respirator if levels above the exposure limits are possible.
Respirator Type :	A NIOSH approved full-face or half-face respirator in combination with chemical goggles. A NIOSH approved air purifying respirator with organic vapor cartridge and P100 filter. Air purifying respirators should not be used in oxygen deficient or IDLH atmospheres or if exposure concentrations exceed ten (10) times the published limit.
Skin Protection :	Wear impervious gloves, boots and apron to avoid skin contact.
Eye Protection:	Use chemical goggles.
Protective Clothing Type:	Impervious
General Protective Measures:	An eye wash and safety shower should be provided in the immediate work area.

Exposure Limit Data

CHEMICAL NAME	CAS #	Name of Limit	Exposure
COPPER COMPOUNDS		NIOSH-IDLH	100 mg/m3
Ethanolamine	141-43-5	ACGIH	3 ppm TWA
Ethanolamine	141-43-5	ACGIH	6 ppm STEL
Ethanolamine	141-43-5	OSHA Z1	3 ppm TWA 6 mg/m3 TWA

Ethanolamine	141-43-5	NIOSH-IDLH	30 ppm

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	liquid
Form	aqueous solution
Color:	Dark blue
Odor:	mild ammoniacal
Molecular Weight:	None established
Specific Gravity :	0.9995 - 1.046
pH :	8.9 - 9.1
Boiling Point:	100 DEG°C / 212 DEG°F
Freezing Point:	4 DEG°C / 39 DEG°F
Melting Point:	Not applicable
Density:	8.33 - 8.72lb/gal
Vapor Pressure:	No data
Vapor Density:	No data
Viscosity:	3 - 4 CPS
Fat Solubility:	No data
Solubility in Water:	dispersible
Partition coefficient n-octanol/water:	No data.
Evaporation Rate:	No data
Oxidizing:	The substance has no oxidizing properties
Volatiles, % by vol.:	No data
VOC Content	No data
HAP Content	No data

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary:	Stable under normal conditions. Product will not undergo hazardous polymerization.
Conditions to Avoid:	High temperatures, Avoid freezing.
Chemical Incompatibility:	Strong oxidizing agents, strong acids, strong bases
Hazardous Decomposition Products:	Hazardous combustion/decomposition products may include but are not limited to:, Carbon monoxide, Carbon dioxide, Copper metal and copper oxides, Oxides of nitrogen
Decomposition Temperature:	No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology
Oral LD50 value:

Ethanolamine	LD50	=	1,700 mg/kg	rat	

Component Animal Toxicology
Dermal LD50 value:

Ethanolamine	LD50	Approximately	1,000 mg/kg	rabbit

Component Animal Toxicology
Inhalation LC50 value:

Ethanolamine	LC50	1 h	> 4.8 MG/L	mouse
Ethanolamine	LC50	4 h	> 970 ppm	mouse

Product Animal Toxicity

Oral LD50 value:	LD50	Believed to be >	5,000 mg/kg	Rat
Dermal LD50 value:	LD50	Believed to be >	2,000 mg/kg	Rabbit
Inhalation LC50 value:	Inhalation LC50	4 h	Believed to be > 11 MG/L	Rat

Skin Irritation: This material is expected to be moderately irritating.
Eye Irritation: This material is expected to be moderately irritating.
Skin Sensitization: This material is not known or reported to be a skin or respiratory sensitizer.

Ethanolamine — This material tested negative for skin sensitization in animals.

Acute Toxicity: May cause skin, eye and mucous membrane irritation (includes upper respiratory tract). Ingestion may cause gastrointestinal discomfort.

Subchronic / Chronic Toxicity: Not known or reported to cause subchronic or chronic toxicity.

Reproductive and Developmental Toxicity: Not known or reported to cause reproductive or developmental toxicity.

Ethanolamine — This chemical has been tested in laboratory animals and no evidence of teratogenicity, embryotoxicity or fetotoxicity was seen.

Mutagenicity: Not known or reported to be mutagenic.

Ethanolamine — This chemical has been tested in a battery of mutagenicity/genotoxicity assays and the results were negative.

Carcinogenicity: This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA.

Ethanolamine	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. Chemicals of similar structure have been shown not to cause cancer in laboratory animals.

12. ECOLOGICAL INFORMATION

Overview: No data for product. Individual constituents are as follows:

Ecological Toxicity Values for: **COPPER COMPOUNDS**

Lepomis macrochirus (Bluegill sunfish)	-	(measured, renewal) 96 h LC50 > 0.660 mg/l (as copper sulfate)
Oncorhynchus mykiss (rainbow trout)	-	(measured, flow-through) 96 h LC50 > 0.0659 mg/l (as copper sulfate)
Daphnia pulex (Water flea)	-	(measured, static) 48 h EC50> 0.025 mg/l (as copper sulfate)
Daphnia magna (Water flea)	-	(measured, static) 48 h EC50= 0.0113 mg/l (as copper sulfate)
Pseudokirchneriella subcapitata (green algae)	-	(nominal, static). 96 h EC50 = 0.0211 mg/l (as copper sulfate)

Ecological Toxicity Values for: **Ethanolamine**

Rainbow trout (Oncorhynchus mykiss)	-	(nominal, static). 96 h LC50 = 150 mg/l
Mosquito fish	-	(nominal, static). 96 h LC50 = 337.5 mg/l
Bluegill	-	(nominal, static). 96 h LC50 = 329.16 mg/l
Fathead minnow (Pimephales promelas),	-	(measured, flow-through) 96 h LC50 = 2,070 mg/l
Goldfish	-	(measured, static) 96 h LC50 = 170 mg/l
Daphnia magna (Water flea)	-	(nominal, static). 24 h LC50= 140 mg/l
Crangon crangon (shrimp)	-	(nominal, renewal). 48 h LC50> 100 mg/l
Brine shrimp	-	48 h LC50= 7,100 mg/l
Daphnia magna (Water flea)	-	48 h EC50= 65 mg/l

13. DISPOSAL CONSIDERATIONS

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THE MATERIAL. THE USER OF THE MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

Waste Disposal Summary : If this product becomes a waste, it will be a nonhazardous waste according to U.S. RCRA regulations. Dispose of in accordance with all Local, State, Federal, and Provincial Environmental Regulations.

Potential US EPA Waste Codes : Not applicable

14. TRANSPORT INFORMATION

Land (US DOT): NOT REGULATED AS A DOT HAZARDOUS MATERIAL
Water (IMDG): NOT REGULATED AS A HAZARDOUS MATERIAL,

Flash Point: Not applicable
Air (IATA): NOT REGULATED AS A HAZARDOUS MATERIAL,
Emergency Response Guide Number: Not applicable

15. REGULATORY INFORMATION

UNITED STATES:

Toxic Substances Control Act (TSCA): This product is a diluted mixture of one or more Registered Pesticides and is regulated by FIFRA (Canada-PMRA).

EPA Pesticide Registration Number: None established

FIFRA Listing of Pesticide Chemicals (40 CFR 180): Not registered in the US under FIFRA.

Superfund Amendments and Reauthorization Act (SARA) Title III:

Hazard Categories Sections 311 / 312 (40 CFR 370.2):

Health Immediate (Acute) Health Hazard
Physical None

Emergency Planning & Community Right to Know (40 CFR 355, App. A):

Extremely Hazardous Substance Section 302 - Threshold Planning Quantity:
ZUS_SAR302 TPQ (threshold planning None established

quantity)

Reportable Quantity (49 CFR 172.101, Appendix):

ZUS_CERCLA	Reportable quantity	None established
ZUS_SAR302	Reportable quantity	None established

Supplier Notification Requirements (40 CFR 372.45), 313 Reportable Components

ZUS_SAR313	De minimis concentration	None established

Clean Air Act Toxic ARP Section 112r:

CAA 112R None established

Clean Air Act Socmi:

HON SOC

US. EPA Hazardous Organic NESHAP (HON) Synthetic Organic Chemicals (40 CFR 63.100-.106, Table 1)
07 1999
Group I
ETHANOLAMINE

Clean Air Act VOC Section 111:

CAA 111

US. EPA Clean Air Act (CAA) Section 111 SOCMI Intermediate or Final Volatile Organic Compounds (40 CFR 60.489)
01 1996
ETHANOLAMINE

Clean Air Act Haz. Air Pollutants Section 112:

ZUS_CAAHAP None established

ZUS_CAAHRP None established

CAA AP None established

State Right-to-Know Regulations Status of Ingredients

Pennsylvania:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine
34590-94-8	Propanol, (2,methoxy-methylethoxy-)

ZUSPA_RTK

Pennsylvania: Hazardous substance list

1989-08-11
ETHANOL, 2-AMINO-

Pennsylvania: Hazardous substance list
1989-08-11
PROPANOL, (2-METHOXYMETHYLETHOXY)-

New Jersey:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine
34590-94-8	Propanol, (2,methoxy-methylethoxy-)

ZUSNJ_RTK

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
ETHANOLAMINE MONOETHANOLAMINE ETHANOL, 2-AMINO-
Special Health Hazard - Corrosive

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
DIPROPYLENE GLYCOL METHYL ETHER PROPANOL, 1(or 2)-(2-METHOXYMETHYLETHOXY)- (2-METHOXYMETHYLETHOXY) PROPANOL

Massachusetts:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine
34590-94-8	Propanol, (2,methoxy-methylethoxy-)

ZUSMA_RTK

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1993-04-24
ETHANOLAMINE 2-AMINOETHANOL

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1993-04-24
DIPROPYLENE GLYCOL METHYL ETHER

California Proposition 65:

CAS #	COMPONENT NAME

ZUSCA_P65	None established

WHMIS Hazard Classification:

None established

16. OTHER INFORMATION

MSDS REVISION STATUS :
Major References : Available upon request.

THIS MATERIAL SAFETY DATA SHEET (MSDS) HAS BEEN PREPARED IN COMPLIANCE WITH THE FEDERAL OSHA HAZARD COMMUNICATION STANDARD, 29 CFR 1910.1200. THE INFORMATION IN THIS MSDS SHOULD BE PROVIDED TO ALL WHO WILL USE, HANDLE, STORE, TRANSPORT, OR OTHERWISE BE EXPOSED TO THIS PRODUCT. THIS INFORMATION HAS BEEN PREPARED FOR THE GUIDANCE OF PLANT ENGINEERING, OPERATIONS AND MANAGEMENT AND FOR PERSONS WORKING WITH OR HANDLING THIS PRODUCT. ARCH CHEMICALS BELIEVES THIS INFORMATION TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION BUT, MAKES NO WARRANTY THAT IT IS. ADDITIONALLY, IF THIS MSDS IS MORE THAN THREE YEARS OLD, YOU SHOULD CONTACT ARCH CHEMICALS MSDS CONTROL AT THE PHONE NUMBER ON THE FRONT PAGE TO MAKE CERTAIN THAT THIS DOCUMENT IS CURRENT. .

FOR ANY EMERGENCY, 24 HOURS / 7 DAYS, CALL:	1-800-654-6911 (OUTSIDE USA: 1-423-780-2970)
FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC®:	1-800-424-9300 (OUTSIDE USA: 1-703-527-3887)
FOR ALL MSDS QUESTIONS & REQUESTS, CALL:	1-800-511-MSDS (OUTSIDE USA: 1-423-780-2347)

PRODUCT NAME: **Wolman® NB**
EPA Registration Number: 75506-5 Canadian Registration: 27132

1. PRODUCT AND COMPANY IDENTIFICATION

Arch Treatment Technologies, Inc.
5660 New Northside Drive, NW
Suite 1100
Atlanta, GA 30328

REVISION DATE:	03/04/2010
SUPERCEDES:	10/07/2009
MSDS Number:	000000002087
SYNONYMS:	Copper Azole
CHEMICAL FAMILY:	Mixture
DESCRIPTION / USE:	General-use pesticide for wood preservative.
FORMULA:	None established

2. HAZARDS IDENTIFICATION

OSHA Hazard Classification:	**Corrosive to eyes, skin and mucous membranes, Liver and kidney toxin**

Routes of Entry:	Inhalation, skin, eyes, ingestion
Chemical Interactions:	No known or reported interactions.
Medical Conditions Aggravated:	Pre-existing liver diseases, Pre-existing kidney disease

Human Threshold Response Data

Odor Threshold
Ethanolamine 2.6 ppm

Irritation Threshold
Ethanolamine > 5.0 ppm

Hazardous Materials Identification System / National Fire Protection Association Classifications

Hazard Ratings :	Health	Flammability	Physical / Instability	PPI / Special hazard.
HMIS	3*	1	0	
NFPA	Not established			

Immediate (Acute) Health Effects

Inhalation Toxicity:	High concentrations are moderately irritating to the eyes, nose, throat, and lungs.
Skin Toxicity:	May be absorbed through skin, but it is unlikely that harmful effects will occur unless contact is prolonged, repeated, and extensive. Short term exposures to skin (3 minutes to 1 hour) can produce mild to moderate irritation. Prolonged exposures (>1 hour to 4 hours) can produce severe irritation characterized by blister and scar formation.
Eye Toxicity:	Severe irritation and/or burns can occur following exposure. Direct contact may cause impairment of vision and corneal damage. Rinsing of the eye should take place immediately.
Ingestion Toxicity:	Moderately toxic if swallowed. Ingestion may cause severe irritation of the gastrointestinal tract and may also cause gastrointestinal discomfort with any or all of the following symptoms: nausea, vomiting or diarrhea. Exposure to large quantities of this material may result in liver and kidney damage, based on animal studies.
Acute Target Organ Toxicity:	Eyes, Skin, Liver, Kidneys

Prolonged (Chronic) Health Effects

Carcinogenicity:	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. This product contains a component that has been classified by the U.S. EPA as a "Group C" Carcinogen.
Reproductive and Developmental Toxicity:	No reproductive or developmental risk to humans is expected from exposure to this product.
Inhalation:	Prolonged or repeated exposure will cause more severe irritation and possibly lung damage. Prolonged or repeated inhalation may cause kidney and liver damage.
Skin Contact:	Prolonged or repeated exposure will cause more severe irritation and possibly permanent skin damage.
Skin Absorption:	May be absorbed through skin, but it is unlikely that harmful effects will occur unless contact is prolonged, repeated, and extensive.
Ingestion:	Chronic ingestion of this product may cause severe irritation and possible corrosive effects. The acute corrosivity of this product, makes chronic ingestion of significant amounts unlikely.
Eye Contact:	Prolonged contact may result in permanent damage. Corneal involvement or visual impairment is expected.
Sensitization:	This material tested negative for skin sensitization in animals.
Chronic Target Organ Toxicity:	Eyes, Skin, Liver, Kidneys
Supplemental Health Hazard Information :	Short term exposures to skin (3 minutes to 1 hour) can produce mild to moderate irritation. Prolonged exposures (>1 hour to 4 hours) can produce severe irritation characterized by blister and scar formation.

3. COMPOSITION / INFORMATION ON INGREDIENTS

CAS OR CHEMICAL NAME	CAS #	% RANGE
COPPER COMPOUNDS	MIXTURE	
Ethanolamine	141-43-5	
Water	7732-18-5	
TEBUCONAZOLE	107534-96-3	
Amines, coco alkyl, ethoxylated or Tallow alkyl amines, ethoxylated*	61791-14-8 or 61791-26-2	

*Tallow alkyl amines, ethoxylated used in US formulation only.

4. FIRST AID MEASURES

General Advice: Call a poison control center or doctor for treatment advice. For 24-hour emergency medical assistance, call Arch Chemical Emergency Action Network at 1-800-654-6911. Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

Inhalation: IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

Skin Contact: IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Eye Contact: IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Ingestion: IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flammability Summary (OSHA):	Combustible.
Flammable Properties	
Flash Point:	> 200 DEG°F
Autoignition Temperature:	Not applicable
Fire / Explosion Hazards:	Material may be ignited if preheated to temperatures above the flash point in the presence of a source of ignition. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Empty containers that retain product residue (liquid, solid/sludge, or vapor) can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose container to heat, flame, sparks, static electricity, or other sources of ignition. Any of these actions can potentially cause an explosion that may lead to injury or death.
Extinguishing Media:	Not Applicable. - Choose extinguishing media suitable for surrounding materials.
Fire Fighting Instructions:	Response to this material requires the use of a full encapsulated suit and self-contained breathing apparatus (SCBA). Use water to cool containers.
Hazardous Combustion Products:	Carbon monoxide, Carbon dioxide, Copper metal and copper oxides
Upper Flammable / Explosive Limit, % in air:	Not applicable
Lower Flammable / Explosive Limit, % in air:	Not applicable

6. ACCIDENTAL RELEASE MEASURES

Personal Protection for Emergency Situations:	Response to this material requires the use of personal protective equipment to prevent contact with this material. Those items include but are not limited to boots, impervious gloves, hard hat, chemical splash-proof goggles, impervious clothing and appropriate approved respiratory protection.
Spill Mitigation Procedures	
Air Release:	Hazardous concentrations in air may be found in local spill area and immediately downwind. Vapors may be suppressed by the use of water fog. Contain all liquid for treatment and/or disposal as a (potential) hazardous waste.
Water Release:	This material is soluble in water. Notify all downstream users of possible contamination. Divert water flow around spill if possible and safe to do so. Contain all liquid for treatment and/or disposal as a (potential) hazardous waste.
Land Release:	Create a dike or trench to contain materials. Absorb spill with inert material (e.g., dry sand, clay, earth or commercial absorbent), then place in a chemical waste container. Do not place spill materials back in their original containers. Contain all liquid for treatment and/or disposal as a (potential) hazardous waste.

Additional Spill Information :	Remove all sources of ignition. Stop source of spill as soon as possible and notify appropriate personnel. Utilize emergency response personal protection equipment prior to the start of any response. Evacuate all non-essential personnel. Dispose of spill residues per guidelines under Section 13, Disposal Consideration.

7. HANDLING AND STORAGE

Handling:	Avoid breathing dust, mist, vapor or gas. Avoid contact with eyes, skin, and clothing. Do not take internally. Keep containers tightly closed when not in use. Upon contact with skin or eyes, wash off with water. Use only with adequate ventilation.
Storage:	Store in a cool dry ventilated location, away from oxidizers, heat, flame, or other incompatible conditions. Keep container(s) closed. Product becomes very viscous. Store between 40°F and 120°F. Protect from freezing during storage.
Shelf Life Limitations:	One year
Incompatible Materials for Storage:	Strong oxidizing agents
Empty Container Warning:	Empty containers retain product residue (liquid and/or vapor) and can be dangerous.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation:	Local exhaust ventilation or other engineering controls are normally required when handling or using this product.

Protective Equipment for Routine Use of Product

Respiratory Protection :	Wear a NIOSH approved respirator if levels above the exposure limits are possible.
Respirator Type :	A NIOSH approved air purifying respirator equipped with combination organic vapor and P100 prefilter. Air purifying respirators should not be used in oxygen deficient or IDLH atmospheres or if exposure concentrations exceed ten (10) times the published limit.
Skin Protection :	Wear impervious gloves, boots and apron to avoid skin contact. A full impervious suit is recommended if exposure is possible to a large portion of the body. A safety shower should be provided in the immediate work area.
Eye Protection:	Use chemical goggles and a faceshield. Emergency eyewash should be provided in the immediate work area.
Protective Clothing Type:	Neoprene, Butyl rubber, Nitrile

Exposure Limit Data

CHEMICAL NAME	CAS #	Name of Limit	Exposure
COPPER COMPOUNDS		NIOSH-IDLH	100 mg/m3

Ethanolamine	141-43-5	ZUS_ACGIH	3 ppm TWA
Ethanolamine	141-43-5	ZUS_ACGIH	6 ppm STEL
Ethanolamine	141-43-5	ZUS_OSHAP1	3 ppm TWA 6 mg/m3 TWA
Ethanolamine	141-43-5	NIOSH-IDLH	30 ppm

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	liquid
Form	Mixture
Color:	Blue
Odor:	mild, Ammonia-like
Molecular Weight:	None established
Specific Gravity :	No data
pH :	9.3 - 11.0
Boiling Point:	107 DEG°C / 224 DEG°F
Freezing Point:	-30 DEG°C / -22 DEG°F
Melting Point:	
Density:	1.1800 - 1.2200g/cc
Vapor Pressure:	No data.
Vapor Density:	No data
Viscosity:	No data
Fat Solubility:	No data
Solubility in Water:	soluble
Partition coefficient n-octanol/water:	No data.
Evaporation Rate:	No data
Oxidizing:	None established
Volatiles, % by vol.:	% No data
VOC Content	6.68 wt%/wt / 0.68 lb/gal
HAP Content	0.00 wt%/wt / 0.00 lb/gal

10. STABILITY AND REACTIVITY

Stability and Reactivity Summary:	Stable under normal conditions. Not sensitive to mechanical shock. Not sensitive to static discharge.
Conditions to Avoid:	Sparks, open flame, other ignition sources, and elevated temperatures.
Chemical Incompatibility:	Strong oxidizing agents, strong acids, sodium hypobromite, nitromethane, aluminum, zinc, acetylene
Hazardous Decomposition Products:	Carbon monoxide, Carbon dioxide, Oxides of nitrogen, Ammonia
Decomposition Temperature:	No data

11. TOXICOLOGICAL INFORMATION

Component Animal Toxicology

Oral LD50 value:

Ethanolamine	LD50	= 1,700 mg/kg	rat	
TEBUCONAZOLE	LD50	= 1,700 mg/kg	Rat	Male
TEBUCONAZOLE	LD50	= 4,000 mg/kg	Rat	Female

Dermal LD50 value:

Ethanolamine	LD50	Approximately 1,000 mg/kg	rabbit
TEBUCONAZOLE	LD50	> 5,000 mg/kg	Rat

Inhalation LC50 value:

Ethanolamine	LC50	1 h	> 4.8 MG/L	mouse
Ethanolamine	LC50	4 h	> 970 ppm	mouse
TEBUCONAZOLE	Inhalation LC50	4 h	> 5 MG/L	Rat

Product Animal Toxicity

Oral LD50 value: LD50 = 880 mg/kg Rat

Dermal LD50 value: LD50 > 2,000 mg/kg Rabbit

Inhalation LC50 value: No data

Skin Irritation: Dermal exposure can cause severe irritation characterized by redness and swelling. Prolonged skin exposure may cause scab formation and/or permanent damage.

Eye Irritation: This material is expected to cause irreversible effects to the cornea with impairment of vision or corrosion to the eyes.

Skin Sensitization: Negative skin sensitizer, guinea pig - Buehler Method

Ethanolamine	This material tested negative for skin sensitization in animals.
TEBUCONAZOLE	This material tested negative for skin sensitization in animals.

Acute Toxicity: This product is corrosive to all tissues contacted and upon inhalation, may cause irritation to mucous membranes and respiratory tract.

Subchronic / Chronic Toxicity: Animal studies suggest that chronic (repeated) overexposure may result in damage to the liver and kidney.

Reproductive and Developmental Toxicity: Not known or reported to cause reproductive or developmental toxicity.

Ethanolamine	This chemical has been tested in laboratory animals and no evidence of teratogenicity, embryotoxicity or fetotoxicity was seen.

Mutagenicity: Not known or reported to be mutagenic.

Ethanolamine	This chemical has been tested in a battery of

mutagenicity/genotoxicity assays and the results were negative.

Carcinogenicity: This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. This product contains a component that has been classified by the U.S. EPA as a "Group C" Carcinogen.

Ethanolamine	This product is not known or reported to be carcinogenic by any reference source including IARC, OSHA, NTP or EPA. Chemicals of similar structure have been shown not to cause cancer in laboratory animals.
TEBUCONAZOLE	This material has been classified by the U.S. EPA as a "Group C" Carcinogen (Suggestive Human Carcinogen), based on the observation of tumors in mouse livers. The relevance of tumors in the mouse liver has been questioned when assessing the risk to humans.

12. ECOLOGICAL INFORMATION

Overview: Toxic to fish and other aquatic organisms., Toxic to wildlife and domestic animals., Do not discharge effluent containing this product into lakes, ponds, streams, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

Ecological Toxicity Values for: **COPPER COMPOUNDS**

Lepomis macrochirus (Bluegill sunfish)	-	(measured, renewal) 96 h LC50 > 0.660 mg/l (as copper sulfate)
Oncorhynchus mykiss (rainbow trout)	-	(measured, flow-through) 96 h LC50 > 0.0659 mg/l (as copper sulfate)
Daphnia pulex (Water flea)	-	(measured, static) 48 h EC50> 0.025 mg/l (as copper sulfate)
Daphnia magna (Water flea)	-	(measured, static) 48 h EC50= 0.0113 mg/l (as copper sulfate)
Pseudokirchneriella subcapitata (green algae)	-	(nominal, static). 96 h EC50 = 0.0211 mg/l (as copper sulfate)

Ecological Toxicity Values for: **Ethanolamine**

Rainbow trout (Oncorhynchus mykiss)	-	(nominal, static). 96 h LC50 = 150 mg/l
Mosquito fish	-	(nominal, static). 96 h LC50 = 337.5 mg/l
Bluegill	-	(nominal, static). 96 h LC50 = 329.16 mg/l
Fathead minnow (Pimephales promelas),	-	(measured, flow-through) 96 h LC50 = 2,070 mg/l
Goldfish	-	(measured, static) 96 h LC50 = 170 mg/l
Daphnia magna (Water flea)	-	(nominal, static). 24 h LC50= 140 mg/l
Crangon crangon (shrimp)	-	(nominal, renewal). 48 h LC50> 100 mg/l

Brine shrimp	-	48 h LC50= 7,100 mg/l
Daphnia magna (Water flea)	-	48 h EC50= 65 mg/l

Ecological Toxicity Values for: **TEBUCONAZOLE**

Daphnia pulex	-	Immobilization 24 h LC50> 0.001 mg/l
Water flea (Daphnia magna),	-	Immobilization 24 h LC50> 0.001 mg/l

13. DISPOSAL CONSIDERATIONS

CARE MUST BE TAKEN TO PREVENT ENVIRONMENTAL CONTAMINATION FROM THE USE OF THE MATERIAL. THE USER OF THE MATERIAL HAS THE RESPONSIBILITY TO DISPOSE OF UNUSED MATERIAL, RESIDUES AND CONTAINERS IN COMPLIANCE WITH ALL RELEVANT LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS REGARDING TREATMENT, STORAGE AND DISPOSAL FOR HAZARDOUS AND NONHAZARDOUS WASTES.

Waste Disposal Summary :	If this product becomes a waste, it DOES NOT meet the criteria of a hazardous waste as defined under 40 CFR 261, in that it does not exhibit the characteristics of hazardous waste of Subpart C, nor is it listed as a hazardous waste under Subpart D.
Disposal Methods :	As a nonhazardous liquid waste, it should be disposed of in accordance with local, state and federal regulations by treatment in a wastewater treatment system.
Potential US EPA Waste Codes :	Not applicable

14. TRANSPORT INFORMATION

Land (US DOT):	UN2491 ETHANOLAMINE SOLUTION	8	III	
Water (IMDG):	UN2491 ETHANOLAMINE SOLUTION,	8	III	MARINE POLLUTANT

Air (IATA): UN2491 ETHANOLAMINE SOLUTION, 8 III
Emergency Response Guide Number: ERG # 153

Transportation Notes**:**	Material is not regulated as a marine pollutant for ground transportation within the US if shipped in non-bulk packages.
EMS:	F-A, S-B

15. REGULATORY INFORMATION

UNITED STATES:

Toxic Substances Control Act (TSCA):	This is an EPA registered pesticide.
EPA Pesticide Registration Number:	75506-5 Canadian Registration: 27132
FIFRA Listing of Pesticide Chemicals (40 CFR 180):	This product is regulated under the Federal Insecticide, Fungicide and Rodenticide Act. It must be used for purposes consistent with its labeling.

Superfund Amendments and Reauthorization Act (SARA) Title III:

Hazard Categories Sections 311 / 312 (40 CFR 370.2):

Health	Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard
Physical	None

Emergency Planning & Community Right to Know (40 CFR 355, App. A):

Extremely Hazardous Substance Section 302 - Threshold Planning Quantity:

ZUS_SAR302	TPQ (threshold planning quantity)	None established

Reportable Quantity (49 CFR 172.101, Appendix):

ZUS_CERCLA	Reportable quantity	None established
ZUS_SAR302	Reportable quantity	None established

Supplier Notification Requirements (40 CFR 372.45), 313 Reportable Components

ZUS_SAR313	De minimis concentration	None established

Clean Air Act Toxic ARP Section 112r:

CAA 112R	None established

Clean Air Act Socmi:

HON SOC

US. EPA Hazardous Organic NESHAP (HON) Synthetic Organic Chemicals (40 CFR 63.100-.106, Table 1)
07 1999
Group I
ETHANOLAMINE

Clean Air Act VOC Section 111:

CAA 111

US. EPA Clean Air Act (CAA) Section 111 SOCMI Intermediate or Final Volatile Organic Compounds (40 CFR 60.489)
01 1996
ETHANOLAMINE

Clean Air Act Haz. Air Pollutants Section 112:

ZUS_CAAHAP	None established
ZUS_CAAHRP	None established
CAA AP	None established

State Right-to-Know Regulations Status of Ingredients

Pennsylvania:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine

ZUSPA_RTK

Pennsylvania: Hazardous substance list
1989-08-11
ETHANOL, 2-AMINO-

New Jersey:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine

ZUSNJ_RTK

New Jersey Right to Know Hazardous Substance List (RTK-HSL)
2007-03-01
ETHANOLAMINE MONOETHANOLAMINE ETHANOL, 2-AMINO-
Special Health Hazard - Corrosive

Massachusetts:

CAS #	COMPONENT NAME
141-43-5	Ethanolamine

ZUSMA_RTK

Massachusetts Right to Know List of Chemicals and Hazard Classifications
1993-04-24
ETHANOLAMINE 2-AMINOETHANOL

California Proposition 65:

CAS #	COMPONENT NAME

ZUSCA_P65 None established

WHMIS Hazard Classification:

Ingredient Disclosure List (WHMIS)
2007-08-24
Threshold limits: 1 Weight percent
1170
Monoethanolamine

16. OTHER INFORMATION

MSDS REVISION STATUS : Revised to meet the ANSI standard of 16 sections
SECTIONS REVISED: 7
Major References : Available upon request.

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MATERIAL SAFETY DATA SHEET
Wolmanized® Residential Outdoor® Wood
September 17, 2010

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: Wolmanized® Residential Outdoor® Wood
General Use: Treated Wood Products
Synonyms: Copper Azole (CA-B) Treated Wood, Copper Azole Treated Wood with Water Repellant, Copper Azole Treated Wood with Mold Inhibitor, Copper Azole Treated Formaldehyde Bonded Wood Products.

MANUFACTURER: **TELEPHONE NUMBERS**:

2. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS	PERCENT[1]	CAS #	EXPOSURE LIMITS (mg/m^3)		
			OSHA-PEL	ACGIH-TLV	ACGIH-STEL
Basic Copper Carbonate or Copper Oxide (Both as Cu) (Dust/Mist)	<3	7440-50-8	1.0	1.0	None
Tebuconazole	<1	107534-96-3	None	None	None
Ethanolamine	<1	141-43-5	6.0	7.5	15
Wood Dust[2] Western Red Cedar All other Species	>95	N/A	 15(total) 5.0 (respirable) 15(total) 5.0 (respirable)	 0.5 (inhalable) 1.0 (inhalable)	 None
Formaldehyde[3]	<0.1	50-00-0	0.75ppm	0.37 (Ceiling)	2ppm
Ammonia[4]	<1	7664-41-7	50ppm	25ppm	35ppm

Notes: [1] Actual retention may vary due to differences in wood stock and treatment retention levels.
[2] A state-run OSHA program may have more stringent limits for wood dust and/or PNOR.
[3] Only applies to Plywood Products
[4] Only applies to wood sold in the West Coast and Canadian regions. Ammonia added at 1% to treating solution at local treating facility.

3. HAZARDS IDENTIFICATION

WARNING! MAY FORM COMBUSTIBLE DUST CONCENTRATIONS IN AIR (DURING PROCESSING)

Inhalation: Airborne treated or untreated wood dust may cause nose, throat or lung irritation. Various species of untreated wood dust can elicit allergic respiratory response in sensitized persons.
Eye Contact: Treated or untreated wood dust may cause mechanical irritation.
Skin Contact: Handling wood may result in skin exposure to splinters. Prolonged and/or repeated contact with treated or untreated wood dust may result in mild irritation. Various species of untreated wood dust can elicit allergic type skin irritation in sensitized persons.
Ingestion: Not anticipated to occur.
Chronic Wood Dust (treated or untreated) Effects: Wood dust, depending on species, may cause dermatitis on prolonged, repetitive contact; may cause sensitization and/or irritation.

4. FIRST AID MEASURES

Inhalation: Remove from wood dust exposure. If breathing has stopped administer artificial respiration. Seek medical aid if symptoms persist.
Eye Contact: Gently flush any particles from the eyes with large amounts of water for at least 15 minutes. DO NOT RUB THE EYES. Seek medical aid if irritation persists.
Skin Contact: Rinse wood dust off with water. DO NOT RUB. Once the skin is free of the wood dust, wash thoroughly with soap and water. Seek medical aid if severe irritation develops.
Ingestion: Rinse the victim's mouth out with water. Do not induce vomiting. If symptoms develop, call a physician.

5. FIRE FIGHTING MEASURES

Flash Point	NA	**Lower Explosive Limit**	NA
Auto-ignition	NA	**Upper Explosive Limit**	NA

Extinguishing Agents: Not applicable

Fire-Fighting Procedures: Fire from a separate fuel source may be intense enough to cause thermal decomposition releasing toxic fumes and/or gases. Wear complete fire service protective equipment, including full-face NIOSH and NFPA – approved self-containing breathing apparatus.
Fire and Explosion Hazard: Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. High airborne levels of wood dust may burn rapidly in the air when exposed to an ignition source.

6. ACCIDENTAL RELEASE MEASURES

Spill or Leak Procedures: Not applicable.
Waste Disposal: See Section 13.
Other: Dust Deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Nonsparking tools should be used.

7. HANDLING AND STORAGE

Storage Conditions: Protect from physical damage. Maintain good housekeeping. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres.
Caution: DO NOT BURN TREATED WOOD. Do not use pressure treated chips or sawdust as mulch. Whenever possible, sawing or machining treated or untreated wood should be performed outdoors to avoid accumulations of airborne wood dust. Wash hands thoroughly before eating, drinking, using tobacco products, and/or using restrooms.
NOTE: For plywood products only, provide adequate ventilation to reduce the possible buildup of formaldehyde vapors.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection: None normally required. When sawing or cutting treated or untreated wood, wear a NIOSH approved N95 or better dust mask.
Eye Protection: Wear safety glasses with side shields or safety goggles when sawing or cutting.
Skin/Foot Protection: Leather or comparable gloves to prevent splinters. Long sleeve shirt, pants and steel toed shoes when handling treated or untreated wood.
Ventilation: Saw, cut or machine wood outdoors or in well ventilated areas. Due to the explosive potential of dust when suspended in air, precautions should be taken when sawing, sanding, or machining wood or wood products to prevent sparks or other ignition sources. If required, use wet methods and/or explosion suppression systems to reduce generation of dust. Local exhaust ventilation is recommended when sawing, sanding, or machining this product. General dilution ventilation is recommended in processing and storage areas. Ventilation should be sufficient to maintain inhalation exposures below OSHA PEL for particulates.
Other Protective Equipment: Wear ear plugs or muffs when using power tools.
NOTE: For plywood products only, if Formaldehyde vapor level exceeds OSHA PEL or STEL, then a NIOSH approved respirator is required.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Light Brown to Green	**Specific Gravity (Water =1)**	NA
Odor	None	**Boiling Point**	NA
Solubility in Water	NA	**Vapor Density (Air=1)**	NA
Physical State	Solid	**Vapor Pressure**	NA
pH	NA	**Freezing Point**	NA

10. STABILITY AND REACTIVITY

Conditions contributing to instability: None known.
Incompatibilities: Strong acids, open flame and oxidizers.
Hazardous Reactions/Decomposition/Combustion Products: Combustion products may include smoke, toxic fumes or gases.
Hazardous Polymerization: Does not occur.

11. TOXICOLOGICAL INFORMATION

Carcinogenicity Data: IARC has classified untreated hardwood and hardwood/softwood mix wood dust as a Group I human carcinogen. The wood dust classification is based primarily on IARC's evaluation of increased risk in the occurrence of adenocarcinomas of the nasal cavities and paranasal sinuses associated with occupational exposures to untreated wood dust. NTP has classified all untreated wood dust as a carcinogen.

A human health risk assessment has been conducted in accordance with U.S. Environmental Protection Agency (EPA) risk assessment guidance in order to evaluate human health risks associated with exposures to Copper Azole Type B (CA-B) treated wood. Four different scenarios, including occupational (adult builders), resident handler (adult female), subchronic (child) and chronic (child to adult) residential, and playground (child and teenager) were evaluated. Exposures evaluated in the risk assessment include incidental ingestion and dermal contact with dislodgeable residue from the surface of CA-B treated wood and soil impacted with tebuconazole (TEB) and copper, inhalation of sawdust from CA-B treated wood, and inhalation of re-suspended soil particulate. Non-cancer health risks are expressed as margin of exposure (MOE), which is a ratio of the no observed effect level (NOEL) or the lowest observed effect level (LOEL) for a constituent, to an estimated exposure level for the constituent. The greater the MOE, the less likely that exposure to the constituent will pose a potential health risk. Based on the evaluation, the lowest MOE of 170 is for incidental ingestion of copper in the soil for the child resident (ages 1-6 years). Based on EPA guidance, an MOE of 10 is the benchmark for this exposure route. Thus, no adverse health effects are expected. Most of the MOEs calculated in the risk assessment are greater than 1,000, and therefore, none of the exposures to TEB or copper evaluated pose a potential health risk. Cancer risks were not assessed because according to EPA, neither TEB nor copper is a known or probable carcinogen.

12. ECOLOGICAL INFORMATION

Copper Azole treated wood leaching studies were conducted for 30.5 days on commodity size products in dynamic test cylinders using diluent water at nominal temperatures of 5, 15, and 25 degrees C and pH of 5.5, 7.0 and 8.5. Samples collected on days 1.5, 2.5, 4.5, 7.5, 10.5, 15.5, 22.5, and 30.5 were analyzed for total copper and tebuconazole (TEB). The treated wood was then leached for an additional 307.6 to 386.8 days in an experimental pond to confirm long term preservative loss rates. A suite of bioassays were conducted on day 0.5 effluent. Copper and TEB loss rates declined exponentially with time and appeared to reach steady state losses at the end of about week 3. Predictive equations describing these loss rates, for use in developing a risk assessment model, were developed using non-linear regression analysis. Bioassay results indicated that environmental risks associated with CA-B preserved wood can be evaluated solely on copper predictions and water quality criteria for copper. The TEB did not add to the toxicity of the effluent. In fact, it appears that the increased dissolved organic carbon associated with TEB and wood extractives reduced the copper's toxicity in the effluent. These studies were conducted at dilution water flow rates much lower than could be anticipated in open aquatic environments. Dilution factors in very slow flowing streams or lakes, where current speeds might be as low as 1.0 cm/sec, are 468 times higher than the flows created in these tests.

Preliminary modeling indicates that a pier sitting on 25 CA-B treated piling in freshwater flowing at a very low current speed of 2.0cm/sec (typical of many small lakes) would increase the copper concentrations by 0.28 µg Cu/L at pH 6.5. This suggests that CA-B preserved piling can be used in most surface waters that do not closely approach or exceed EPA water quality criteria. However, the models will provide a basis for conducting site specific risk assessments where large volumes of treated wood are proposed for immersion in poorly circulating bodies of water.

13. DISPOSAL CONSIDERATIONS

Disposal Guidance: DO NOT BURN TREATED WOOD. Do not use pressure treated chips or sawdust as mulch. Dispose of in accordance with local, state and federal regulations. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This product is typically not considered a hazardous waste but State run waste programs may be more stringent. Check with your local or state regulators prior to disposal.

14. TRANSPORT INFORMATION

DOT Hazardous Material Classification: This material is not regulated as a hazardous material by the DOT.

15. REGULATORY INFORMATION

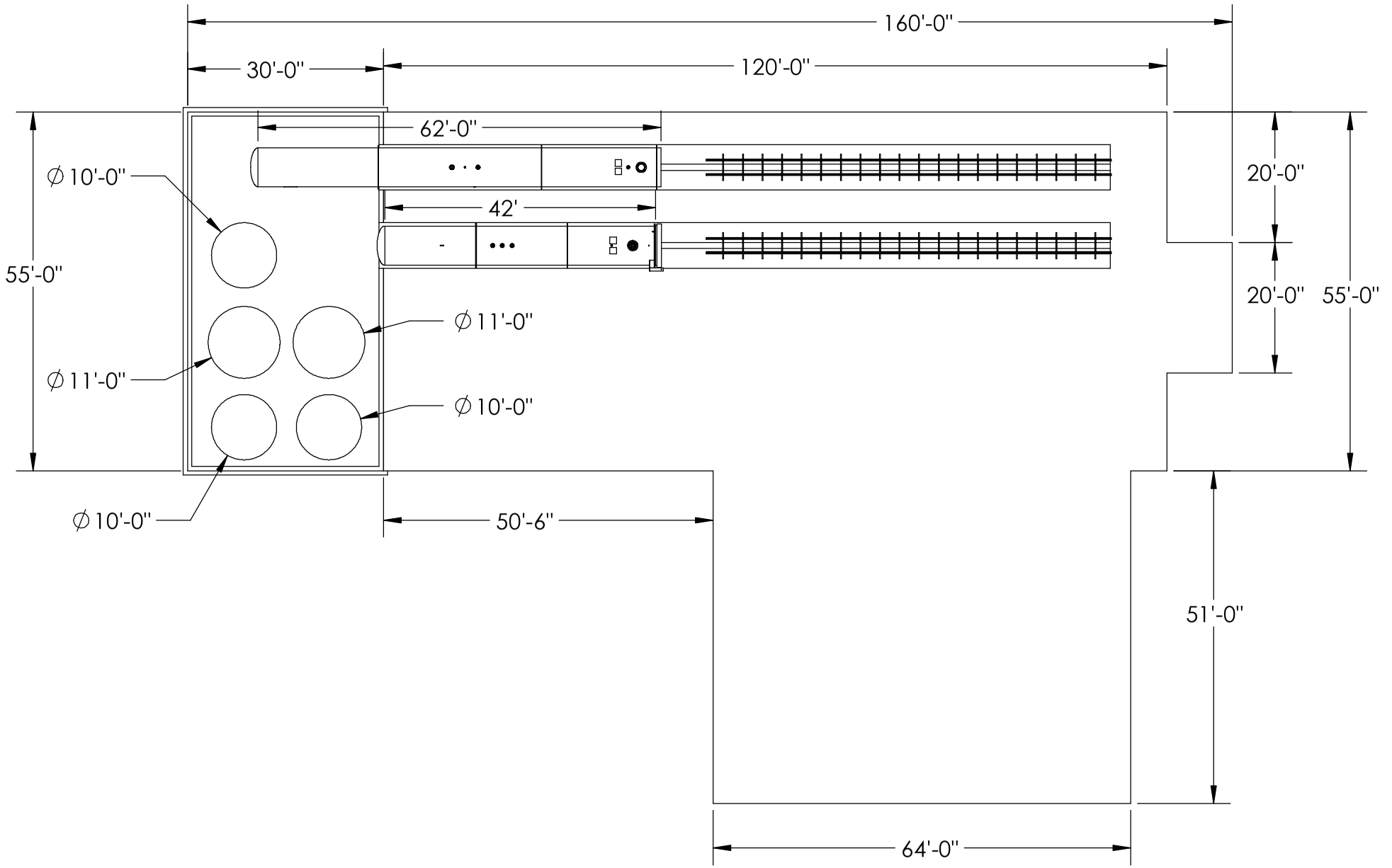
OSHA (29 CFR 1910.1200): This product is regulated under the Hazard Communication Standard.
RCRA (40 CFR 261): DO NOT BURN TREATED WOOD. Do not use pressure treated chips or sawdust as mulch. Dispose of in accordance with local, state and federal regulations. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This product is typically not considered a hazardous waste but State run waste programs may be more stringent. Check with your local or state regulators prior to disposal.
SARA 313 (40 CFR 372): Unless exempted, this product may require a Toxic Release Inventory reporting for individual material uses of 25,000 pounds or more. Reporting is under Copper Compounds. It is the user's responsibility to determine applicability of reporting requirements and exemptions.
California Proposition 65: WARNING: Wood Dust is known to the State of California to cause cancer and/or birth defects or other reproductive harm.
NFPA: Refer to NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, for safe handling.

ABBREVIATIONS

OSHA	Occupational Safety and Health Administration	**TLV**	Threshold Limit Value
NFPA	National Fire Protection Association	**STEL**	Short-Term Exposure Limit
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act	**RCRA**	Resource Conservation and Recovery Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	**ACGIH**	American Conference of Governmental Industrial Hygienists
SARA	Superfund Authorization and Reauthorization Act	**NIOSH**	National Institute of Occupational Safety and Health
PEL	Permissible Exposure Limit	**TSCA**	Toxic Substances Control Act
DOT	Department of Transportation	**IARC**	International Agency for Research on Cancer
NTP	National Toxicology Program	**IBC**	International Building Code
CFR	Code of Federal Regulations	**mg/m3**	Milligrams per cubic meter
CWA	Clean Water Act	**CAA**	Clean Air Act
CAS	Chemical Abstracts Service		

APPENDIX 3

Proposed Treating Plant Design and Existing Buildings



MARWOOD LTD 3307 ROUTE 101 TRACYVILLE, NB E5L 1N7	**DESCRIPTION** JAMESTOWN - SAWMILL / TREATING PLANT PRELIM.		**PROJECT** NFLD - TREATING PLANT		**REV.** 0
	SCALE NTS	**DATE** 18-FEB-13	**DRAWN BY** RCJ	**PROJECT NO.** PRJ0174	**DWG. NO.** 174-JAMESTOWN-001

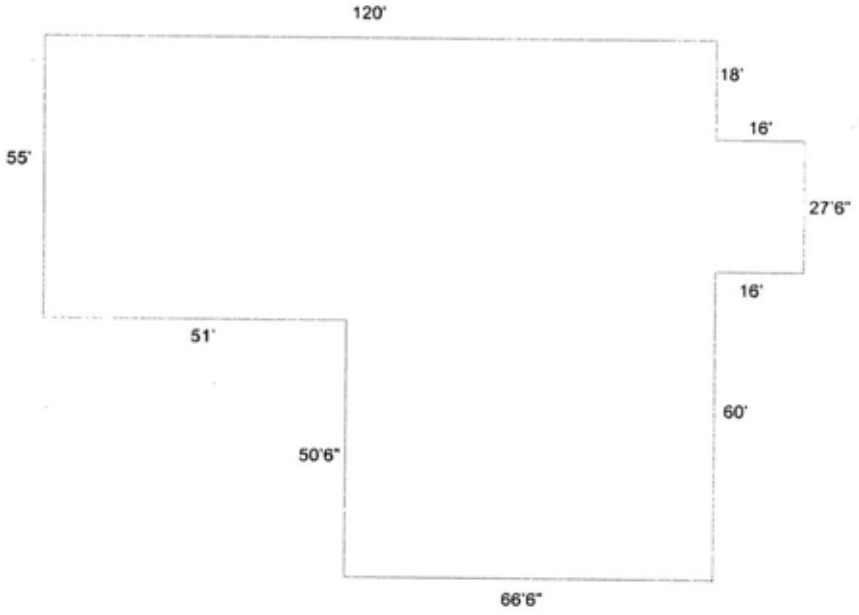
- Sawmill and Planermill

Sawmill Description:

Year Built (approximate)	1995
Number of Storeys	One (1)
Foundation	Slab on grade
Framing	Steel Frame
Exterior Walls	Vertical metal siding
Roof	Metal
Total Rentable Area (approximate)	7,470 sq. ft.
Building systems – Electrical	1,600 amp

Plan of Exterior Dimensions

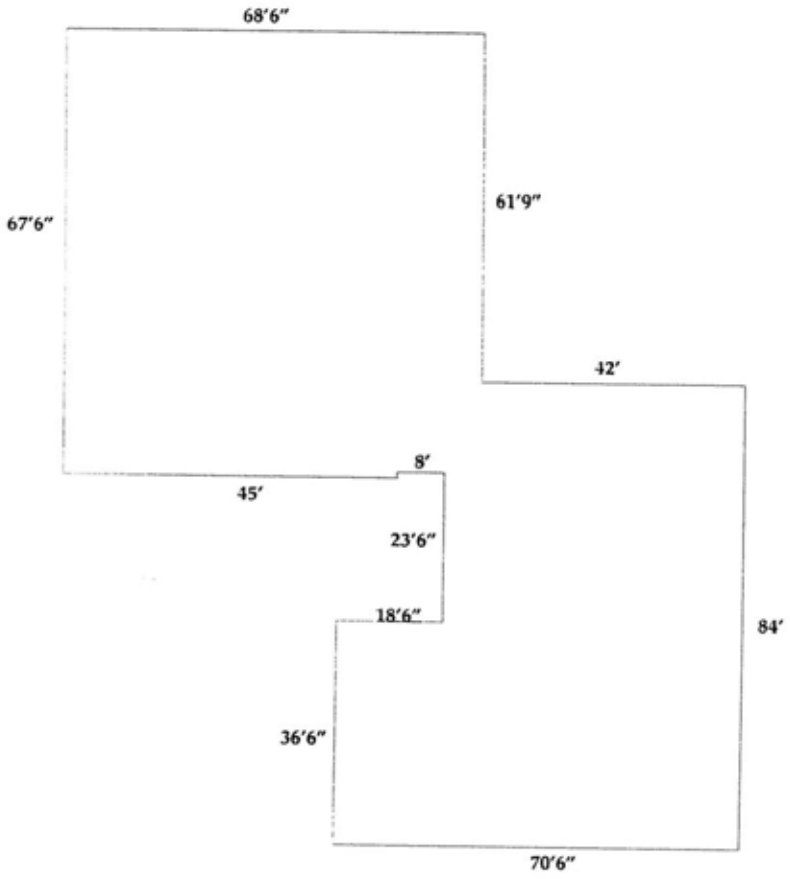
Saw Mill

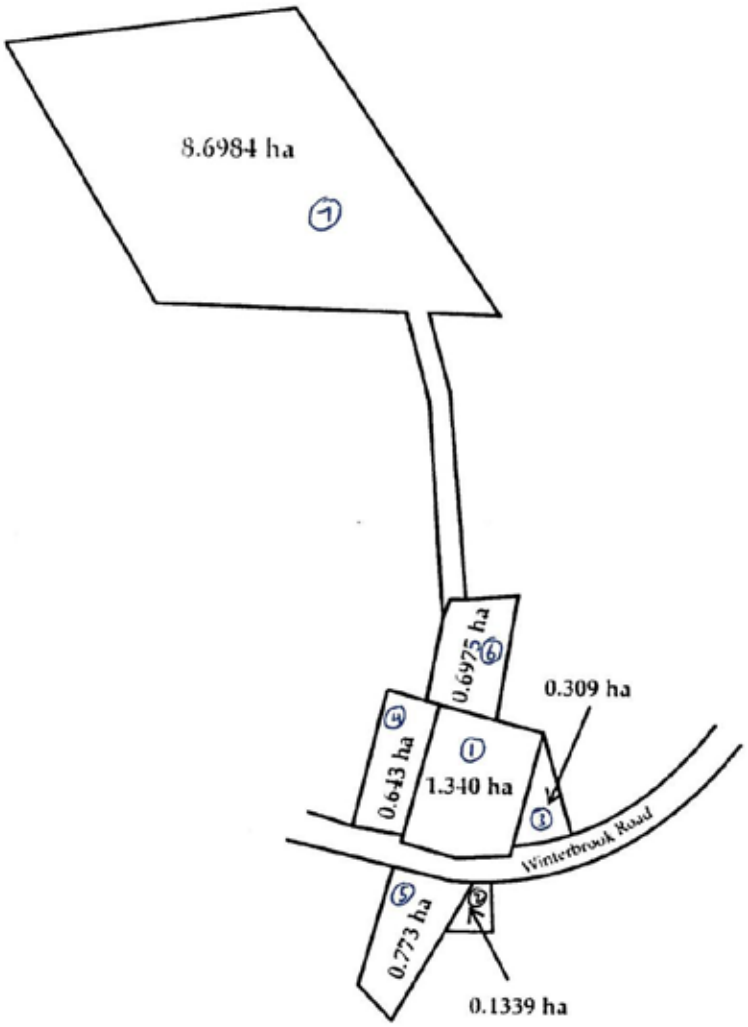


Planermill Description:

Year Built (approximate)	Original section constructed in 1974: other areas added as required
Number of Storeys	One
Foundation	Slab on grade
Framing	Wood/steel frame
Exterior Walls	Clapboard
Roof	Metal and shingles
Total Rentable Area (approximate)	9,667 sq. ft.
Building Systems:	
Electrical	600 amp

Planer Mill




8.6984 ha
7
0.6925 ha
6
0.309 ha
4
0.643 ha
1
1.340 ha
2
Winterbrook Road
5
0.773 ha
3
0.1339 ha

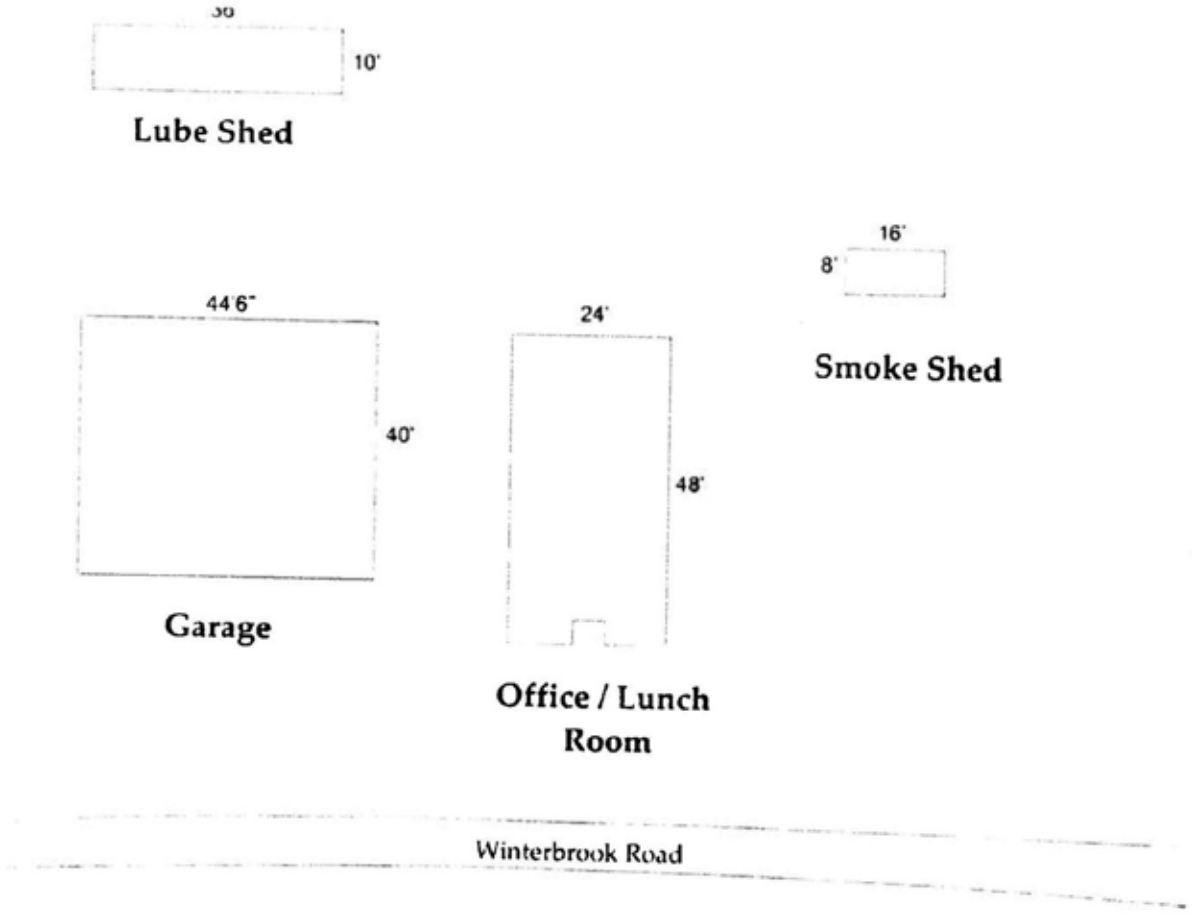
- Garage and Office Building

Garage Description:

Year Built (approximate)	1980
Number of Storeys	One
Foundation	Slab on grade
Framing	Wood frame
Exterior Walls	Clapboard
Roof	Asphalt shingles
Total Rentable Area (approximate)	1,780 sq. ft.

Office Building Description:

Year Built (approximate)	1977	
Number of Storeys	One & Two	
Foundation	Poured concrete	
Framing	Wood frame	
Exterior Walls	Clapboard	
Roof	Metal	
Total Rentable Area (approximate)	Main floor	1,134 sq. ft.
	Second Floor	432 sq. ft.
	Total	1,566 sq. ft.


30
10'
Lube Shed
16'
8'
Smoke Shed
44'6"
40'
Garage
24'
48'
Office / Lunch Room
Winterbrook Road

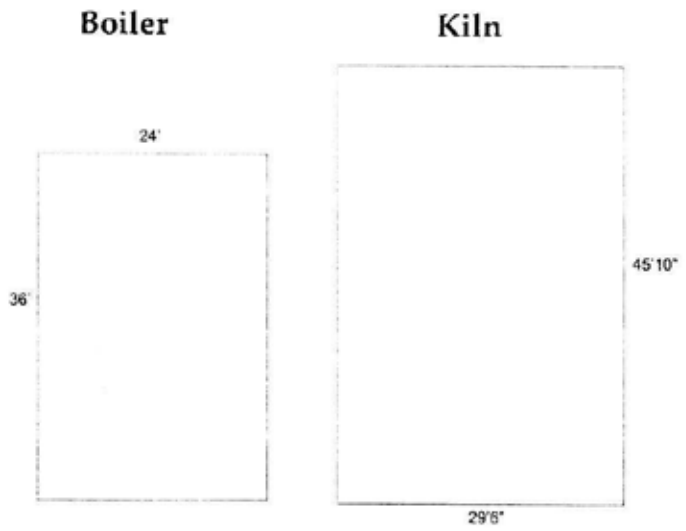
- KILN AND POWER PLANT EQUIPMENT

Year Built (approximate)	2000
Number of Storeys	One
Foundation	Slab on grade
Framing	Steel frame
Exterior Walls	Vertical metal siding & aluminum
Roof	Metal
Total Rentable Area (approximate)	2,221 sq. ft.
Building Systems	Electrical 400 amp
Size	1766 KW
Pressure	103 KPA
Serial #	5.1098738/ Pin # 309574

- KILN AND POWER PLANT EQUIPMENT – Cont'd.

1 - Energie FEI package kiln with 89,600 fbn (nominal 2") powered by Boilersmith 190 hp, 15 psi boiler housed in a 2 storey steel building with an automated control room

1 - Chip and sawdust feed system with hopper, 40' container and hydraulic conveyor and leveling batcher.


Boiler
Kiln
24'
36'
45'10"
29'6"

APPENDIX 4

Technical Recommendations Document (TRD)

Environment Canada Environnement Canada

Recommendations for the design and operation of wood preservation facilities, 2004

Technical recommendations document

Report EPS 2/WP/6

Prepared for
Environment Canada
(National Office of Pollution Prevention)
and the
Canadian Institute of Treated Wood
by
G.E. Brudermann, Frido Consulting

Canada

Recommendations for the design and operation of wood preservation facilities, 2004

Technical recommendations document

April 2004

Recommendations for the design and operation of wood preservation facilities, 2004

Technical recommendations document

Report EPS 2/WP/6

Prepared for

Environment Canada
(National Office of Pollution Prevention)

and the

Canadian Institute of Treated Wood

by

G.E. Brudermann, Frido Consulting

Ce document est également disponible en français sous le titre *Recommandations pour la conception et l'exploitation des installations de préservation du bois, 2004 : document de recommandations techniques*.

This guidance manual (also referred to as the 2004 TRD) may be cited as follows:

Environment Canada. 2004. Recommendations for the design and operation of wood preservation facilities, 2004: technical recommendations document. Prepared for the National Office of Pollution Prevention, Environment Canada, and the Canadian Institute of Treated Wood by G.E. Brudermann, Frido Consulting. Report EPS 2/WP/6. Available from Environment Canada, Ottawa. Binder and CD. 326 pages.

(It supercedes the five 1988 EPS reports [EPS 2/WP/1, EPS 2/WP/2, EPS 2/WP/3, EPS 2/WP/4, and EPS 2/WP/5] and the previous version of the binder of the same name that was published in March 1999.)

Cat. no.: En40-578/2004E
ISBN: 0-662-36697-2

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Fax: 819.994.5629
E-mail: epspubs@ec.gc.ca

This document is available on the Environment Canada Web site at the following address:
http://www.ec.gc.ca/toxics/wood-bois/pubs/trd_e.htm

Health and safety information in this publication is provided for general guidance only. It is the responsibility of the owners and operators to ensure that workers are provided with adequate health and safety information.

The printing processes used in producing this document conform to environmental performance standards established by the Government of Canada under *Canada's National Guidelines on Lithographic Printing Services*. These standards aim to ensure the environmental integrity of printing processes through reductions in toxic emissions to the environment, reductions in loading of wastewater, reductions in the quantity of materials sent to landfills, and the implementation of resource conservation procedures.

The paper used in the interior of this document conforms to Canada's *National Printing and Writing Paper Guideline* and/or *Uncoated Mechanical Printing Paper Guideline*. These guidelines set environmental performance standards for fibre-use efficiency, chemical oxygen demand, energy use, global warming potential, acidification potential, and solid waste.

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Contents of binder

Regulatory Note

Each wood preservation facility must provide the operators with the most recent labels for all registered pesticides used in the facility.

Pesticide labels are legal documents and must be complied with in accordance with the *Pest Control Products Act*. This includes adherence to use rates, directions for use, and usage of the personal protective equipment recommended on the label. Each facility is responsible for inserting a copy of the most recent label for each registered pesticide used within the facility into this manual. The pocket in the next page is provided for this purpose. Electronic copies of labels may be obtained at http://www.eddenet.pmra-arla.gc.ca/4.0/4.01.asp.

Recommendations for the design and operation of wood preservation facilities, 2004: technical recommendation document (2004 TRD), is a guidance manual that establishes best management practices (BMPs) for the design and operation of heavy duty wood preservation facilities. Its primary purpose is to establish benchmarks for design and operation that wood preservation facilities should strive to achieve. The recommendations in this guidance manual are consistent with good pollution prevention practices and environmentally sound management. Conformance with the manual should minimize the environmental and human health effects potentially associated with heavy duty wood preservation facilities.

The target audiences for this guidance manual are the owners and operators of wood preservation facilities and those who are designing new facilities or retrofitting existing ones. In many instances the manual contains general summary information on topics such as potential environmental and human health hazards and environmental effects potentially associated with exposure to these preservatives. Pesticide label compliance is essential to minimizing the risks associated with their use. This should not preclude the users of this guidance manual from obtaining other, more comprehensive information on these topics. This includes the regulatory documents published by Health Canada's Pest Management Regulatory Agency that outline the health and environmental risks of individual pesticides (http://www.hc-sc.gc.ca/pmra-arla/english/pubs/pubs-e.html).

This guidance manual has been designed to allow facilities to insert additional information, so that all information relevant to the design and operation of a facility can be found in one convenient location. For example, facilities are encouraged to keep recent copies of their pesticide labels in this binder. As information may change over time, facilities should ensure that all information is current. At a minimum, annual reviews of content by the facility manager or designated health and safety individual are recommended.

Relation to Federal, Provincial, Territorial and Aboriginal Regulations

This guidance manual provides the Best Management Practices for the wood preservation industry; it does not have regulatory authority unless a federal, provincial, territorial or aboriginal authority having jurisdiction has adopted its recommendations. Conformance with this guidance manual does not absolve a facility from its other legal obligations under the applicable laws and regulations of municipal, aboriginal, provincial, territorial or federal authorities.

Provincial regulation of heavy duty wood preservation facilities and industrial operations in general varies across Canada. Each facility should consult with all authorities that may have jurisdiction over it and its operations.

Pocket for pesticide labels

Please insert copies of the most recent labels for the registered pesticides used within your facility

Foreword

Wood exposed outdoors is subject to degradation by various organisms, including fungi, insects and marine borers. The impregnation of wood with preservative chemicals retards or prevents its destruction by these agents. By design, such preservative chemicals must be toxic to the target organisms. However, their use may also affect non-target biota and the environment, unless proper safeguards are taken. Like many other industrial chemicals, wood preservatives require proper handling to prevent hazards in the workplace and during transportation and storage, as well as to avoid emissions from the process and the treated product.

In 1984, Environment Canada, as part of a federal strategy to protect the environment and human health from potentially toxic commercial chemicals, evaluated use practices within the wood preservation industry. The department subsequently initiated a technical steering committee to develop technical recommendations for facility design and operations.

The objectives were to develop recommendations that would outline practices to:

- reduce or eliminate the release of wood preservative chemicals to the environment;
- minimize the exposure of workers to wood preservative chemicals.

The development process, which included the participation of representatives from federal and provincial government agencies, the wood preservation industry, forest industry labour unions, and workers' compensation boards, concluded with the publication of five technical recommendations documents (TRDs) in 1988 (1, 2, 3, 4, 5). The documents covered good practices for pressure treatment with each of the major wood preservatives then in use: chromated copper arsenate (CCA), ammoniacal copper arsenate (ACA), pressure treatment with pentachlorophenol (PCPP), thermal treatment with pentachlorophenol (PCPT) and creosote.

These documents have since been widely applied in Canada to the construction of new facilities and the upgrading of existing wood preservation plants. In addition, international technical guide documents for the preservation industry have made use of information contained in the Canadian TRDs from 1988 (6, 7).

The measures recommended in the 1988 TRDs were based on knowledge of the existing technology and the properties of the preservative chemicals at the time of their development. However, since the publication of the 1988 TRDs, a variety of new and modified operating technologies have been developed, environmental compliance criteria have changed, and knowledge of the properties of the chemicals has been expanded. Hence, it was deemed necessary to review the TRDs, update information where appropriate, and include any new technologies to take advantage of improved design and operational practices.

In response to the need to update the 1988 TRDs, Environment Canada and the Canadian Institute of Treated Wood (CITW) initiated development of a single revised TRD, which was published in March 1999(8). A review of the 1988 TRDs was organized by CITW and was undertaken by industry members. The industry comments were compiled by Frido Consulting. Relevant industry information, as well as additional information from the open literature or from experts and regulatory agencies, was also used to update the recommendations. The document underwent four draft stages, each entailing reviews and comments by industry, as well as federal and provincial regulatory personnel. It was finalized by a technical coordinating committee.

As indicated above, the 1988 recommendations were presented in five comprehensive documents. These have been found to be user-friendly in format and general content. However, there were many subjects and recommendations common to all, leading to duplication. To eliminate such duplication, the 1999 TRD included all preservatives and treatments in a single manual. Although the 1999 manual followed the contents and format of the 1988 TRDs as closely as possible, general background information and recommendations applicable to all preservatives were separated from information specific to individual preservatives. This structure made information about individual preservatives easier to find and facilitates additions of new preservatives and any other incidental information.

Following publication of the 1999 manual (1999 TRD) , the working group proceeded with a voluntary program to implement the recommendations at all wood preservation facilities in Canada. The goal of the program is to have all facilities conform with the intention of the TRD by 2005. To meet this goal, the TRD Implementation Program was developed with the following steps:

- Two rounds of information sessions were held across Canada to inform wood preservation facilities about the program.
- A baseline assessment, referred to as Assessment 2000, was conducted at every facility to determine conformance with the TRD.
- Each facility was required to submit an implementation plan by Dec. 31, 2001, which would describe how it intended to correct deficiencies from Assessment 2000.
- On Dec. 31 of years 2002 to 2005 inclusive, facilities are required to submit annual update reports to demonstrate continual improvement towards the 2005 goal.

- Random audits are conducted to determine whether the work conducted at facilities meets the intention of the TRD.

The program generated questions and additional knowledge regarding Best Management Practices. As a result, the 1999 TRD was revised and this updated document was published.

This updated manual, which maintains the format and content of the 1999 version, is meant to provide necessary information on the physico–chemical properties of the industrial wood preservatives. It includes new chapters on the preservatives alkaline copper quaternary (ACQ), copper azole (CA-B) and inorganic boron, which are newly registered in Canada. Ammoniacal copper arsenate (ACA) has been replaced by the new preservative "ammoniacal copper zinc arsenate" (ACZA). As well, the manual contains design and operational measures to enable safe operations in wood preservation facilities in terms of worker exposure and health risks as well as environmental impact.

The document is divided into three major parts: I - General background information and recommendations for wood preservation facilities, II - Preservative-specific information and recommendations for wood preservation facilities, and III - Appendices. Part I contains recommendations applicable to all currently used preservative chemicals. Part II includes specific recommendations for individual preservatives: these are supplementary to those made in Part I and must be used in conjunction with them. Part III contains a summary of the applicable legislation and space for additional documents.

The recommendations contained in this document may not be the only options available to attain the stated objectives. Alternative approaches may be equally effective or more suitable for site-specific conditions. When programs are developed for a particular facility, the recommendations provided may be modified if it can be demonstrated that an alternative approach, more suitable to the plant's conditions, would be equally effective in attaining the objectives. Although the recommendations do reflect currently available best practices, local regulatory authorities may want to deviate to accommodate local conditions.

The CD attached to the inside front of this binder contains a supporting document: "Technical guidelines for the design and operation of wood preservation facilities, 2004: technical guidance document." The technical guidance document contains detailed information and interpretation of general TRD requirements, which will help facilities to conform with the TRD. It also provides clarity, which will ensure consistency from facility to facility.

References

1. Konasewich, D.E., and F.A. Henning. 1988. Creosote Wood Preservation Facilities: Recommendations for Design and Operation. Report EPS 2/WP/1. Environment Canada, Ottawa.

2. Konasewich, D.E., and F.A. Henning. 1988. Pentachlorophenol Wood Preservation Facilities: Recommendations for Design and Operation. Report EPS 2/WP/2. Environment Canada, Ottawa.

3. Konasewich, D.E., and F.A. Henning. 1988. Chromated Copper Arsenate (CCA) Wood Preservation Facilities: Recommendations for Design and Operation. Report EPS 2/WP/3. Environment Canada, Ottawa.

4. Konasewich, D.E., and F.A. Henning. 1988. Ammoniacal Copper Arsenate (ACA) Wood Preservation Facilities: Recommendations for Design and Operation. Report EPS 2/WP/4. Environment Canada, Ottawa.

5. Konasewich, D.E., and F.A. Henning. 1988. Pentachlorophenol (PCP) Thermal Wood Preservation Facilities: Recommendations for Design and Operation. Report EPS 2/WP/5. Environment Canada, Ottawa.

6. Das, G., and V.N.P. Mathur. 1994. Generic Code of Good Practices for Wood Preservation Facilities. International Research Group on Wood Preservation document presented at annual conference in Indonesia.

7. United Nations Environment Programme. 1994. Environmental Aspects of Industrial Wood Preservation: A Technical Guide. UN Technical Report Series No. 20.

8. Environment Canada. 1999. Recommendations for the Design and Operation of Wood Preservation Facilities. Prepared for the National Office of Pollution Prevention, Environment Canada, and the Canadian Institute of Treated Wood by G.E. Brudermann, Frido Consulting. Available from Environment Canada, Ottawa. Binder.

Acknowledgements

The current update of this manual was jointly sponsored by Environment Canada and the Canadian Institute of Treated Wood (CITW). The guidance and assistance provided by the representatives of these organizations, C. Englot and H. Walthert, were greatly appreciated.

This manual is based and largely relies on the information contained in the preservative-specific TRDs issued in April 1988. Those documents were co-authored by Dr. D.E. Konasewich and Dr. F.A. Henning of Envirochem Services, whose excellent work is acknowledged.

Special thanks are extended to all CITW members and personnel from Environment Canada who reviewed the 1999 TRD and shared information on current industry practices, best management practices and best available technologies.

Part I

General Background Information and Recommendations

CHAPTER A

General Background Information and Recommendations

Contents

List of tables

List of figures

1 The Need for Wood Preservation

1.1 Introduction

Wood preservation is the pressure or thermal impregnation of chemicals into wood to a depth that will provide effective long-term resistance to attack by fungi, insects and marine borers. By extending the service life of timber, wood preservation reduces the harvest of already stressed forestry resources, reduces operating costs in industries such as utility and railroads, and ensures safe conditions where timbers are used as support structures. In addition, a significant part of the treated wood volume is used for residential construction to improve the value of homeowners' investments and provide outdoor living space that is an essential part of the Canadian way of living.

The chemicals predominantly used in Canada for wood preservation are:

- aqueous formulations of arsenic, copper and chromium; borate; or copper, in combination with organic pesticides;
- pentachlorophenol in petroleum oil; and
- creosote and creosote/petroleum oil mixtures.

1.2 Wood Deterioration

Timber is subject to several types of deterioration following its removal from the forest. Wood-decaying fungi and insects drastically reduce the usefulness of unprotected lumber and other forest products. Decay reduces wood to its basic components: carbon dioxide and water. This may happen quite rapidly depending on the exposure conditions. As an example, untreated red pine posts were found to be serviceable for only 4.5 years, whereas creosote-treated posts lasted between 40 and 48 years under the same conditions (1). Similarly, railway ties used in North America would have an average life of five years without treatment, whereas treated ties under normal service conditions last in excess of 30 years. Protection is also needed against wood-boring insects. For example, termites are responsible for extensive damage to wood in storage and in service in southern Ontario and on the Pacific Coast. Marine structures, such as untreated dock pilings along North American coasts, can be destroyed by marine borers in less than one year. In contrast, properly preserved wood structures in marine waters are reported to perform for 30 to 45 years (2).

The main enemies of wood and the wood destroyers of greatest commercial importance are decay fungi. The growth of these fungi is dependent upon the temperature, moisture content, oxygen level and nature of the wood. Wood products, such as construction lumber, railway ties, bridge timbers, fence posts and utility poles, are usually in direct contact with moist soil or in locations where moisture collects and cannot readily evaporate. When there is no practical means of controlling the moisture, oxygen level or temperature, the options for the protection of such wood products are limited to the application of chemicals, which prevent fungal growth by making the wood unsuitable as a food source. Simultaneously, the treatment can also protect the wood from other wood-destroying organisms, such as insects and marine borers.

1.3 Wood Preservation Chemicals

The preservation of wood by chemical means can be traced back over 4000 years, to the time when the Egyptians apparently used bitumen to treat wooden dowel-pins in the stonework of temples (3). During the Roman Empire, tar, linseed oil, oil of cedar, and mixtures of garlic and vinegar were used for the preservation of wooden statues. Charring of wood surfaces and soaking in brine, alum, arsenic or copper salts were other methods used in Roman times and in the Middle Ages (4). Investigations to define alternative wood preservation agents were reported in the late 1600s. Efforts escalated during the 1800s, when economic considerations, prompted by the need for durable wooden ships and railway ties and trestles, spurred the search for effective preservatives and application methods (5). A review of the many chemicals and chemical formulations used historically and currently can be found in the above references and in texts such as those written by Hunt and Garratt (6) and Wilkinson (7).

Creosote and the full-cell treatment process have been used since the early 1800s, whereas the empty-cell processes were introduced in the first decade of the 20th century. Pentachlorophenol and the water-borne arsenical preservatives became of commercial significance in Canada during the 1950s and 1970s respectively. Current research has yielded not only modifications to existing formulations and treatment technologies but also the introduction of new preservative chemicals. The voluntary withdrawal of CCA from residential markets in 2003 prompted the introduction of new organometallic preservatives, namely alkaline copper quaternary (ACQ) and copper azole (CA-B).

The choice of wood preservatives depends upon the character of the wood to be treated, the anticipated service and the properties of the chemical or formulation. Wood preservation formulations must:

- protect against attacking organisms;
- be able to penetrate wood;
- remain in the wood for the length of the intended service;
- be chemically stable;
- be safe to handle;
- be economical to use;
- not weaken structural strength;
- not cause significant dimensional changes within the wood.

Other factors that determine selection of chemicals or formulations include fire resistance, colour or odour; paintability, corrosiveness, electrical conductivity and environmental considerations.

In Canada the predominant wood preservative chemicals or formulations in commercial use are:

- CCA (chromated copper arsenate). Major CCA-treated products include fence posts, foundation lumber and plywood, utility poles and construction timber.
- ACQ (alkaline copper quaternary). Major ACQ-treated products include lumber for patios and fencing in residential construction.

- CA-B (copper azole). Major CA-B-treated products include lumber for patios and fencing in residential construction.
- Borates. Uses are for wood components in interior applications.
- ACZA (ammoniacal copper zinc arsenate). Major ACZA-treated products include marine structures and construction timbers.
- PCP (pentachlorophenol). Major PCP-treated products include utility poles and cross-arms.
- Creosote. Major uses include treatment of railway ties, utility poles for export, and pilings and timbers for marine applications.

The development of alternative chemicals for wood preservation is the subject of ongoing research. The actual use of alternative chemicals will depend on industry and safety evaluations, and on approval under the *Federal Pest Control Products Act*, now administered by the Pest Management Regulatory Agency of Health Canada

1.4 The Value of Wood Preservation

A recent study showed that the Canadian preservation industry (8) in 1995 consisted of 64 active plants and treated about 2 million m^3 (70 million ft^3) of wood representing a value of $700 million. That wood volume amounts to 13% of Canada's lumber consumption and virtually 100% of Canada's pole production. Controlled studies have shown that wood preservation enhances the lifetime utility of wood by a factor of 5 to 10 or more, depending on the species, end use and efficacy of the treatment. If treated wood products had to be replaced by untreated wood, the annual Canadian log harvest would have to increase by 12.5%, which represents 66 million trees grown on 162 000 acres of boreal forest land. The total area of forest land required to sustain this level of production was estimated to be about 1.5 million acres, roughly the area of Prince Edward Island. This emphasizes the considerable contribution that the industry makes to forest conservation (8).

Substituting alternative materials (such as steel, concrete or plastics) for treated wood in industrial applications (not including residential) would incur increases in material costs to users of 100% to 200%, or $250 to $500 million per year, not including attendant cost increases in installation and maintenance (9). Such applications represent about 52% of total wood industry output.

Wood preservation also allows the more efficient use of the forestry resource by increasing the use potential of various wood species and the use of smaller and faster growing trees.

In 2000 a total of 67 plants operated in Canada. The product volume treated in 1999 was estimated at 3.5 million m^3 (122 million ft^3). It was valued at $724.6 million (10).

2 Overview of Wood Preservation Facilities

2.1 The Canadian Preservation Industry

There were 67 preservation plants operating in Canada in 2000 (10). Of these, 64 had pressure treatment facilities, two employed both pressure and thermal treatments and one used thermal treatment only. All except three plants used CCA. CCA was the sole preservative in 51 operations, while creosote and PCP were the sole preservatives in one plant each. Thirteen plants were involved in multipreservative operations: seven with CCA and PCP; five with CCA, creosote and PCP; and one with CCA, ACZA, PCP and creosote. One treated with borates exclusively.

Treatment plants exist in all provinces, except Prince Edward Island. The early plants were conveniently located to serve the railways. However, newer plants are concentrated in areas where there is great demand for consumer lumber, which represents more than 50% of the total industry output (9). The provinces with the most plants are Ontario, with 18, and British Columbia, with 16 (10).

2.2 Description of Current Plant Designs

2.2.1 General Plant Designs

Wood preservation plants generally consist of four components (9):

- yards for storage of untreated and treated wood;
- wood processing facilities (peelers, framing lines, kilns, etc.);
- impregnation facilities;
- offices, laboratory space.

The size of storage yards can vary significantly depending on the plant's treatment capacity and the manner of drying the wood. Air seasoning, which is generally used for poles, ties and large timbers, requires a large storage space. However, plants that process lumber particularly for the residential market may kiln dry or process wood under a "treatment service only" agreement, in which case smaller white wood inventory space is required. The storage cycle of treated wood is generally short, necessitating only a limited yard or shed area. Plants that provide storage for their customers, for example, the major railways and utilities, are an exception.

Wood processing equipment may include pole peelers, saws, framing lines, sorting tables, incisors, kilns, stackers and the like. Railway tie plants are equipped with special adzing, boring and incising machines.

The designs of impregnation facilities are specific to the treatment process employed and the preservatives used. A more detailed description can be found in the relevant preservative-specific sections. The following is a general description.

2.2.2 Preservation Processes

Preservation processes are aimed at injecting requisite amounts of preservative liquids deep into the wood to provide long-term protection against wood destroyers. In North America, the majority of preserved wood is treated by pressure impregnation processes. Thermal treatments are of secondary importance. The applied treatment parameters for all processes are limited by standards — in Canada, this standard is CAN/CSA 080 (11) — to ensure effective treatments without damage to the wood. Special requirements are contained in the *Best Management Practices for the Use of Treated Wood in Aquatic Environments* issued by the Canadian Institute of Treated Wood (CITW) (12).

Wood Conditioning

Before wood can be successfully impregnated with preservatives, the bark has to be removed and the moisture content reduced by a process involving drying or conditioning. This may be achieved by air seasoning, kiln drying or by a process carried out in the treatment cylinder, for example, a steam/vacuum process or boiling-under-vacuum (Boultonizing) in the presence of the treating solution. The method chosen depends on the wood product, specifications, the available equipment, desired moisture levels and the preservative used. For example, kiln drying is most common for lumber destined for the residential market; air seasoning is most economical for large commodities, such as ties, timbers and poles; a steam/vacuum process is preferred for poles to be treated with PCP/oil; and Boultonizing is common with ties and marine pilings to be treated with creosote or creosote/oil solutions.

Sawn wood, which generally exposes refractory heartwood, requires "incising" to enable good preservative penetration. Incising is a process whereby the wood surfaces are punctured by toothed rollers. Various incising patterns are available to ensure good penetration without causing undue structural damage. Individual pieces are generally cut to final size and shape prior to treating to ensure good preservation of all exposed faces. Machining after treatment may expose untreated wood, in which case subsequent field treatments must be applied. Even

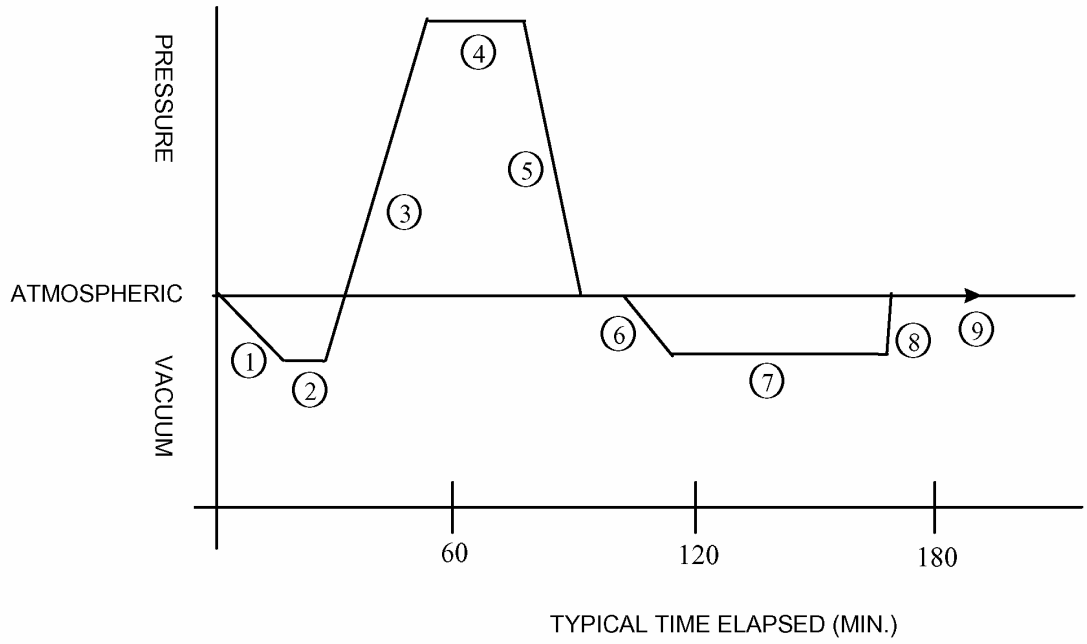
properly applied field preservation cannot protect such exposed wood as effectively as either pressure or thermal treatments.

Full-Cell (Bethell) Process

The full-cell process was introduced in 1838. It is the only process employed for all treatments with CCA, and the other waterborne preservatives, as well as for creosote, where high preservative retentions are specified, as is the case with marine structures (Figure 1).

After a wood charge is placed into the pressure cylinder, the treatment process commences with the application of an initial vacuum for half an hour to an hour. The preservative solution is then admitted to the cylinder, while maintaining the vacuum. In case of the water-borne

Figure 1 The Full-Cell (Bethell) Pressure Treatment Process



Process Steps:

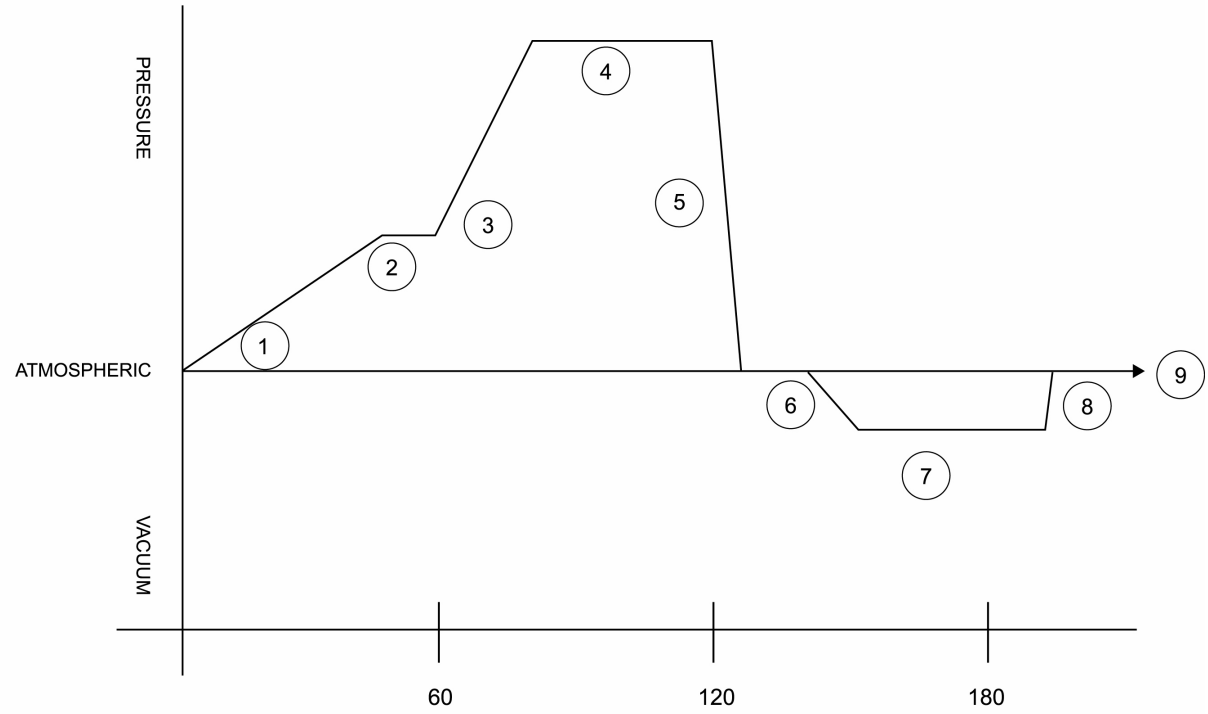
1 Initial vacuum
2 Fill with preservative
3 Pressure increase
4 Pressure impregnation cycle
5 Pressure release
6 Preservative pump-out
7 Final vacuum
8 Vacuum release
9 Treated wood discharge

preservatives, the solution is at ambient temperature, whereas oil-borne preservatives are heated (70 to 90°C). After the cylinder is filled, pressure is applied, usually to a maximum of 1040 kPa, and held until a predetermined amount of preservative has been injected into the wood. This pressure cycle may take from 30 minutes to several hours. At that point the pressure is released and the excess preservative is returned to a storage tank for use on subsequent treatments. The impregnation stage is usually followed by a final vacuum in the case of CCA and the other water-borne preservatives or an expansion bath and a final vacuum in the case of creosote. These processes remove excess preservative from wood subsurfaces and are aimed at rendering the product surfaces as dry as possible.

Empty-Cell Processes

This category includes two processes, the Rueping and the Lowry, both of which are used with creosote and pentachlorophenol for treatment of utility poles, railway ties, posts and construction lumber and timber. The processes are designed to give deep penetration, while minimizing the preservative retention (Figure 2).

Figure 2 The Empty-Cell (Rüping) Pressure Impregnating Process



Process Steps:

1 Initial pressure
2 Fill with preservative
3 Pressure increase
4 Pressure impregnation cycle
5 Pressure release
6 Preservative pump-out
7 Final vacuuum
8 Vacuum release
9 Treated wood discharge

The Rueping process applies an initial air pressure (200-500 kPa for 15 minutes) to the wood charge in the cylinder prior to admitting the preservative. The pressure compresses the air inside the wood. Hot preservative is then admitted to the wood, without releasing the air pressure. The pressure is increased to a typical maximum of 1040 kPa and held until a predetermined solution absorption has been achieved. When the pressure is released at the completion of the impregnation cycle, the compressed air in the wood expands and expels excess preservative. This effect, which is called the "kickback," is usually enhanced by a quick final vacuum. Excess preservative is returned to storage for use in subsequent treatments.

The Lowry process is similar to the Rueping process, except that no initial air is applied and the preservative is admitted at atmospheric pressure. The remainder of the process continues in the same manner as the Rueping process. There is usually a smaller amount of preservative recovered by the kickback in a Lowry process.

Thermal Treatment Process

This process is applied with PCP/oil solutions for the full-length treatment of dry utility poles and cross-arms of thin-sapwood species (11). A pressure vessel is not required to carry out the process. Instead, most thermal treatments are carried out in horizontal, rectangular tanks that are covered by lids. During the cycle, dry wood is first immersed in hot preservative (88 to 113°C) for a minimum of six hours (hot bath). Thereafter, the hot preservative is quickly replaced by preservative at ambient temperature, in which the wood is held for at least two hours (cold bath). Excess preservative is returned to the storage tank.

A variation of this process is the "pole butt" treatment, whereby only the lower ends of poles (butts) are impregnated with preservative. This process is carried out in upright, cylindrical tanks and employs process parameters similar to the full-length treatments described above.

After-Impregnation Processes

After application of the pressure cycle, process steps are generally added to remove excess preservative from the wood, so as to render wood surfaces clean and dry or to fix the preservative chemically to the wood. Such processes are now quite common and are aimed at easing potential environmental and human exposures to preservative chemicals.

Most treatment cycles are followed by a final vacuum, which equilibrates internal pressure, removes air and preservative from the surface fibres of wood and, in the case of oil-borne treatments that use elevated temperatures, cools the wood. For creosote and PCP, a final vacuum may not be adequate to create clean surfaces. In these cases, the impregnation cycle may be followed by an expansion bath or a final steam cycle, both of which add a final vacuum step. These processes can be quite effective, but the final steam cycle creates large volumes of contaminated water that must be treated to meet all discharge criteria.

Storage After Treatment

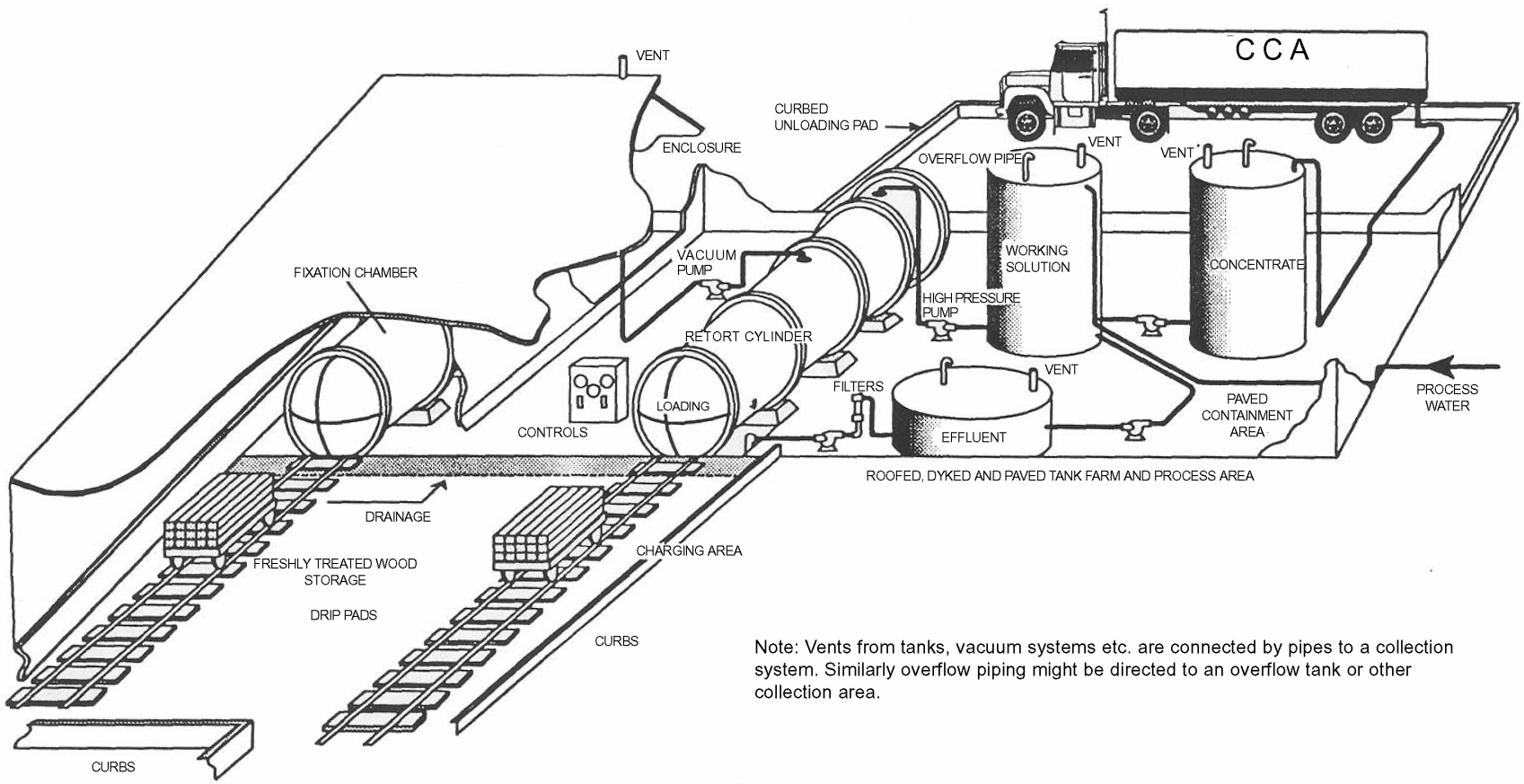
Treated wood, removed from the cylinder, is generally stored on a drip pad until preservative drippage has stopped. The duration of this storage may vary from hours to days. Alternatively, many CCA treatment plants now carry out an accelerated fixation process to ensure a high level of leach resistance of the preservative chemicals. Such a process entails a heating cycle, usually in the presence of high humidity. Special fixation chambers may be employed or the process may be carried out in drying kilns (13). From the drip pad of the fixation facility, the wood may be transferred to a designated yard area for storage until shipment or may be directly loaded onto railcars or trucks for immediate shipment.

2.2.3 Current Treatment Plant Designs

CCA Plant Designs

Most CCA plants are housed within a heated building (9). Figure 3 is a schematic view of a typical CCA plant. The centrepiece is the pressure vessel, also called a retort or cylinder. Cylinders are commonly 1.8 m in diameter and 24.4 m long. They are normally charged and discharged through a single door by means of trams that run on tracks. Other designs use conveyors to move wood in and out of the cylinder and may involve doors at either end to enter and exit the wood. Pumps are provided to apply process conditions (i.e. vacuum or pressure) as well as to transfer liquids from and to the cylinder and between tanks. A tank farm typically includes a concentrate tank, one or more tanks for working solutions, and an effluent recovery tank or makeup water tank. The process controls and instrumentation vary in sophistication, depending on the degree of automation. Most CCA plants have systems that are fully automated to control the impregnation process parameters. A number of plants have recently added heated storage areas for treated wood or special facilities for accelerating the fixation of the preservative components in the treated wood (13, 14). Paved drip areas for treated wood were enlarged in many plants, and some have roofs over some or all of the treated wood storage area.

During 2003 a significant number of CCA plants converted to application of either ACQ or CA-B. The general plant components involved with CCA apply to these chemicals as well, although additional tankage and heating equipment might be installed and the accelerated fixation facilities for CCA do not apply.



Note: Vents from tanks, vacuum systems etc. are connected by pipes to a collection system. Similarly overflow piping might be directed to an overflow tank or other collection area.

Figure 3 Conceptual Drawing of a CCA Treatment Facility

Similarly, borates can be applied in facilities that use the basic CCA layout. A roofed area is required for storage of treated material prior to wrapping, which is essential, because borates are water soluble and would leach when exposed to precipitation.

ACZA Plant Design

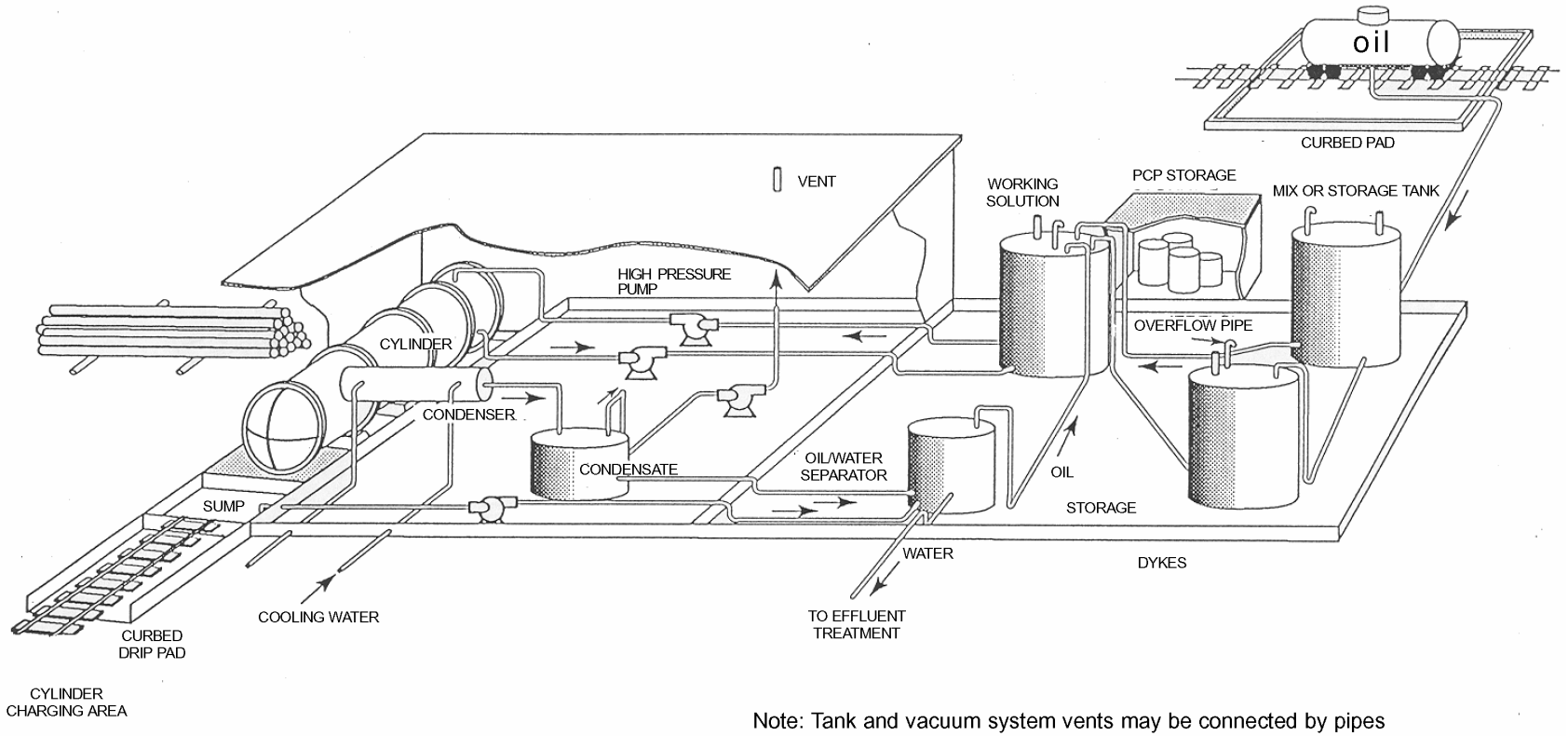
There is only one ACZA plant operating in Canada. This plant is enclosed and automated. The equipment is similar to that in CCA plants. Additional tankage is required for storage of the aqua ammonia and for mixing the ingredients to prepare a working solution.

Creosote and PCP Plant Designs

Creosote and PCP/oil solutions are often used interchangeably in the same treatment facility. Hence, plants using these preservatives have a similar layout (Figure 4). The pressure cylinders are usually somewhat larger than those used in water-borne preservation plants (2.1 m in diameter and 36.5 m in length). Tank farms are generally placed outdoors, and tanks are equipped with internal heating devices. The production equipment, including the cylinder, pumps, condensers, controls and effluent treatment systems, is within a treating house. Facilities treating with PCP or creosote solutions require a heat source for warming the preservative and to carry out specific processes, such as steam conditioning. When treating with PCP, either an autoclave or a designated mix tank is used to dissolve the solid preservative in a suitable oil solvent. Effluent treatment facilities may consist of an oil/water separator, a flocculation system and carbon filtration. An air filtration system to collect exhausts from treatment vessels, vacuum systems and tank vents may also be part of the installations. The vacuum systems are equipped with condensers and condensate collection tanks.

Thermal Treatment Plant Designs

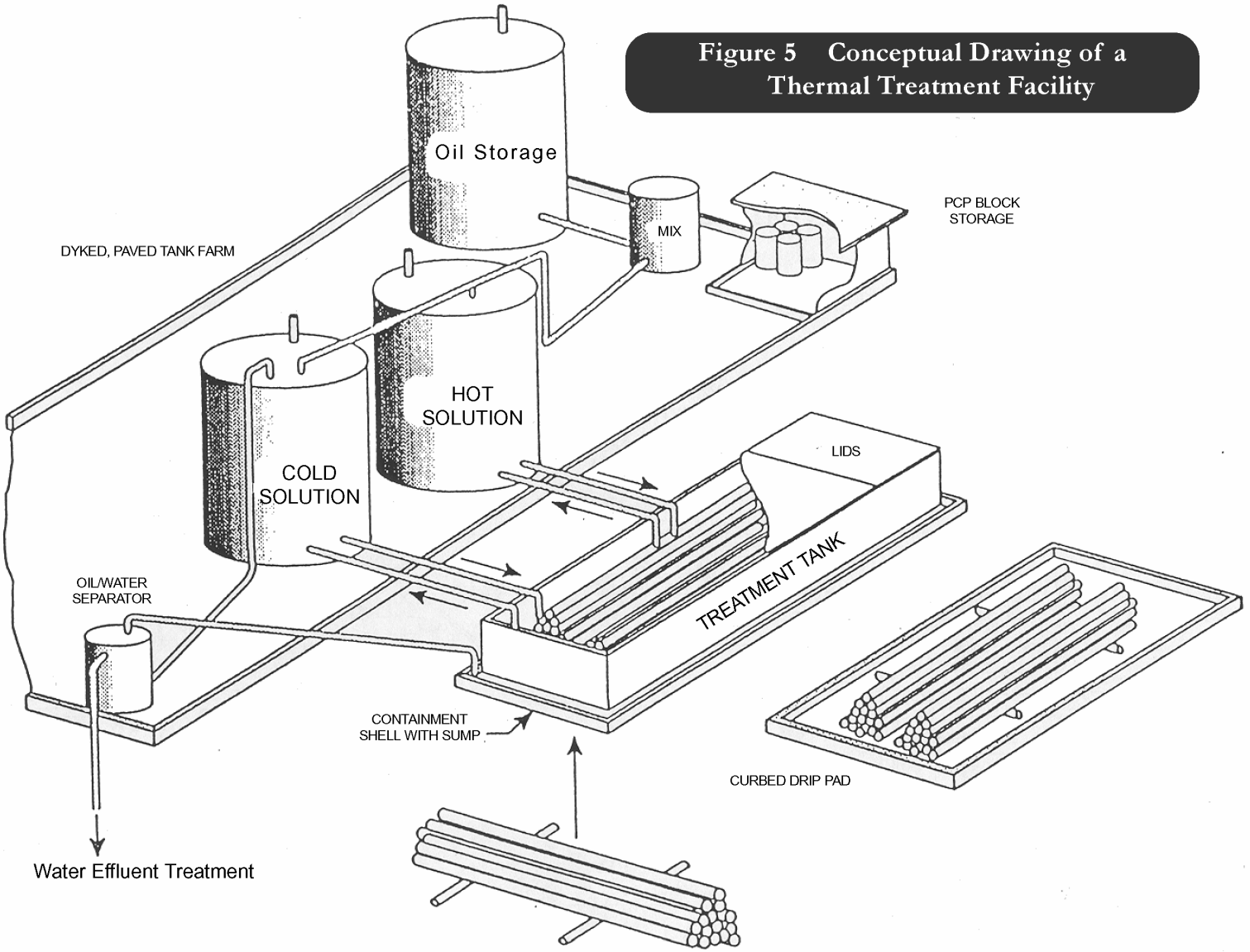
As Figure 5 shows, thermal plant facilities have less sophisticated impregnation equipment and process controls than pressure treatment facilities. The treatment vessel is a rectangular tank, which may be provided with spill containment. A tank typically measures 3.65 m x 3.00 m x 24.00 m and may be equipped with removable lids and hold-down bars for restraining the poles during treatment. Wood is loaded into the tanks by forklifts or grapples. An outdoor tank farm would contain a PCP/oil mix tank, as well as oil storage and hot and cold preservative solution storage tanks. Transfer pumps accomplish the removal of solution from the treatment vessel to the storage tanks. As with PCP pressure treatment facilities, the effluent treatment system may involve oil/water separation, flocculation and carbon filtration. One plant applies thermal treatments in a closed cylinder.



Note: Tank and vacuum system vents may be connected by pipes to a recycling or filtration system.

Figure 4 Conceptual Drawing of an Oil-Borne Pressure Treatment Facility (Creosote or PCP/Oil)

Figure 5 Conceptual Drawing of a Thermal Treatment Facility



3 Description of Preservative Properties

The commercial preservatives used in Canada have a long history of success in preserving a large variety of wood products. Not only are they effective in preventing wood deterioration, but each preservative also has physical and chemical properties that make it suitable for one or another product. No one preservative is considered suitable for all possible product applications; each has found a niche of preferential use.

The preservatives in use have a range of physical, chemical and toxicological characteristics that determine their potential for causing harm and, therefore, the best modes of handling them during operation. Their specific properties are described in Part II - Preservative-specific Information and Recommendations.

3.1 Toxicity, Hazards and Risks

The following explanations should allow a better understanding of the potential risks to humans and the environment (15):

Toxicity: any harmful effect of a chemical on an organism, including humans, or the environment. Exposure to wood preservatives can be in three basic forms: as pure active ingredients, as formulations, or as the treated wood. Toxicity can be short-term (acute toxicity), as defined by criteria such as the median lethal dose (LD_{50}) or the medium lethal concentration (LC_{50}), or long-term (chronic toxicity) that may have several effects, including cancer.

Hazard: the set of inherent properties of a chemical substance or mixture that makes it capable of causing adverse effects on humans or the environment, when a certain degree of exposure occurs.

Risk: the predicted or actual frequency of occurrence of an adverse effect of a chemical or a mixture from a given exposure to humans or the environment.

In most wood preservatives, the active ingredients are combined with other substances, most commonly solvents. Such preservative formulations may exhibit different physical and toxicological properties from the undiluted preservative. This factor needs to be taken into account when recommendations for proper designs and operational practices are proposed.

3.2 Human Health Concerns

Wood preservatives can be harmful to humans, if not properly handled. The exposure routes by which they can enter the human body are inhalation (vapour, dust, aerosol, etc.), ingestion (solid, liquid) and through the skin (vapour, liquid, solid). Exposure limits are given for individual preservatives in Part II - Preservative-specific Information and Recommendations. Such limits are usually also contained in the material safety data sheets issued by chemical manufacturers.

Plant operators should obtain references to or copies of relevant material safety data sheets (MSDS) from their preservative supplier and follow the requirements of the pesticide label.

3.3 Environmental Concerns

The properties of a preservative chemical or formulation are also important in determining its environmental fate and its potential for contaminating the treatment plant and other sites. A preservative can enter the environment in many ways, such as by spillage or leaching, as effluent or air emission. Subsequently it may be subject to a wide variety of processes that may eliminate it from the environment completely, modify it into a more or less harmful substance, or transfer it to another environmental medium (15).

The main physico-chemical properties that determine the migration of a chemical are (15):

- solubility in water and in organic solvents;
- vapour pressure;
- adsorption/desorption in soil or sediment;
- stability;
- partition coefficient between octanol and water;
- reactivity with co-contaminants and soil microbes.

Detailed information on the environmental considerations for each preservative is contained in Part II - Preservative-specific Information and Recommendations.

4 Description of Preservative Applications and Potential Chemical Discharges

The use of wood preservatives at treatment plants creates the potential for human exposure and may lead to chemical discharges to the environment. The actual impact of any chemical depends upon many factors, including the site, facility characteristics, processes employed and operational practices. Due to their physical, chemical and toxicological properties, as well as their modes of application, each type of preservation facility requires specific attention to ensure safe operation.

See Part II - Preservative-specific Information and Recommendations.

5 Personnel Protection

5.1 Precautions and Hygiene

The potential hazards of exposure to preservative solids or their solutions include immediate and long-term toxic effects from ingestion, skin contact or inhalation of vapours or other airborne contaminants. These potential hazards can be adequately controlled by proper protective measures. The severity and speed of damage to tissue and probability of health effects following contact depend on the extent of the exposure and are generally highest with concentrated solutions. These factors diminish as the solution is diluted. The general rule for dealing with exposure is as follows: **the higher the concentration of a preservative to which a worker is exposed, the greater the need for protective measures and immediate response if contact occurs**. If there is any doubt as to the concentration, the response should be the same as for the most concentrated form.

The first aid procedures for exposures to specific preservatives and objectives for an overall worker protection program are contained in Part II - Preservative-specific Information and Recommendations.

First aid personnel must be properly trained and should maintain regular contact with chemical suppliers and/or industrial medical advisors for information on up-to-date response measures. Table 1 outlines general precautions and personal hygiene measures for an overall worker protection program.

5.2 Regulatory Controls

Most regulatory criteria established by worker protection agencies are based on threshold limit values (TLVs) and biological exposure indices, as recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). Part II - Preservative-specific Information and Recommendations presents the ACGIH-recommended limits for individual preservatives to define acceptable levels of exposure in the wood preservation workplace.

The hygiene and protective measures as well as precautions recommended in this document represent general good practice to ensure minimal worker exposure. However, such measures to protect workers may differ from various federal and provincial regulations. For example, under the federal *Pest Control Products Act* all pesticides including all wood preservatives are required to be registered and to carry a label issued by Health Canada. The pesticide label contains specific requirements for handling and use of the preservative as well as the protective measures that apply. The user must be familiar with these and must comply with them.

5.3 Biological Monitoring of Exposed Workers

Biological monitoring is a useful tool for evaluating the long-term effectiveness of the protective measures applied. Routine biological monitoring of exposed workers (primarily those who handle preservatives and treated wood, e.g. plant operators and quality control personnel) is recommended and can be achieved using established procedures for determining the presence of the various preservatives and their components. Among these procedures are analyses of urine,

blood or hair. Note that biological monitoring might not be possible for all preservative ingredients and solvents used. The monitoring programs should be carried out and interpreted by qualified occupational hygienists or occupational physicians. If there is concern for confidentiality and/or sample handling procedures, these can be addressed and resolved by a joint management-worker committee.

A comprehensive occupational health and safety program is important for worker health and safety. Two components of such a program are environmental and worker health monitoring, which may be used to assess worker exposure to wood preservatives. Since occupational health and safety is under provincial jurisdiction, the appropriate workers' compensation board or department of labour should be contacted for specific requirements for wood preservation facilities.

Table 1 General Precautions and Personal Hygiene for Personnel Working in Wood Preservation Facilities

General Precautions	
Objective	**Recommendations**
Assure that workers are familiar with all aspects of preservative usage.	• Provide documentation and training to educate workers about the chemical properties of, hazards of exposure to, and emergency procedures associated with use of the preservative. • Implement preventive measures to minimize ingestion or inhalation of, and skin or eye contact with, preservatives, preservative solutions and contaminated waters.
Assure that first aid can be applied when necessary.	• Install and regularly check emergency eyewashes and showers. • Provide all necessary first aid equipment for first response as indicated in Part II of this document. • Ensure that first aid is always available from qualified (trained) personnel. • Ensure first aid personnel are familiar with updated emergency response procedures. • Identify medical contacts who are readily available during all working hours.
Personal hygiene	
Implement personal hygiene practices that minimize potential exposure to preservatives.	• Do not carry, store or consume food or drink in working areas (e.g. areas where preservatives are stored or used, or where freshly treated wood is stored). • Do not carry or smoke cigarettes in working areas. • Wash hands thoroughly before leaving working areas and before eating, drinking, smoking or using the toilet facilities. • Do not expose cuts or abrasions to preservatives. • Wash skin immediately if contact with preservative solutions occurs. • Get immediate first aid if skin or eyes contact preservative solutions. Even small contact exposures should receive immediate cleaning and treatment. • Change outer clothing immediately if splashed with preservative solutions. Change clothing daily if any incidental contact with the treatment chemical occurs. Wash contaminated clothing separately from other clothing. • Wear impermeable footwear in all working areas. Preservative solutions may penetrate leather shoes and apparel. • Shower daily immediately after work. • All work clothing and boots must be left at the plant.

6 Site Selection

6.1 Purpose

Preliminary assessment of an industrial site involves an evaluation of technical site characteristics (e.g. hydrogeology, topography and soils) and of socio-economic and geographic factors (e.g. cost, land use and availability, proximity to raw materials, markets and transportation routes). This section highlights site features that contribute to the control of any potential chemical releases from wood preservation facilities.

In many cases, natural site characteristics may impose constraints on the technical features of a facility. Early recognition of less desirable characteristics will allow development of a compensating design and speed site approval.

6.2 Assessment Factors

Active plant sites have the potential for chemical contamination of groundwater and surface water. The extent of potential contamination is dependent on the type of chemical, its physical and biological properties, plant design and operating practices, and site-specific characteristics including soil type, geology, hydrology (subsurface), climate, topography and drainage.

This section describes environmentally important site characteristics and how those characteristics can affect the eventual impact of a chemical release. These characteristics are important in designing features of a wood preservation plant that:

a) minimize the possibility of off-site contamination via groundwater and surface water;
b) minimize chronic on-site contamination to protect worker health during operation;
c) facilitate decommissioning in the event of partial or complete closure.

The preliminary assessment factors rely on readily available information. Table 2 lists the site features that must be considered in an environmental impact assessment.

6.2.1 Regional Geology

Geologic information about many areas of Canada may be obtained from federal and provincial surveys. Information that should be obtained includes:

- Texture of unconsolidated material — Fine-grained material is more likely to retain chemical contaminants than coarse material.
- Depth to bedrock — Shallow soils imply a limited ability to retain spilled chemicals.
- Aquifer recharge and discharge zones — Potential for hydraulic connections to regional groundwater and sensitive surface waterbodies should be considered.
- Discontinuities such as faults, fissures, joints, fractures — Discontinuities may cause “short-circuiting” of a contaminant plume.

Table 2 Site Features Affecting the Design of a Wood Preservation Facility

	Suggested degree of mitigating design/operational measures	
Site features	Slight	Severe
Soil texture	Loam, silty loam, silty clay loam, clay loam, sandy clay	Gravel
Permeability (cm/h)	< 0.5	> 50
Topography (% slope)	0 - 9	> 30
Soil depth to bedrock (cm)	> 200	< 60
Depth to groundwater (cm)	>200	< 60
Flooding	None	Frequent (>once/20 years)
Drainage	Slow	Very rapid
Distance to surface waterbody (lake or river)	Depends on interaction with other site features (e.g. permeability of soil)	Directly adjacent

6.2.2 Soils

Soil properties should be assessed to evaluate the potential for leaching of treatment chemical constituents. Physical properties to consider include depth, permeability, texture, water-holding capacity and shrink-swell potential; chemical properties to consider include cation exchange capacity (CEC), anion exchange capacity (AEC), organic carbon content, and iron and aluminum oxide content. Soils with high amounts of organic carbon will have higher capacities for sorption of neutral organic compounds; those with high AEC will provide greater retention of dissociated phenols; while those with high CEC will provide greater retention of organic bases. High AEC, high levels of aluminum oxides, and/or high levels of calcium compounds will enhance the retention of arsenate and chromate anions, while high CEC, high clay content and high organic matter will enhance the retention of the copper cation.

Soil depth and soil types are routinely indicated on soil maps (and often on geology maps). Although the available maps may not indicate the exact soil composition of a small site (e.g. 2 ha), they can be used for preliminary assessment purposes.

6.2.3 Geotechnical Description (including subsurface hydrology and water table data)

Published maps and reports on regional geology and soils are adequate references for establishing subsurface hydrogeology at the preliminary site assessment stage. However, site-specific hydrologic data will be required if one or more of the following conditions are identified during preconstruction assessment:

- the site is located over a shallow, unconfined aquifer;
- the site is located over an aquifer used for a potable or irrigation water supply;
- the aquifer has hydrologic connections with other aquifers in the area and/or regional groundwater flow patterns.

The additional information required must be defined in consultation with the appropriate regulatory agency.

6.2.4 Topography

Topographical information is easily obtained from published government maps. In general, steep sites should be avoided due to runoff problems and erosion. However, topography is a site selection parameter that can be addressed by facility design. Slope gradients between 1% and 10% should present few problems. Upland flat and terraced landforms are desirable locations for treatment facilities. Floodplains are acceptable if they lie above the 100-year flood level; otherwise special design provisions must be implemented.

6.2.5 Climate

Climactic variables, such as precipitation (form, historical 1-hour and 24-hour maximums, and annual total amount), temperature regime and wind patterns, influence chemical loss during storage of treated wood and leaching in the subsurface. Climactic variables can also influence conditioning needs for wood prior to preservation treatment and can affect worker exposure to emissions. Information on such climactic variables is generally available from Environment Canada. However, definitive criteria are difficult to establish for climactic influences. For example, the amount of precipitation will influence leaching potential, but this parameter can be alleviated by selecting sites with soils of low permeability and/or by introducing compensating design features at the facility.

6.2.6 Proximity to Sensitive Uses

Sites located adjacent to waterbodies (e.g. lakes, rivers, marine waters) or above aquifers used for drinking or irrigation water supplies, food manufacturing plants and beverage processing plants should be considered cautiously by the wood preservation industry. If such a site is selected, exceptional design approaches and operational and monitoring procedures will be required. Desirable minimum distances between facilities and sensitive waterbodies depend upon previously discussed factors such as soil type, regional geology, topography and climate. If a selected site is adjacent to waterbodies used by migratory fish, then the plans must be reviewed by both Environment Canada and Fisheries and Oceans Canada.

6.3 Selection Procedures

After compiling the data for potential sites, the developer is faced with a decision-making process for site selection. The process integrates environmental protection with economic considerations. On the basis of economic factors alone, a less environmentally acceptable site might be most desirable. However, since the less acceptable environmental features will add to the cost of adapting the design and operation of the plant to the site, environmental protection must be interpreted as a real location cost at such a site.

All factors previously described should be considered. Techniques used to select a site on the basis of environmental acceptability include criteria ranking, matrices, decision trees or

mathematical modelling. Since assessment techniques among regulatory agencies may vary considerably, local and provincial regulatory agencies (and federal agencies where necessary) must be consulted.

Table 2 provides examples of site characteristics requiring very little environmental mitigation as well as those requiring significant mitigation. Deviations from the most desirable characteristics suggest various degrees of mitigating design and operational measures:

- Slight mitigating design/operational measures are necessary for sites that are well suited to the location of a treatment facility. The site will require only low-cost maintenance and monitoring to assure environmental protection.
- Moderate mitigating design/operational measures present more of a problem, but in general sites requiring such measures are acceptable.
- Severe mitigating design/operational measures such as special innovative designs may partially overcome the constraints of a marginally suitable site. Design costs are likely to be high. Extensive monitoring efforts will be required, adding to the cost of the location.
- Very severe mitigating/operational measures indicate that a site may be economically impractical and should not be considered.

Site features and the degrees of mitigating design/operational measures shown in Table 2 are based on siting criteria suggested by various investigators (16, 17).

7 Design Recommendations

This section suggests approaches to designing wood preservation facilities that protect workers and the environment from harmful exposure to preservative chemicals. Recommendations are based on currently available best practices. The design aspects are intended to achieve the following general objectives:

- to prevent or reduce direct contact of personnel with preservative chemicals;
- to provide maximum reduction of preservative releases to the environment by providing secure containment;
- to enable prompt response and effective corrective measures to assure worker safety and environmental protection after abnormal events (e.g. tank rupture).

Figure 6 presents an overview of the subject areas covered by the design objectives. It is based on the typical handling and use of preservatives. Means of achieving the objectives outlined in Figure 6 are presented in Tables 3 to 9.

It is intended that all new wood preservation facilities be designed to achieve the specific objectives listed in these tables. Existing facilities should review their abilities to comply with the objectives, and gaps, if present, should be addressed using the suggested features or alternative but similarly effective features. Assessment 2000 aided plants in the determination of shortcomings in design and operation, and through the Strategic Options Process for the industry, plants have pledged to meet the objectives of the TRD by the end of 2005.

The recommended design features in the tables may not be the sole options available to attain the stated objectives. Alternative approaches may exist that would be equally effective or more suitable to site-specific conditions. Where this is the case, an appropriate design feature that has not been included in these recommendations could be used at a specific facility.

Note that roofing is a recommendation for several process areas. But galvanized roofing may contribute to stormwater runoff toxicity from mobilized zinc. Particular caution with such roofs should be exercised at sites near waterbodies or in areas of low pH precipitation.

Figure 6 Overview of Design Recommendations for Preservation Facilities

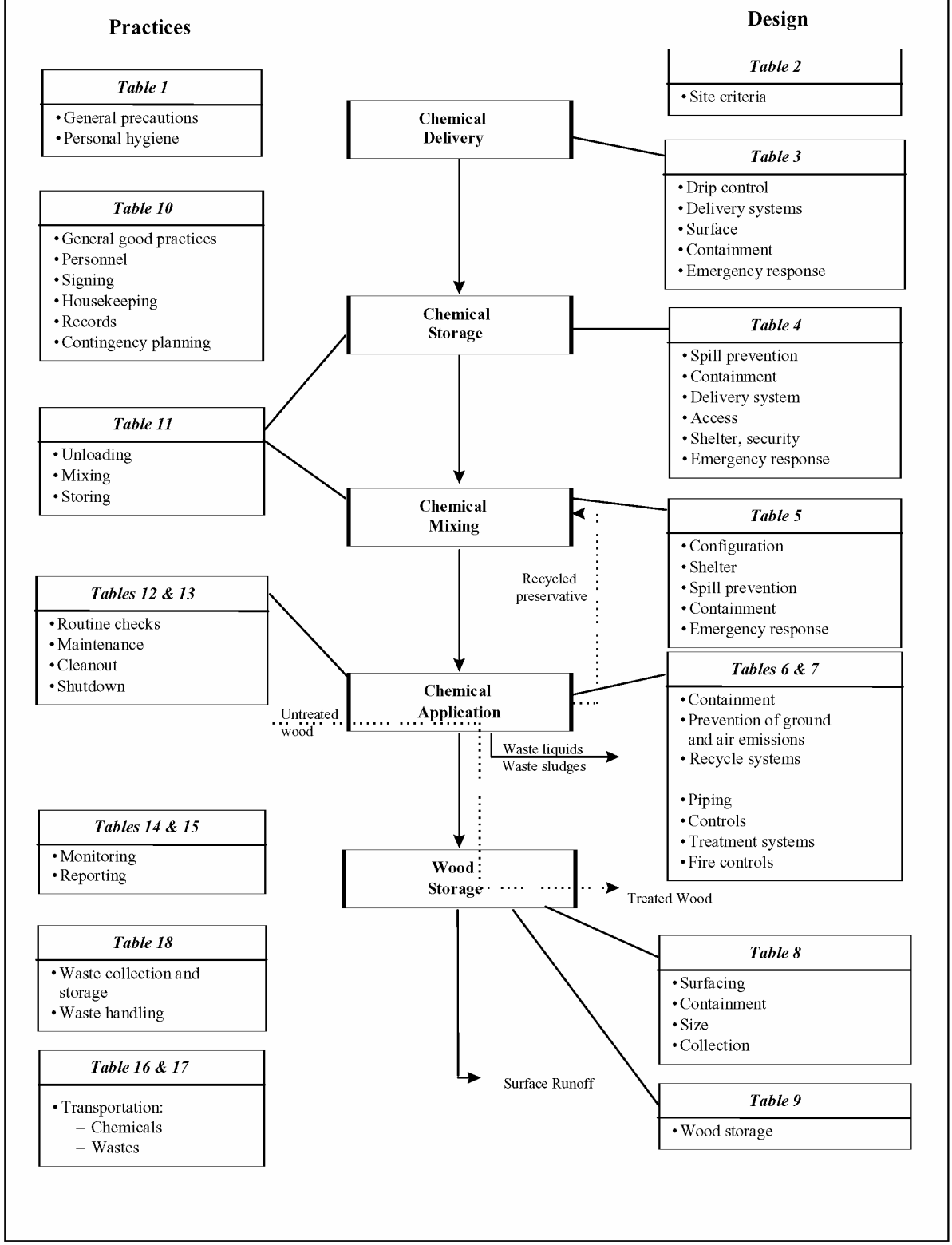


Table 3 Recommended Design Features for Chemical Delivery Areas

Delivery format	Design feature	Recommendations
Bulk liquid (delivered by truck or rail tanker)	**Objective:** To provide an off-loading area that enhances spill prevention and containment.	
	Off-loading pad	• Provide an impervious pad that drains to a containment area. • Design to prevent settling or cracking of the pad.
	Surfaces	• Seal surfaces to prevent leakage and enhance cleanability.
	Joints	• Provide liquid-tight joints (if applicable).
	Drip control	• Provide local drip catchment to minimize contamination of the containment system. • Provide for wash down of minor drips or spills with recovery of washwater (or infiltrating precipitation) for reuse.
	Access	• Locate off-loading area away from high yard traffic routes. • Restrict access during delivery.
	Delivery system piping	• Install permanent delivery systems with rigid, accessible, visible delivery lines (not buried). Piping in sealed, contained channels with leak detection is an optional approach. • Protect delivery systems from mechanical damage. • Provide mechanically secure connections between the tanker and delivery hook-up point. • Clearly identify all delivery lines. • Use top delivery to concentrate storage tanks.
	Backflow prevention	• Install backflow preventers on delivery line.
	Security	• Install locking valves on delivery lines; restrict access.
	Overflow prevention	• Provide maximum visibility of the delivery system from the point of off-loading. • If visibility is limited, use audible alarms to detect tank overflow during delivery.
	Emergency response	• Provide accessible storage for spill-response equipment, absorbent and personnel protection equipment. • Install a phone or manual alarm switch near the off-loading area.
Containerized liquid (drums)	**Objective:** To provide an off-loading area that enhances spill prevention and containment.	
	Off-loading pad/shelter	• Provide an off-loading area near the storage area
	Containment	• Ensure containment for a worst event spill (e.g. 4 drums or 1 pallet load).
	Surfaces	• Provide a sealed surface.
	Container handling	• Design for safe manipulation of containers.
	Emergency response	• As for bulk off-loading areas.

Table 4 Recommended Design Features for Chemical Storage Areas

Storage format	Design feature	Recommendations
Bulk liquids • Solvents • Concentrates • Working solutions • Contaminated surface runoff • Drip return	**Objectives:** ◊ To provide positive spill prevention features. ◊ To provide spill containment capability of 110% of the volume for a single tank, and in multiple tank containment to provide 100% of the largest tank plus 10% of the aggregate volume of the remaining tanks or 110% of the volume of the largest tank, whichever is greater (18).	
	Tanks	• Engineer construction materials and dimensions in consultation with chemical suppliers and applicable codes. • Provide tanks in sound physical condition, with no rust or serious physical damage. • Mount tanks on containment pad surfaces. • Mount tanks in stable positions and anchor securely. • Locate tanks within a dyked area. • Shelter from the weather (where appropriate) and protect from mechanical impact, vandalism. • Protect against freezing (as recommended for external tanks). • Provide means for detecting leaks in insulated tanks (e.g. identify inspection points, undertake regular leakage tests). • Vent interior tanks to the exterior or into a dedicated overflow tank (**never** vent directly into the workplace): – protect vents against release of entrained liquids or overflow (e.g. direct overflow piping to sumps or containment areas).
	Spill containment	• Install impervious, structurally sound floors. • Provide structurally sound dykes, seal all joints. • Provide a dyked containment volume (as stated under the objectives above). • Engineer containment for long-term integrity (leak-proof for infiltration and exfiltration). • Provide either an impermeable top coat to floors and dykes or a liner under the containment area. • Consider providing means for detecting subsurface leakage from containment systems (where warranted by site-specific conditions; e.g. where the site overlays sensitive groundwater systems). • Provide for directing all spills, washes and infiltrating water to tankage (contaminated liquids must be treated to applicable limit before discharge). • Provide effective capability for transferring spilled liquids from containment areas. • Provide surface drainage to prevent pooling of minor spills and washdowns. • Design to minimize tracking of fluids from containment surfaces.

Table 4 Recommended Design Features for Chemical Storage Areas (continued)

Storage format	Design feature	Recommendations
Bulk liquids (continued)	**Piping and valves**	• Design according to applicable codes. • Use rigid, permanent piping throughout. Tank car/truck unloading requires shielded and protected hose connection. • Provide visible, accessible piping with a simple layout (to facilitate early leak detection and easy repair). • Maximize above-floor piping or open containment channels for subgrade piping. **Do not bury** piping! • Properly engineer piping systems for material and dimensions. • Identify piping systems and valves (e.g. by labelling and/or colour coding). • Provide mechanical impact protection for vulnerable exposed piping. • Provide freezing protection for piping (as required).
	Drip containment	• Provide local collection/containment (isolated from large containment areas) at drip points (e.g. under pumps, valves, flanges, etc.).
	Spill prevention / detection	• Install reliable, accurate level indicators on all tanks. • Provide mechanical impact protection on glass sight gauges (including provision for containing and stopping release from broken gauge tubes). • Install shut-off valves on all rupturable lines and tank gauges. • Install permanent overflow piping from tanks directly to a definitive contained area. • Install reliable, independent high-level alarms on tanks (visual and audible alarm). • Interlock high-level alarms to tank feed pump (auto shut-off). • Consider installation of 24-hour monitoring alarms (with remote) for immediate detection of major spills. • Install emergency communication means (e.g. telephone, manual alarm button) at potential major spill points.
	Backflow prevention	• Design to protect against inadvertent transfers to/from interconnected tanks.
	Shelter	• The preferred location for tanks containing aqueous liquids (all solutions) is in an interior centralized process area. • The preferred location for oil-type liquids is in an exterior centralized tank farm area. • If possible, roof exterior tank farms to minimize the quantity of infiltrating precipitation.
	Security	• Provide security precautions to prevent vandalism or access by unauthorized persons.

Table 4 Recommended Design Features for Chemical Storage Areas (continued)

Storage format	Design feature	Recommendations
Bulk liquids (continued)	**Emergency response**	• Provide accessible storage for spill response equipment, absorbents and personnel protection equipment. • Provide appropriate measures for fire detection and suppression, as well as for rapid, effective fire control with containment of liquid firefighting residues and treatment to required limits before discharge. • Install a telephone and manual alarm switch near the off-loading area.
Drummed liquids	**Objective:** To provide secure storage with containment for the worst event spill.	
	Location	• Provide safe, easy access to the mixing area.
	Shelter	• Provide storage in an enclosed, secure area, segregated from other chemicals.
	Ventilation	• Provide adequate ventilation for routine operations and emergency situations.
	Containment	• Store in a paved, curbed or dyked area with no floor drains: – provide containment capacity for the worst event spill (no less than 4 drums), – provide for effective cleanup (including recovery of washdown water) in the event of a spill.
	Surfaces	• Seal surfaces and joints to facilitate cleanability and surface impermeability.
	Emergency response	• Provide accessible storage for spill response equipment, absorbents and personnel protection equipment.

Table 5 Recommended Design Features for Chemical Mixing Systems

Chemical form	Design feature	Recommendations
Bulk concentrate	**Objective:** ◊ To provide a mixing system with effective spill prevention features. ◊ To provide a mixing system that minimizes worker contact with base ingredients and concentrates.	
	Configuration	• Use permanent, closed systems (rigidly piped, tank to tank).
	Location/shelter	• Locate in a contained area.
	Spill prevention	• Install high-level alarms to prevent mixing tank overflow. • Interlock high-level alarms to tank feed pumps.
	Spill containment	• Provide all applicable features for spill containment of bulk liquids described in Table 4.
	Drip containment	• Provide local drip collection at all potential drip points.
	Splash protection	• Discourage open transfer operations; if unavoidable, provide reliable splash protection.
	Emergency reponse	• Provide emergency response features described in Table 3.

Table 6 Recommended Design Features for Treatment Process Systems: General Recommendations

Design feature	Recommendations
Objectives: ◊ To minimize and contain all releases of preservative chemicals. ◊ To recover and recycle releases that occur.	
Spill containment	• Provide spill containment capability of 110% of the volume for a single tank, and in multiple tank containment provide 100% of the largest tank plus 10% of the aggregate volume of the remaining tanks or 110% of the largest tank, whichever is greater. • Locate treatment cylinders and process tanks in an area with: – continuous, structurally sound concrete floors or with slabs or sections with sealed joints, – sealed surfaces for cleanability and impermeability, – reinforced dyke walls and sealed joints, – graded surfaces for ready drainage of wetted surfaces, – walkway grates (or alternative design) to minimize worker exposure and prevent tracking of chemicals from containment areas — keep surfaces clean. • Provide either an impermeable top coat to floors and dykes or a liner under the containment area. • Engineer containment for long-term integrity (leak-proof for infiltration and exfiltration). • Provide permanent, isolated drainage/transfer systems to direct all spills, washes and infiltrating water to tankage. Treat contaminated liquids to applicable limits before discharge. • Isolate control and transfer equipment to avoid damage from spilled liquids in containment areas.
Process control area	• Segregate the operator control area from retort and tank spill containment areas. • Locate the process control area for maximum visibility of treatment systems. • Provide proper lighting in all operating areas.
Process emissions to air	• Provide control equipment for any air emissions vented to the interior, including tank and any emissions subject to environmental controls. – prevent worker exposure to vacuum pump exhausts, – install additional control equipment as required to comply with applicable air emissions limits, – provide traps to remove entrained liquids, – assess levels of workplace air contaminants. Provide ventilation in areas where excessive levels may occur, – where applicable, condense emissions and return to storage.
Fire control	• Provide fire controls as decided on site-specific basis in consultation with the local fire department. • Provide containment for contaminated runoff waters and residues generated by firefighting activities (e.g. blockage of storm drains, adjacent ditches).
Weather protection (winter operations)	• Protect equipment from freezing temperatures, particularly where water is or may be present. • Winterize process control area.

Table 7 Recommended Design Features for Treatment Process Systems

Design feature	Recommendations
Objectives: ◊ To provide fail-safe operation of the treatment system. ◊ To minimize the potential for preservative spills.	
Treating cylinder	• Treatment cylinder and pressurized components must meet all pressure vessel certifications stipulated by the provincial ministry responsible for such certification. • Install an effective protection device to prevent doors opening when the cylinder is pressurized or filled with preservative: – provide independent backup protection, – install independent indication and/or alarm/interlocks between the cylinder door and the control point (where the door is not visible from the control point). • Design to facilitate drainage of excess preservative.
Piping and recycle systems	• Design an overall system that is effective at containing and recycling all chemicals with minimum potential for release and dispersal and minimum infiltration of water. • Select and install piping as per Table 4.
Sumps	• Provide leakproof design (e.g. impermeable surfaces, sealed joints). • Provide a tertiary containment for sumps (e.g. steel lining or other suitable materials or devices) in addition to the concrete containment and impermeable liner or coating. • Provide overflow protection if sump is not in containment area (e.g. install independent high-level alarms).
Process controls	• Design for simple, unambiguous operation (regardless of the degree of automation). • Establish a clear relationship between process controls and process functions in order to minimize operator error.

Table 8 Recommended Design Features for Freshly Treated Wood Drip Areas

Design feature	Recommendations
Objectives: ◊ To minimize losses of preservative chemicals from treated wood to the environment by: - providing adequate controls to ensure minimization of preservative drippage prior to removal to unprotected storage areas, - controlling the generation and disposal of contaminated runoff waters.	
General design	• Consider integrated design provisions for: – shelter from precipitation, dust, debris, – efficient drip and runoff collection and containment, – surface drainage and return of fluids to process with minimum dispersal from tracking by personnel and vehicles.
Drip area	• Provide a sufficiently sized and contained area to hold all freshly treated wood until visible dripping ceases. • Roofing, as an alternative to collection and treatment of contaminated waters, might be necessary in areas of high precipitation.
Containment	• Provide impermeable and curbed charge unloading and drip areas, sloped to enable collection and storage of all runoff and infiltrating precipitation (for reuse or controlled discharge under terms of existing regulatory standards). • Provide drip areas with either an impermeable top coating on floors and dykes/berms or a liner underneath.

Table 9 Recommended Design Features for Treated Wood Storage Areas

Design feature	Recommendations
Objective:	To minimize and control releases of contaminated surface waters from treated wood storage areas.
Storage areas	• Where applicable, fix the preservative prior to yard storage. • Store treated wood under roof or wrap and provide impermeable flooring where continuing dripping or leaching may cause excessive runoff or ground contamination. • Elevate treated wood packages above the ground by placing them on supports to avoid treated wood contact with runoff water. • Maintain minimum inventories of treated wood. • Segregate treated wood storage areas from uncontaminated runoff water to minimize the need for water treatment and/or recycling. • Locate unsurfaced ground storage areas away from surface waterbodies. • Routinely monitor contaminant levels in storage area runoff. • Evaluate options for storage area surfaces on the basis of factors such as groundwater, usage, probability of bleeding/leaching and expected levels of precipitation (large paved areas will result in large quantities of runoff waters but may be necessary if groundwater is used for drinking water supply). As per the National Fire Code of Canada (19): • "yard storage areas shall be separated from mill operations and other structures by an acceptable clear space permanently available for fire-fighting operations." • "storage site shall be maintained free of combustible ground vegetation including grass and weeds for at least 4.5 m from the stored material and at least 30 m from bush or forested area." • "lumber treated with combustible liquids shall be stored in piles separated from other stored material, . . . not less than 4.5 m." • "at least two fire department access routes shall be provided."

8 Operational Recommendations

In addition to the design objectives described in section 7, a preservation facility must develop operating procedures to protect both workers and the environment from harmful exposure to preservative chemicals. The protective measures recommended in this document must be used in conjunction with those provided on the pesticide labels issued by the Pest Management Regulatory Agency (PMRA) under the *Pest Control Products Act*. The operating procedures should:

a) minimize direct contact of personnel with wood-preserving chemicals;
b) minimize releases of chemicals to the environment;
c) facilitate clear and accurate definition of responsibility and action when emergency response is required.

Recommended operating practices are presented in Tables 10 to 13 and include:

- general practices (Table 10);
- procedures for handling and storing chemicals (Table 11);
- practices for operating process systems (Table 12);
- practices for maintenance, cleanout and shutdown of preservation systems (Table 13).

The recommendations may not be the sole options available to attain the objectives. Alternative approaches may be equally effective or more suitable in view of site-specific conditions. When programs are developed for a particular facility, the specific recommendations may be modified if it can be demonstrated that an alternative approach, more suitable to plant-specific conditions, would be equally effective in attaining the objectives.

It is recommended that all existing and new wood preservation facilities meet the objectives outlined in Tables 10 to 13 by implementing the practices or their equivalents. Detailed operating procedures for each facility should be incorporated into a written operations manual available to all personnel. Responsibility and accountability for implementing procedures should be clearly assigned to supervisory personnel and to workers.

Table 10 Recommended General Practices for Operating Wood Preservation Facilities

Operation	Recommendations
Personnel	**Objective:** To enhance worker protection by providing education and medical surveillance.
	• Train all forepersons, on-scene supervisors, operators and handlers in good work practices. • Provide periodic review and update of education and training. • Provide pre-employment medical checkup and annual ongoing medical surveillance (see section 5).
Procedures	**Objective:** To assure that worker responsibilities are well understood, and that site-specific procedures are available in hard copy for reference.
	• Prepare (and have readily available) explicit written instructions for all aspects of chemical use, facility operation, maintenance and emergency response. • Identify and communicate precautions for all other on-site handlers of treated wood (including quality control personnel, sorters and transporters).
Signing*	**Objective:** To assure clear and accurate signing of all wood preservation use areas.
	• Identify the contents of all tanks (e.g. CCA work tank, PCP oil storage tank). • Identify the function of each tank (e.g. concentrate tank, work tank). • Prominently display personnel safety precautions and first aid procedures. • Prominently display emergency response procedures. • Prominently display emergency telephone numbers for medical aid, facility management, local environmental control agencies.
Personal hygiene and safety precautions	• Follow precautions outlined in section 5, Table 1.
Housekeeping	**Objective:** To maintain a clean, orderly site.
	• Define and practice regular housekeeping standards (suggest daily). – contain all contaminated debris, – minimize generation and accumulation of wastes, such as empty drums and containers (provide secure designated storage or dispose of in the appropriate manner). • Visually inspect for, record and report leaks routinely as defined in the facility's procedure manual (preferably daily). • Contain and repair leaks promptly.
Record keeping	**Objectives:** ◊ To provide a secondary level of control for chemical losses. ◊ To enable a rapid assessment of potential hazards, in the event of a catastrophic incident (e.g. tank rupture, fire).
	• Maintain accurate daily records for: – chemical delivery, use and inventory, – equipment condition and maintenance. • Record and compare bulk tank volumes before and after facility shutdowns in excess of two days. – if changes in volume are apparent, check for tank leaks and/or irregular practices.

*All signing is preferably done in accordance with workplace hazardous materials informations system (WHMIS) requirements. (Note: At this time, wood preservation chemicals are not yet included under WHMIS legislation.)

Table 10 Recommended General Practices for Operating Wood Preservation Facilities (continued)

Operation	Recommendations
Spill response	**Objective:** Maintain a state of readiness to implement the plan in case of a chemical spill.
	• Establish a spill contingency plan (section 12.1). • Carry out spill response drills.
Firefighting	**Objective:** To maintain a state of readiness in case of fire emergency.
	• Establish a fire contingency plan (section 12.2) and maintain a state of readiness to implement the plan in case of fire emergency (including routine checks of the pressure and proper function of firefighting equipment; drills with all affected personnel in cooperation with the local fire department). • Communicate with the local fire department about chemicals in storage and use and emergency procedures. • When a fire alarm call is made, notify firefighters of chemical quantities in stock and verify the status quo of storage locations. • Provide self-contained breathing apparatus for all personnel exposed to smoke. (Only trained firefighting personnel should be allowed at the fire scene.) • Make advance preparation to contain and properly dispose of contaminated fire residues to the greatest degree possible. – runoff water, soot and ash from fire areas are presumed to be contaminated and provision should be made to contain these residues, – analyze fire residues and involved ground soils (as applicable) to determine the need for and scope of special cleanup and disposal activities, – dispose of contaminated firefighting waters as “contaminated runoff,” – dispose of solid treated wood fire residues as “contaminated solid wastes.”

Table 11 Recommended Operating Practices for Chemical Handling and Storage

Operation	Recommendations
Unloading chemicals	**Objective:** To assure that unloading of treatment chemicals occurs in a safe manner as per section 4 of the National Fire Code of Canada (24).
	• Assure that the delivery of preservation chemicals to the plant is undertaken by personnel who are trained in emergency response procedures (as required by Transportation of Dangerous Goods Regulations). • Assure that personnel with recognized first aid training are on-site at the plant during the unloading procedure (personnel can include the truck driver). • Assure that ready access to emergency advice and aid is available during all chemical unloading periods. • Restrict access to the unloading area during chemical transfer operations. Prohibit nearby pedestrian or vehicle traffic.
Preparation of wood preservation solutions	**Objective:** To assure worker safety during handling of treatment chemicals.
	• Follow the personnel safety precautions for all procedures (Table 1). • Avoid inhalation, ingestion or skin or eye contact with all preservative chemicals. • Thoroughly empty and clean preservative containers (if applicable): – recycle rinse water (for water-borne formulations), – return containers to suppliers or reuse sound containers for storage of wastes, – dispose of unusable containers only in landfills specifically approved for such disposal (section 9).
Storage of wood preservation chemicals	**Objective:** To assure that all preservative chemicals are safely stored.
	• Assign responsibility for storage areas to trained personnel. • Label storage tanks, identifying contents by chemical name, type of solution and concentration: e.g. CCA concentrate (50%), CCA work solution (1% to 4%). • Place chemical identity placards, fire or spill emergency response procedures, personnel safety precautions and first aid procedures at storage room entrances. • Check and maintain the integrity of storage tanks and storage containers: – clean up all leaks or spills and implement remedial actions immediately. • Provide secure storage areas; restrict access to authorized personnel only.

Table 12 Recommended Operating Practices for Process Systems

Operation	Recommendation
Routine checks	Objective: To define procedural practices that will enhance environmental and worker safety.
Worker safety	Follow all precautions listed in Table 1.
Work solutions	• Regularly check and record quantities of treatment solution in storage. • Test and record solution strengths at regular intervals. • Ensure that solutions do not become excessively contaminated.
All process components	• Visually check the complete system for leaks: take immediate action to stop leaks. • Check sludge levels in retorts: clean out as appropriate, in accordance with facility policy, observe personnel safety precautions (see Table 1).
Tank vents	• Test tank vents to assure the absence of blockage (suggest once/month).
Charges	• Secure loads to avoid uncontrolled floating and jamming. • Stack loads to allow good drainage of preservative from all wood surfaces after treatment.
Treating cylinder	• Check door seals for damage and wear: replace door seals at regular intervals or as required if damaged or worn. • Check cylinder doors for proper seal after loading charges: ensure that all bolts on doors are securely fastened or that the hydraulic collar has moved to its regular endpoint.
Recycle systems	• Check filters: clean or replace if necessary.
Trams	• Clean soil and debris from trams to prevent contamination of the preservative. • Use tram design that will facilitate ready drippage during “drain” stage. • Thoroughly clean trams before alternative preservative treatments are used.
Checks during treating	Objective: To monitor the treatment system to quickly identify potential/actual problems.
System integrity	• Closely monitor process systems for leaks during initial stages of treatment. • Check for leaks or abnormal conditions throughout pressurized system at least once per shift or once per charge (whichever is more frequent). • Compare recording instrument readings with indicating gauges and thermometers. • Note malfunctions of recording devices, thermometers, gauges (including level floats) and arrange for prompt repairs. • Carefully observe pressures during treatment to make certain that maximum limits are not exceeded (maintain records of treatment cycles, tank gauge readings and chemical consumption). • Define (in writing) operator actions for abnormal situations of concern (e.g. response to equipment breakdown).
Post-treating checks	Objective: To prevent worker contact with treatment solution and with freshly discharged loads.
Retort opening	• Ensure that retorts cannot be opened when liquid and/or pressure remains. • Avoid breathing preservative mists. If airborne concentrations are unknown or are at or above TLVs, wear an approved respirator. • Wear goggles during retort door openings.
Charge removal	• Wear impermeable gauntlets during handling of freshly treated charges. • Pull charges only when the superficial excess preservative has sufficiently drained and the charges are essentially drip-free.
Load jams	• Follow standard regulatory safety procedures for tank entry. • Do not enter retorts until purged with fresh air (and cooled): if retort TLV levels exceed regulatory values or the concentration is unknown, then the attendant entering the cylinder must wear a self-contained full-face respirator mask, impermeable coveralls, boots and gauntlets, if TLV levels are below regulatory limits; wear NIOSH-approved respirator, impermeable coveralls, boots and gauntlets. • Assure presence of and constant communication with a standby attendant. • Shower immediately after tank entry.

NIOSH = National Institute for Occupational Safety and Health.

Table 13 Recommended Operating Practices for Maintenance, Cleanout and Shutdown of Treatment Systems

Operation	Recommendations
Equipment maintenance	**Objective:** To assure that equipment is maintained in a manner that will minimize releases of preservative chemicals and minimize worker exposure to them and their by-products.
	• Maintain all equipment in good operating condition. • Comply with National Fire Code of Canada 4.4.11 recommendations for maintenance. • Consider preparing explicit written maintenance procedures with assigned responsibility and accountability. • Follow all personnel safety precautions during maintenance procedures (Table 1). • Drain and/or clean wood preservation chemicals from equipment prior to maintenance: – equipment should be flushed thoroughly with water, with reuse of the water for work solution preparation (where applicable). • Use extreme caution if contaminated equipment must be welded (toxic fumes can be generated): – thoroughly clean surfaces to be welded, – wear an approved respirator when welding equipment contaminated with preservatives or their components, – provide good ventilation in the work area, – contain all sparks and remove flammable materials from the repair area.
Cleanout	**Objectives:** ◊ To prevent accumulation of preservative solutions and sludges within the treatment system. ◊ To assure worker safety during cleanout operations.
	• Observe personnel safety precautions during all procedures (Table 1). • Wash down and/or scrape drip pads at regular intervals to prevent accumulation of preservative residues. (The cleanup frequency should be determined by site-specific factors including the probability of worker exposure, vehicle traffic and washdown by rain.) – if possible, recover and reuse drainage from drip pads (or provide appropriate treatment or disposal). • Provide appropriate treatment for washwater (if applicable). • Routinely inspect sludge levels in storage and mix tanks and clean out if necessary. – during cleanup, inspect gauge floats or similar equipment within tanks. • Routinely inspect treatment cylinders for sludge accumulation and clean if necessary: – purge cylinders with fresh air sufficiently to permit entry, – if airborne concentrations are unknown, at, or above TLVs, the attendant must wear self-contained breathing apparatus, impermeable gloves, boots and coveralls, – a standby attendant must always be present and continuous communication must be provided, – follow standard safety procedures for entry of confined spaces, – prevent skin contact with sludges, – collect, drain and store contaminated material in sealed drums pending disposal (Table 4), – the attendant must shower immediately after cleaning retorts or tanks.
Alarms	• Test all alarms and safety devices at regular intervals (as specified by the manufacturer).
Long-term shutdown	**Objective:** To assure orderly shutdown prior to long-term closure.
	• Thoroughly clean all equipment that has been in contact with preservatives. • Collect all solvents and washwaters generated by cleanup operations (Table 4). • Hold solutions in closed tanks for prolonged shutdown: – drain all open tanks or sumps to closed storage tanks, – assure that temperatures in storage areas are above freezing levels or provide adequate freezing protection for all stored liquids. • In case of permanent shutdown, arrange for reuse of treatment solutions at another facility; reuse is preferable to disposal.

9 Process Emissions

The preservation of wood in treatment facilities generates liquid and solid wastes and may also produce emissions to the air. There are numerous approaches available for control, treatment and disposal of process wastes and emissions. Due to the specific characteristics of the various preservatives, designs and operating procedures for pressure or thermal facilities, the issues are generally specific to individual facilities.

Information on wastes and emissions for each type of facility, as well as their recommended disposal practices, are contained in Part II - Preservative-specific Information and Recommendations.

10 Emission and Site Monitoring

Site monitoring and assessment is recommended at wood preservation facilities, in accordance with the design and operating objectives described in this manual, to verify that chemicals are being properly managed at the site and to achieve environmental and worker health protection. Furthermore, archiving of the assessment records will provide an orderly evaluation of site decommissioning activities, if a plant shutdown does occur.

Environmental monitoring requirements for most facilities would normally be developed in consultation with the provincial environmental regulatory agency. Additional consultation with Environment Canada would be required if the facilities were to affect federally managed resources (e.g. facilities located on or adjacent to Indian lands, or adjacent to waters used by

anadromous fish, such as salmon). Worker health monitoring programs may be developed in consultation with the provincial workers' compensation board and/or department of labour.

The level of detail and scope of these monitoring activities depends on site characteristics, facility design and the regulatory requirements. Components of a site environmental and worker exposure and health monitoring program are suggested in Tables 14 and 15.

Table 14 Recommended Routine Environmental Monitoring

Item	Recommendations
Authority/reporting	• Develop a site-specific monitoring plan. • Define reporting requirements. • Re-evaluate the plan if the facility expands or changes the design or operating practices.
Soils	• Consider implementing a soil monitoring program (with emphasis on unsurfaced grounds) including: – all areas where preservative chemical is routinely stored, processed or handled, – all freshly treated wood storage areas, – all treated wood storage areas, – drainage ditches or areas exposed to surface runoff (including overflow from drip pads and paved areas). • Define sampling frequency (e.g. annual), sample type (e.g. surface, core), and required analyses (e.g. constituents, detection levels, quality control) in consultation with the regulatory agency.
Surface waters	• Consider implementing a monitoring program for adjacent waterbodies: – define monitoring frequencies and required analyses (e.g. constituents, detection levels, quality control) in consultation with the regulatory agency, – define concentrations of concern.
Groundwaters	• Consider implementing a groundwater monitoring program using permanent monitoring points down-gradient of uncontained process areas and treated wood storage areas: – define well construction, – define sampling frequencies and required analyses (e.g. constituents, detection levels, quality control). • Give special attention to on-site wells used for drinking water.
Air emissions	• Identify air emission sources using data provided in workplace exposure study (Table 15). • Monitor air emissions as required by emission permits.
Liquid waste streams	• Identify liquid waste discharges (including stormwater runoff): – determine concentrations of preservative constituents, – estimate total mass rates of emissions (suggested). • Thereafter, monitor as required for all discharges governed by permits.

Table 15 Recommended Routine Workplace Monitoring

Item	Recommendations
Authority/reporting	• Develop a facility-specific plan, preferably in consultation with the regional workers' compensation board. • Define reporting formats.
Contact exposure	• Identify existing and potential sources of skin exposure by periodic walk-through inspections.
Air inhalation exposure	• Define an initial monitoring program (e.g. sampling techniques, frequency of sampling, etc.), preferably in consultation with the regulatory agency responsible for worker safety. • For the purpose of defining worker health protection measures, provide an initial evaluation of peak and average levels of preservative constituents in air at significant points of worker exposure. Include areas such as: – cylinder doors (openings), – kiln interiors, – all vents to exhausts that discharge to enclosed work areas, – receiving areas for all vents/exhausts that discharge to areas frequented by personnel, – all enclosed preservative process areas, – areas adjacent to freshly treated wood storage. • Provide for subsequent monitoring, if required by regulatory agency. • Make personnel samplers available for spot monitoring (as required) if high emission levels are suspected.
Biological monitoring	• Conduct initial screening medical exams to identify sensitive individuals (section 5). • Define a schedule for: – medical exams to confirm the absence of symptoms or signs of exposure to preservative constituents, – biological monitoring of workers for preservative constituents (e.g. arsenic concentration in urine).

11 Transportation of Preservative Solids, Solutions and Wastes

The transportation of preservative solids, solutions and the wastes generated by their use is regulated under the federal *Transportation of Dangerous Goods Act* (TDGA) and the *Canadian Environmental Protection Act, 1999* (CEPA 1999). The acts do not apply to the transportation of lumber and forestry products treated with preservatives or to treated wood wastes. The regulation of intraprovincial movement of dangerous goods is a provincial responsibility.

Transported dangerous goods must be classified according to the TDG regulations. The local Transport Canada office should be contacted for classification requirements for preservative solids, solutions and the wastes generated by their use. The treating company has to be aware that all preservatives and preservative wastes require transportation that conforms to regulations set out under the TDGA and CEPA 1999. These regulations cover, amongst others, packaging, shipping documentation, interprovincial and Canada–U.S. shipments, labeling and placarding and the reporting of dangerous occurrences.

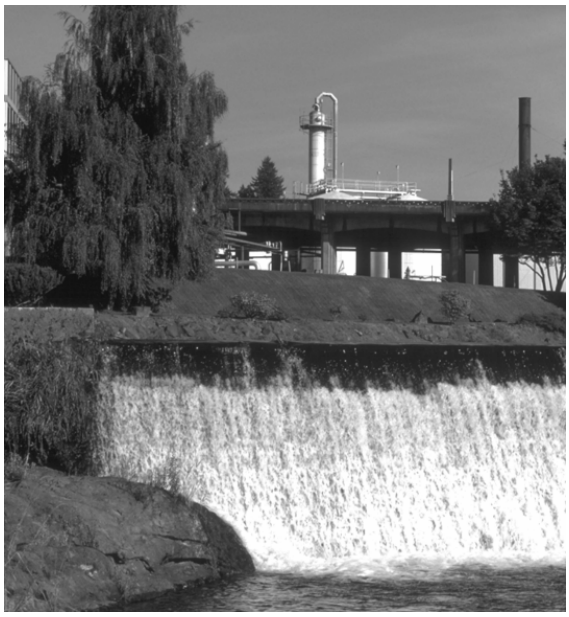
Table 16 suggests more specific transportation procedures for preservative chemicals, which are based on good operating practice and which complement the regulations. It is the intent of these control measures to minimize the potential for accidental release in transit and to provide an effective mechanism for safely managing spills if they do occur.

Table 16 Recommended Transportation Practices for Preservative-Containing Solutions or Wastes

Feature	Recommendations
Container specifications	• Containers for transporting preservatives must be: – free from mechanical defects, – protected against physical abuse, – filled and closed in the manner prescribed for wood preservatives by the Regulations for the Transportation of Dangerous Commodities by Rail, 1986, as amended, published by the Canadian Transport Commission.
Container labelling	• Comply with TDG Act label requirements. • Affix the proper labels to each container. • Label each container on at least two sides.
Vehicle placarding	• Affix vehicle placards for the class and quantity of material shipped as designated by the TDG regulations. Note: Vehicles carrying preservative-treated commodities need not be placarded.
Securing vehicle loads (e.g. drummed wastes)	• Replace drum spouts with leak-proof bungs prior to transit. • Strap drums or blocks vertically to pallets. • Strap drums or blocks horizontally to each other. • Brace or tie down loads to prevent shifting (do not rely on the vehicle floor or sides to prevent shifting). • Ensure a stable load consistent with the vehicle floor strength. • Secure other load items to prevent drum or wrap punctures and to prevent abuse to blocks.
Responsibilities of truck driver, ship captain or railroad crew	• Know the nature of the load. • Carry suitable emergency equipment and be trained in its proper use. • Know and follow correct procedures for the reporting of accidents or spills: – immediately telephone the 24-hour contact identified in the shipping manifest, – if more than 5 kg is spilled, also telephone the emergency contact, – know and comply with any other requirements of the shipper/manufacturer. • Immediately replace lost or damaged placards or labels (carry spares). Notify the receiver of goods that preservative materials are in transit.(Note: Some provinces allow only licensed carriers to transport hazardous wastes.)
Loading procedures	• Ensure that personnel have the means and ability to transfer bulk materials safely. • Assure that all procedures involving transfer of oil or other flammable preservative solutions are in accordance with section 4.11 of the National Fire Code of Canada. • Set vehicle handbrakes securely and place wheel blocks prior to unloading. • Assure the presence of a person who knows the hazards of the preservative and who is trained and prepared to respond to spills and other emergencies. • If leakage or spillage occurs, decontaminate the vehicle prior to returning it to service. • Dispose of absorbents and spill cleanup materials as per the appropriate tables in Part II for specific preservative systems.
Shipping documents	• TDG regulations stipulate a shipping document (products) or a manifest (wastes).

TDG = Transportation of Dangerous Goods.

12 Spill and Fire Contingency Planning



Facilities using preservative chemicals should prepare a detailed contingency plan to ensure that response to spills and fires is safe and effective. Although the details of a contingency plan are facility-specific, the following provisions are typical of most spill contingency plans. A generic spill and fire contingency plan is available from the Canadian Institute of Treated Wood (CITW). This can be adapted to individual plant conditions. It is recommended that the individual facility plan be filed with the authority and/or municipality having jurisdiction.

12.1 Spill Contingency Planning

12.1.1 General Components

A contingency plan should:

I. Have policy, purpose and organizational structure.
II. Be geared to the most probable spill size.
III. Address the following phases of spill response:
    a. discovery and notification;
    b. evaluation and initiation of action;
    c. containment and countermeasures;
    d. cleanup, mitigation and disposal;
    e. documentation and cost accounting.
IV. Clearly assign duties and roles to responsible personnel and organizations.
V. Outline equipment requirements for spill control.
VI. Include procedures for updating the plan on a scheduled basis.
VII. Outline training needs for plant personnel in prevention and response.
VIII. Coordinate with other chemical spill prevention plans and procedures if appropriate.
IX. Be submitted to chemical suppliers and the cleanup consultant or contractor for review.
X. Subsequently be submitted to appropriate government agencies including the local fire department for review.

12.1.2 Implementation Capability

A contingency plan should:

I. Describe location, capability and limitations of cleanup and containment equipment.
II. Pre-arrange for use of the best available cleanup and containment equipment.
III. Identify detailed response options and strategies.
IV. Provide for training programs and regular practice sessions.
V. Identify communication requirements with police, fire departments and regulatory agencies.

VI. Describe how communications will be maintained among all parties during response operations.
VII. Describe steps to be taken as a routine precaution against spills.
VIII. Address human safety issues.
IX. Assign selected personnel to respond to public and media calls.
X. Provide for sampling of and data collection about runoff waters.

12.1.3 Environmental Protection and Other Liability Risks

A contingency plan should:
I. Identify high-risk areas and operations.
II. Discuss expected chemical and physical behaviour of spill materials.
III. Identify and prioritize sensitive environments for protection.
IV. Detail specific actions planned for minimizing damage to resources.
V. Define explicit standards for the components and extent of effective cleanup.
VI. Include provisions for responding to spills under all anticipated weather conditions.
VII. Pre-arrange all response capability needed for the estimated worst case spill.

12.1.4 Examples of Action Steps

Safety of people is a prime concern. If a spill occurs:
I. Stop the flow of preservative solutions or any liquids containing preservative components:
   a. use common sense;
   b. act quickly;
   c. shut off pumps, close valves, etc., if this can be done without risk;
   d. if applicable, shut down mechanical production systems first (e.g. lumber movement) to prevent injury.
II. Warn people in the immediate vicinity:
   a. do not allow unauthorized personnel to enter the area;
   b. provide proper protective equipment for on-site personnel;
   c. avoid any contact with skin, eyes, clothing or shoes.
III. Contain the spill:
   a. act promptly;
   b. block off drains, culverts and ditches;
   c. surround spilled material with earth, peat, straw, sand, booms or commercial sorbents;
   d. use a liquid-recovery type vacuum cleaner (or empty cylinder and vacuum pump) for recovery of pools.
IV. Obtain assistance as needed from:
   a. company personnel (advise at earliest opportunity);
   b. chemical suppliers;
   c. fire/police/public works/highways department/contractors (depending on the situation).
V. Notify applicable government agencies:
   a. prompt notification is especially important for spills that have entered or may enter receiving waters;
   b. spills to marine waters require contact with Environment Canada;

c. spills to waterbodies with anadromous fish or spills on or adjacent to Indian lands require contact with Environment Canada and the provincial emergency program office;
d. for all other spills, contact the provincial emergency program office.

VI. Commence recovery, cleanup, restoration action:
a. recover pools using vacuum systems and contain recovered liquid for reuse;
b. use an inert absorbent to complete cleanup;
c. carry out cleanup and disposal in consultation with provincial and federal regulatory personnel.

12.2 Fire Contingency Planning

Not all preservatives or their components are flammable, and they may behave differently in fires depending on their physico-chemical characteristics. All preservative substances can emit toxic fumes during fires. The contingency plan recommendations made here are of a general nature. More information on contingency planning for specific preservatives can be found in Part II - Preservative-specific Information and Recommendations.

12.2.1 General Components

A fire contingency plan should:

I. Be prepared in consultation with local fire authorities.
II. Describe policy, purpose and organizational structure.
III. Assure that creosote, petroleum oil solutions (including PCP/oil solutions) and other flammable liquids are stored as per the National Fire Code of Canada (18).
IV. Be geared to the most probably affected area.
V. Address the following phases of fire response:
a. discovery and notification;
b. evaluation and initiation of action;
c. cleanup, mitigation and disposal;
d. documentation and cost accounting.
VI. Assure that proper fire extinguishing agents are available in adequate quantities.
VII. Clearly assign duties and roles to responsible personnel and organizations.
VIII Include procedures for updating the plan on a scheduled basis.
IX. Coordinate with other fire prevention plans and programs as appropriate.
X. Be submitted to local fire department for review.

12.2.2 Action Steps

Fire contingency plans and defined action steps will be site-specific. Nonetheless, an overall strategy should include provisions to ensure that:

I. Water can be used to cool fire-exposed containers.
II. Appropriate firefighting media are available.
III. Firefighters are protected from dusts, gas and smoke emissions by the use of respirators.
IV. An evacuation plan is prepared for populations with potential exposure to the smoke plume.
V. Contaminated runoff waters are contained.
VI. The provincial emergency program office is notified if runoff waters could have entered receiving waters.

13 Solid Wastes and Sludges

The manufacture of treated wood generates solid wastes and sludges that require careful handling and eventual disposal (see recommendations in Table 17). Preservative- and operation-specific characteristics determine the types of wastes that may be generated and the procedures to handle them. Wastes may include wood debris, treated or untreated, such as cut-offs and broken sections of product, as well as contaminated filters, wraps, solution precipitates and sludges periodically removed from sumps, cylinders, tanks and containment areas. Other wastes are sludges from wastewater treatment processes (e.g. flocculated material) and contaminated soils. The principles of waste minimization and the recovery and reuse of preservatives should be practised to the utmost to limit the volumes of waste at the plant.

A provisional code of practice for the management of post-use treated wood has been prepared by the Hazardous Waste Task Group of the Canadian Council of Ministers of the Environment (19). This would also apply to treated waste wood from preservation plants.

Table 17 Recommended Practices for Handling Solid Wastes and Sludges

Feature	Recommendations
Objective: To minimize and safely process plant wastes.	
Minimization	• Appropriately condition wood prior to treatment. • Avoid the introduction of debris, soil, snow, ice and other foreign matter from wood and trams into the treatment vessel. • Keep the treatment solution clean and ensure that solution concentrations and component balances are in accordance with acceptable standards (CAN/CSA 080). • Minimize the frequency of switching from one preservative to another in a single treatment vessel: – avoid mixing trams, – thoroughly clean vessels, ancillary piping, etc., and trams prior to a switch. • Do not exceed the stipulated limitations of process parameters (e.g. temperature).
Collection	• To be carried out by personnel trained in potential chemical hazards and appropriate handling methods. • All personal hygiene and general precautions as outlined in section 5 must be followed. • Prescribed practice for vessel entry must be observed (see Table 13, Cleanout). • Collect, drain (where appropriate) and place wastes and sludges into sealed drums.
Storage	• Provide a roofed and paved enclosure to store all wastes.
Records/reporting	• Label all drums to indicate contents (type of waste). • Maintain current and complete records (inventory) for all solid wastes and sludges stored on-site (pending disposal). • Undertake all reporting and disposal activities in accordance with applicable regulations.
Transportation	• Classify waste in accordance with the *Transportation of Dangerous Goods Act*. • Follow all instructions as outlined in Table 16.

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Part II

Preservative-specific Information and Recommendations

CHAPTER H

Copper Azole (CA-B) Wood Preservation Facilities

Preservative-specific Information and Recommendations

This chapter must be used in conjunction with Part I -
General Background Information and Recommendations.

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1 Production and Use

Copper azole (CA-B) is a waterborne formulation that is delivered in concentrate form to wood preservation facilities. Copper azole was originally formulated in the mid-eighties in Europe to meet the demand of consumers requesting an alternative wood preservative. Variants of this formulation have been in commercial production in more than 20 countries worldwide.

The preservative is shipped to wood treating facilities as a concentrate by tanker truck. Agitation is required for the concentrate tank to maintain a homogenous solution. The concentrate is diluted with water to obtain a working solution.

CA-B is suited for treatment of refractory wood species, as well as all commercially used species. It is for use as a heavy-duty wood preservative in the treatment of wood products such as decks, patios, fencing, play structures, boardwalks, picnic tables, landscaping timbers, residential fencing and walkways. It is not currently recognized for use in salt water marine immersion applications.

CA-B and other preservatives, e.g. CCA, are incompatible and will cause chemical problems if used in a single treatment system. (It is therefore not recommend that CA-B be used in the same cylinder as other preservative systems, such as CCA, as an ongoing practice. CA-B solutions are basic in pH; whereas CCA, for example, is acidic. In any case where a switch is unavoidable, the situation would dictate complete flushing of one preservative from the cylinder, piping and pumps and all sumps and collection areas before introduction of the other preservative.

Table 1 CA-B Usage in Canada

Feature	Characteristics
Pest Control Products Act registration number	• 27132
Proportions of active ingredients	• Copper 9.25% Tebuconazole 0.37%
Delivery format	As a concentrate by tanker trucks or totes
Suppliers to Canadian facilities	Arch Wood Protection Canada Corp., Mississauga, Ontario
Estimated use quantity (2002)	Introduced in 2002, no figures yet available
Concentration of work solutions	0.4 to 5% as total actives
Typical preservative retention in treated wood	1.6 to 4.96 kg/m^3 treated wood (0.1 to 0.31 lb/ft^3)
Major products	Decks, patios, fencing, play structures, boardwalks, picnic tables, landscaping timbers, residential fencing and walkways

2 Physical and Chemical Properties

Copper and tebuconazole, the two active components of CA-B, are used because of their fungicidal and termiticidal properties and their ability to offer long-term protection in the wood. Ethanolamine is used as a solubilizing agent for the copper and is deposited in the wood cells. The physical and chemical properties of CA-B are outlined in Table 2.

Table 2 Physical and Chemical Properties of CA-B Solution

Identification		
Common synonyms: Copper azole Wolman® E (CA-B) Wolman® NB	Manufacturer: Arch Wood Protection Inc. (12 locations in the U.S.)	
Transportation and storage information		
Shipping state: Liquid concentrate **Concentration**: 9.62% by weight **Classification**: Corrosive liquids, n.o.s.	**Storage temperature**: Ambient **Inert atmosphere**: No requirement **Venting**: To plant exterior with overflow protection	**Containers/materials**: Carbon or stainless steel. No copper-based alloys **Labels and classification**: Check with Transport Canada
Physical and chemical properties		
Physical state: Liquid (20°C, 1 atm.) **Solubility**: Freely soluble in water pH @15°C: 9.5 to 11.0 **Vapour pressure**: N/E	**Floatability**: Soluble in water **Freezing point**: <-30°C **Flash point**: >93°C **Specific gravity**: 1.18 to 1.22 @ 22°C	**Colour**: Dark blue **Odour**: Negligible
Hazard data		
Extinguishing agents: Use water, dry chemical or other common extinguishing media. *Fire-fighting procedures*: Fire from a separate fuel source may be intense enough to cause thermal decomposition releasing toxic fumes and/or gases. Wear complete fire service protective equipment, including full-face NIOSH- and NFPA-approved* self-contained breathing apparatus. *Fire and explosion hazard*: Moderate fire and explosion hazard when exposed to heat or flame. *Combustible liquid*: May burn. Does not ignite unless there is an ignition source. Flammable, poisonous gases may accumulate in enclosed areas. Avoid contact with or storage with any of the incompatible substances listed in "Stability and reactivity" section of this table.	*Conditions contributing to instability*: Stable under normal conditions *Incompatibilities*: Oxidizers, strong acids, cellulose nitrates, sodium hypobromite, acetylene, hydrazine, nitromethane, aluminum and zinc *Hazardous reactions/decomposition/ combustion products*: Toxic or hazardous oxides of carbon and/or nitrogen *Hazardous polymerization*: Not known to occur	

**Do not weld on empty uncleaned containers.*
NIOSH = National Institute for Occupational Safety and Health. NFPA = National Fire Protection Association.

3 Environmental Effects

3.1 Distribution in the Natural Environment

Copper is found naturally in the environment. Typical background levels of naturally occurring copper are listed in Table 3. As with all metals, there is a wide range of naturally occurring concentrations of copper found in soil, and it is recommended that baseline levels be determined prior to operation of a facility using copper azole, to enable meaningful future environmental assessments.

Ethanolamine and tebuconazole are synthetically produced and are not naturally occurring; therefore all ethanolamine (MEA) and tebuconazole that may be found in the environment is expected to be from human-made sources.

Tebuconazole

Persistence: Tebuconazole degrades approximately 20% in water in Organization for Economic Cooperation and Development (OECD)Test Guideline 301C. Its half-life in soil is around 100 days.

Overall Ecotoxicity Statement, Tebuconazole: Tebuconazole is moderately toxic to aquatic organisms and has a slight potential to bioconcentrate, but it is rapidly eliminated from fish. While tebuconazole is slightly persistent in the environment it has been shown not to be mobile. In addition, light dramatically enhances the degradation process.

MEA in the Environment

Using certain known physical parameters of MEA, such as water solubility and vapour pressure, a computer simulation of the partition of MEA in the environment predicts that MEA should partition primarily into the aqueous component. It is expected to be mobile in soil and is not expected to absorb to suspended solids or sediment in water. MEA readily undergoes biodegradation and is not expected to persist in the environment. Twenty-day BOD values ranged from 40 to 67% biodegradation; a Modified Sturm Test showed 97% biodegradation in 28 days; and a Modified OECD Screening Test showed 94 to 99% biodegradation in 28 days.

3.2 Aquatic Toxicity

The guidelines and limitations for copper noted in Table 4 are based on total concentrations, reflecting the recommendations of many scientific reviews that indicate that the current state of knowledge does not enable water quality limitations to be based on either valence state or dissolved fractions in water (1).

Table 3 Background Levels and Canadian Limitations for Copper

Component	Typical background levels in environment	
	Surface waters (mg/L)	Soils (mg/L)
Copper (Cu) CAS # 7440-50-8	<0.001 to 0.04	2 to 100

Element guidelines	IJC Recommendations[(a)] Great Lakes waters	Canadian drinking water objectives[(b)]	Canadian water quality[(c)]
Copper	0.005 mg/L for the protection of aquatic life	Aesthetic objective[(c)] : ≤ 1.0 mg/L	For protection of aquatic life: 0.002mg/L hardness 0 to 60mg/L as $CaCO_3$ 0.003mg/L hardness 60 to 120mg/L as $CaCO_3$ 0.004mg/L hardness 120 to 180mg/L as $CaCO_3$ 0.006mg/L hardness >180mg/L as $CaCO_3$

a) Recommendations of the International Joint Commission to the governments of Canada and the United States, 1977.
b) The term "aesthetic objective" is defined in Federal-Provincial Subcommittee on Drinking Water , 1996 (2).
c) The aesthetic objective is taken from Health Canada's website, Healthy Environments and Consumer Safety [http://www.hc-sc.gc.ca/hecs-sesc/]. Summary of guidelines for Canadian drinking water quality, Table 2 Summary of guidelines for chemical and physical parameters http://www.hc-sc.gc.ca/hecs-sesc/water/publications/drinking_water_quality_guidelines/ch4.htm (accessed on March 23, 2004).
d) Guidelines consider local conditions (e.g. background levels) (3).

The observed chronic toxicity and acute toxicity values of copper for salmonid species are summarized in Table 4.

Table 4 Aquatic Toxicity of Copper

Element	Concentration (mg/L)	Effect
Copper (+2)	0.002	Avoidance Atlantic salmon (4)
	0.006 to 0.015	Cough-frequency increase brook trout (4)
	0.02 to 0.89 (depending upon water hardness)	96-h LC_{50}* rainbow trout

* LC_{50} is defined as that concentration that results in death of 50% of the fish population within 96 hours.

3.3 Aquatic Toxicity Testing for Tebuconazole

Acute effects: Fish: LC_{50} of 4.4 mg/L (96 hr) to trout; of 5.7 mg/L (96 hr) to *Lepomis macrochirus Daphnia*: EC_{50} of 4.2mg/L (48 hr) to *Daphnia magna*.

Acute toxicity to fish: LC_{50} to *Leuciscus idus* is approximately 3.5 mg/L (96 hr); LC_{50} to *Leuciscus idus* is approximately 8.7 mg/L (96 hr); and LC_{50} to *Salmo gairdneri* is approximately 4.4 mg/L (96 hr).

Acute toxicity to *Daphnia* sp.: EC_{50} to *Daphnia magna* is approximately 25 mg/L (24 hr); EC_{50} to *Daphnia magna* is approximately 11.8 mg/L (24 hr).

3.4 Aquatic Toxicity Testing for Ethanolamines

MEA is not expected to bioaccumulate in aquatic organisms with a log octanol:water partition coefficient (log K) of -1.23. MEA has demonstrated a relatively low degree of toxicity to aquatic organisms: the acute fish toxicity (LC) ranges from over 150 to over 300 mg/L (practically nontoxic); the acute *Daphnia magna* toxicity (EC) is greater than 100 mg/L (practically nontoxic); and the acute algae toxicity (LC) ranges from 1 to 10 mg/L (moderately toxic).

4 Human Health Concerns

Any chemical can be handled and used safely if proper precautions are taken by the workers involved. Abuse or noncompliance by workers or employees may result in excessive exposure.

Suggested measures for the wood preserving industry are as follows:

- use of clean and undamaged impervious (nitrile) gloves when handling treating solutions and freshly treated products, to reduce potential for dermal exposure (5);
- adequate worker education and good safety practices at all sites (6);
- proper eye, skin and respiratory protection (6).

Copper is found naturally in food, water and air. Estimated daily intake of copper oxide in the general population is 3 mg with no adverse health effects.

Table 5 Potential Health Effects of Exposure to Copper Amine Solutions

		Possible health effects	
Exposure category	**Type of exposure**	**Short-term exposure**	**Long-term exposure**
Properly protected worker	Minimal	None reported	None reported
Exposed worker with significant skin or eye contact	Skin or eye contact	*Skin*: Irritation, reddening *Eyes*: Irritation, pain and reddening	*Skin*: Ulceration, chemical burns, dermatitis *Eyes*: May cause blindness
Exposure to contaminated aerosols	Inhalation of vapours	Corrosive irritation or burns to nose, throat and lungs; wheezing; difficulty breathing; visual disturbances	Liver and kidney disorders, adverse lung effects, pulmonary edema, death
Ingestion	Ingestion of work solution or concentrates	Irritation and burns of the mouth, throat, esophagus and digestive system	May be fatal

Table 6 Potential Health Effects of Exposure to Tebuconazole Concentrate*

Exposure category	Type of exposure	Possible health effects	
		Short-term exposure	**Long-term exposure**
Properly protected worker	Minimal	None reported	Minimal
Exposed worker with significant skin or eye contact	Skin or eye contact	*Skin*: Non-irritating, *Eyes*: Non-irritating	*Skin*: None known *Eyes*: Toxic effects may result on the lens of the eye.
Exposure to contaminated aerosols	Inhalation of vapours	No known effects	No known effects
Ingestion	Ingestion of concentrate	Concentrate may be considered slightly toxic orally	Possible toxic effects on the spleen, liver and adrenals

* In the Wolman® NB concentrate, tebuconazole concentration is at 0.37%. Manufacturers data supplied is based upon a pure tebuconazole product. Workers will generally only come into contact with the working solution, which again is 0.37% of the diluted percentage of the working solution.

Table 7 Potential Health Effects of Exposure to Ethanolamine Concentrate

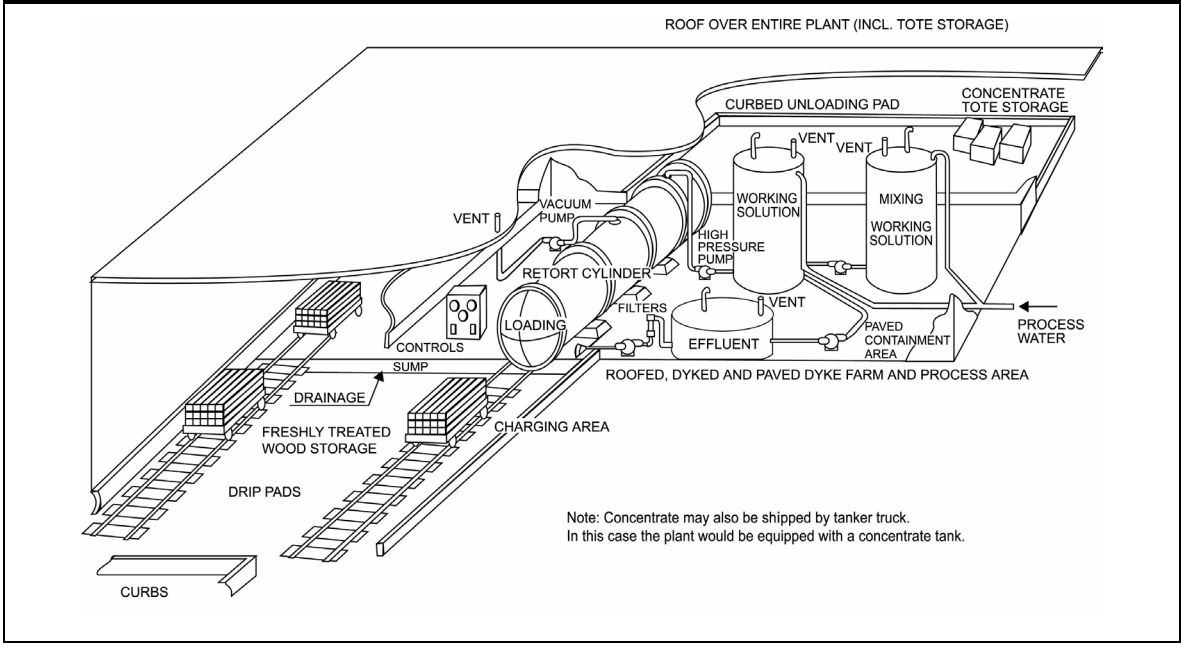
Exposure category	Type of exposure	Possible health effects	
		Short-term exposure	**Long-term exposure**
Properly protected worker	Minimal	None reported	Minimal
Exposed worker with significant skin or eye contact	Skin or eye contact	*Skin*: Irritating, *Eyes*: Irritating	*Skin*: May cause extreme dermal irritation *Eyes*: May cause severe injury to the eye.
Exposure to contaminated aerosols	Inhalation of vapours	Can be irritating	No known effects
Ingestion	Ingestion of concentrate	Concentrate may be considered slightly toxic orally	Possible toxic effects on kidneys and liver

5 Application and Potential Chemical Discharges at Copper Azole (CA-B) Wood Preservation Facilities

5.1 Application

CA-B working solution is prepared at wood preservation facilities by diluting the preservative concentrate with water to form a working strength solution of 1.0 to 5.0% actives. The working solution strength is determined by the desired treatment level to be retained in the wood. CA-B treating solution is applied by pressure treatment in a similar manner to CCA and ACZA (Figure 1). Vacuum and pressure cycles are varied depending on the wood species and size of the wood product being treated, such that they meet the desired standard (7) or specification.

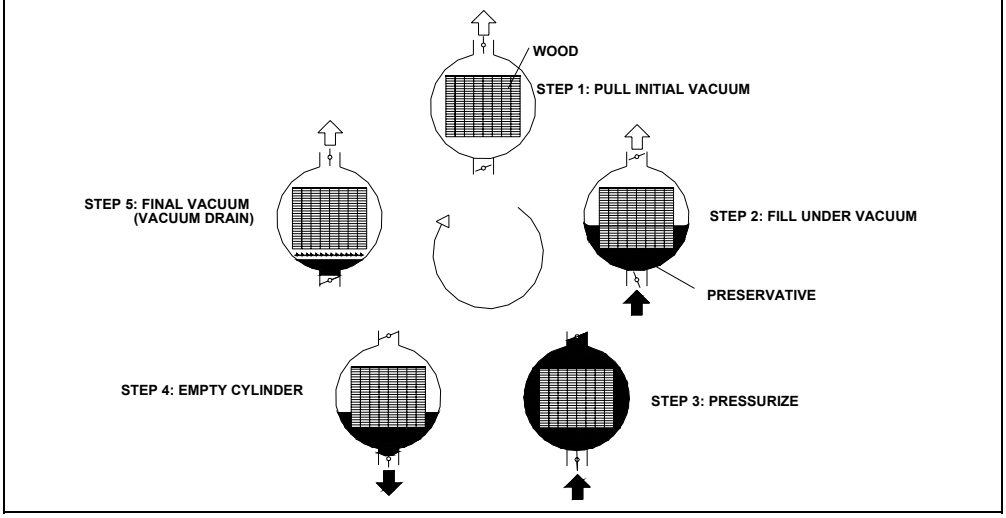
Figure 1 Conceptual Drawing of a Copper Azole Treating Plant



The treatment process used in CA-B treatment plants consists of the following basic steps. An initial vacuum removes air from the wood cells, and then the cylinder is filled with CA-B working solution. Once the predetermined pressure is attained, it is maintained until the desired treatment is achieved. Pressure is then released, the solution is transferred back to the work tank and a final vacuum is pulled to remove excess preservative solution. The wood is removed from the cylinder to a contained drip pad until dripping has ceased. The wood may then be either placed in the storage yard once fixation is complete or moved to an accelerated fixation chamber.

The specific treatment times and pressures are dictated by the species of the wood, the wood product, and the moisture content of the wood. A predetermined range of process parameters is defined by the applicable treatment standards (7), and quality control tests are carried out to ensure that a minimum treated product quality is maintained. The treated wood is stored on site until ready for shipment.

Figure 2 The Full-Cell CA-B Pressure Treating Process



5.2 Potential Chemical Discharges

CA-B wood preservation facilities vary in design and operating practices, which may cause differences in the nature of potential releases from any particular plant.

Liquid Discharges

Solution that drips from freshly treated wood onto drip pads will be reused in the closed system process. The following primary facility design features should be used for CA-B containment and reuse in the treatment process.

- All concrete containment surfaces must have a secondary containment, either by liners or coatings, and be adequately dyked. This applies to the chemical storage area, the cylinder area, the drip pad and any wet wood storage areas.
- A lined collection sump to receive residual preservative from the cylinder following the treatment cycle and the accumulated contaminated runoff from other containment surfaces. This material can then be used as make-up water for new mixes following filtration to remove dust and debris.

Under normal operating practices in a properly designed facility there should not be any contaminated liquid discharges. In the event an accident or spill does occur, the facility should be equipped to immediately clean up the contamination to prevent adverse effects to the environment, and at that time the facility may have to notify the authorities, depending on local regulations.

Once dripping has ceased, freshly treated lumber should be stored in the yard or under sheds. If incidental drippage occurs, the lumber must be returned immediately to the drip pad area until all dripping has been confirmed to have stopped. Immediate cleanup of the drippage should be initiated to prevent any potential for causing stormwater contamination or tracking.

Solid Wastes

Solid waste generation at CA-B facilities should be relatively small. During normal operating conditions solid waste sources are limited to filters, and to dirt and debris that is periodically scooped from the sump, cylinder and tanks. Treated wood debris and contaminated articles are another source.

Air Emissions

The use of an amine formulation at ambient temperature will have minimal tank emissions from normal operation. Typically no controls are necessary for ambient temperature solutions with the CA-B product. There should be no in-plant emissions from storage tank vents or vacuum pump exhausts, as these must be vented to the plant exterior with liquid-release protection.

The use of heated solutions may imply some potential for amine emissions at the CA-B facility if proper controls are not in place.

Potential fugitive emissions for amines based upon personnel and area monitoring at other facilities have been well below American Conference of Governmental and Industrial Hygienists (ACGIH) standards. (These include vapours released when cylinder doors are opened and from freshly removed wood charges). Personnel should still be monitored and appropriate (PPE) personal protective equipment employed where found necessary.

Potential Chemical Releases/Exposures from Wolman® NB Pressure Treatment Plants

- hose ruptures during the unloading of trucks
- overfilling of storage tank or tank failure
- piping failure
- damage of waste drum
- drippage from lumber that was removed from the drip pad too soon

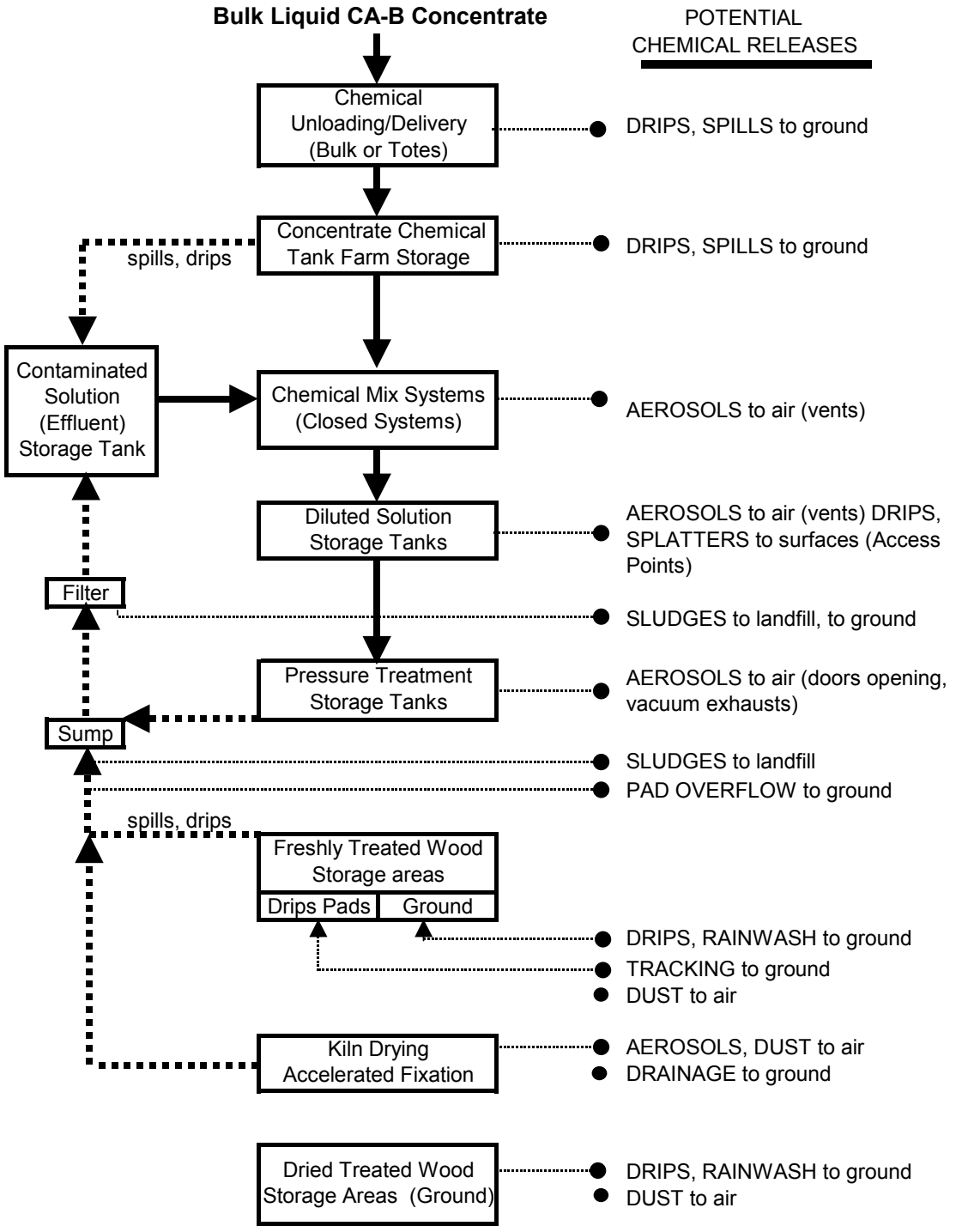
5.3 Potential Effects of Chemical Discharges

The actual impact of any chemical release depends on many factors including the location of the wood preservation facility relative to ground or surface waters, the amount and concentration of preservative released, the frequency of releases, and contingency measures in place at the facility.

There have been no documented environmental or worker health effects as a result of "normal" usage of CA-B preservatives at wood preservation facilities. However, improperly operated facilities have the potential to contaminate surrounding site soils and groundwaters to levels that exceed drinking water standards.

Human health effects for workers are minimized by the use of closed systems for concentrates and working solutions. The main source of potential contact with CA-B would be from improper handling of product.

Figure 3 Potential Releases from CA-B Pressure Treating Plants



6 Personnel Protection

6.1 First Aid

When exposure to a chemical occurs, the severity and speed of damage to human health depends on the concentration. Immediate response is required if a worker is exposed to CA-B concentrate solutions. Tables 8 to 11 outline first aid measures for exposure to CA-B and its constituents.

Table 8 First Aid for Exposure to CA-B Concentrate Solutions

Exposure	First action	Second action
Eye contact	• Immediately flush with large amounts of water for at least 15 minutes. DO NOT rub the eyes. If victim is wearing contact lenses, immediately flush eyes with water for a short period prior to removing contacts, then continue flushing eyes for at least 15 minutes.	• Immediately seek medical aid.
Skin contact	• Flush exposed skin with large amounts of water. Then use soap and water to clean area. Remove contaminated clothing. Immediately seek medical aid if severe irritation develops.	• Immediately seek medical aid.
Inhalation	• Remove from exposure. If severe breathing difficulty should arise, immediately seek medical aid. If breathing has stopped, administer artificial respiration or oxygen.	• Immediately seek medical aid.
Ingestion	• DO NOT induce vomiting. Seek medical aid immediately. Do not attempt to give anything to an unconscious person. Call a physician or poison centre.	• Call physician or poison control center for further advice. Get medical attention.

Table 9 First Aid for Exposure to CA-B Working Solutions

Exposure	First action	Second action
Eye contact	• Immediately flush with large amounts of water for at least 15 minutes. DO NOT rub the eyes. Immediately seek medical aid. If wearing contact lenses, immediately flush eyes with water for a short period prior to removing contacts, then continue flushing eyes for at least 15 minutes.	• Immediately seek medical aid.
Skin contact	• Flush exposed skin with large amounts of water. Then use soap and water to clean area. Remove contaminated clothing. Immediately seek medical aid if severe irritation develops.	• Immediately seek medical aid.
Inhalation	• Remove from exposure. If severe breathing difficulty should arise immediately seek medical aid. If breathing has stopped, administer artificial respiration or oxygen.	• Immediately seek medical aid.
Ingestion	• DO NOT induce vomiting. Seek medical aid immediately. Do not attempt to give anything to an unconscious person. Call a physician or poison center.	• Call physician or poison control center for further advice. Immediately seek medical aid.

First aid personnel should periodically verify up-to-date response measures by reviewing current material safety data sheets (MSDS) with chemical suppliers and/or industrial physicians.

6.2 Regulatory Controls

Most regulatory criteria established by worker protection agencies are based on the threshold limit values (TLVs) and biological exposure indices recommended by the American Conference of Governmental Industrial Hygienists (ACGIH).

Table 10 provides potential exposures and general recommendations for worker protection.

Table 10 Levels of Concern for CA-B Exposure in the Workplace

Route of entry	Basis for recommendation	Recommendations/comments
Skin and eye contact	CA-B concentrate – corrosive CA-B working solution – may be corrosive	• Protective measures should be used by workers in contact with CA-B solutions (Table 11). • Avoid direct contact of skin and eyes with all CA-B solutions and ingredients (10) • Sensitive individuals should take special care to avoid exposure. *Comment*: current material safety data sheets (MSDS) should always be readily available to workers.
Inhalation	ACGIH TLV time-weighted averages (TWA): Copper: 1 mg/m^3 air Amine: 8 mg/m^3 air	• Full face protection and good ventilation should be used during chemical unloading and open mixing operations. • Provide respiratory protection, eye protection and good ventilation: - during unloading and mixing operations and when removing charges of wood; - when welding contaminated equipment; - when CA-B mist or spray is present. • Self-contained breathing apparatus should be used for firefighting activities where CA-B is present. *Comments*: current MSDS should always be readily available to workers.
Ingestion	Literature reports a lethal dose level for copper $^{+1}$ of 1.5 to 3.5 g	Prevent ingestion of any quantity of CA-B solutions
Tebuconazole ingestion	Oral (LD_{50} acute oral rats active technical degree) LD_{50} oral, rate approx: 4000 mg/kg, air, 4 h of exposure. Inhalation (LC_{50} inhalation rats active technical degree) LD_{50} inhalation (dust) rat: more than 5000 mg/m^3. A concentration of dust of 5093 mg/m^3 caused no symptoms and no mortality.	If product is swallowed, rinse the mouth and drink water. If you feel unwell, seek medical advice. Individuals who have inhaled dusts should be taken out into the fresh air. If there is difficulty in breathing, medical attention should be obtained. Respiratory protection: in case of dust formation particle filter, P Type (1)

6.3 Safety Precautions

Following is Table 11, which gives safety recommendations for specific plant activities. Note that the pesticide label may prescribe additional or more stringent requirements for personnel protective equipment for various activities than is indicated here. These label requirements must be followed.

Table 11 Safety Precautions for Personnel Working with CA-B Solutions

Objective: To ensure safe workplace practices for each activity during the treatment process.	
Activity	**Recommendations**
Unloading bulk containers	• Wear protective apparel and equipment as specified by the appropriate component material safety data sheet (MSDS). • Prohibit foot or vehicle traffic between the point of delivery and the transport vehicle. • Ensure that at least two individuals trained in handling CA-B are present at all times during unloading operations (i.e. at least one person other than the truck driver; may include forepersons, supervisors and management employees). • Ensure that all connections are secure and leakproof. • Provide an emergency eyewash and shower in the immediate unloading area.
Unloading drums or totes	• Wear protective apparel and equipment as specified by the appropriate component MSDS. • Prohibit foot or vehicle traffic in the area. • Ensure that all connections are secure and leakproof. • Provide adequate equipment for safe, controlled handling of the containers.
Preparing CA-B work solutions	• Wear protective apparel and equipment as specified by the appropriate component MSDS. • Thoroughly clean and hose down the work area to containment area following solution preparation. • Dispose of debris and empty containers according to appropriate component MSDS. • Thoroughly clean protective equipment after use. Reuse all rinse waters for preparing treating solutions. • Provide an emergency eyewash and shower in the immediate area.
Sampling procedures	• Wear protective apparel and equipment as specified by the appropriate component MSDS. • Use sample containers approved for the application and any shipment. • Wash the outside of sample containers immediately after sampling solutions. • Wash hands thoroughly after all sampling operations
Cleaning cylinders or storage tanks	• Follow all standard precautions for vessel entry and confined space (as per provincial health and safety regulations). • Wear protective apparel and respiratory equipment as specified by the appropriate component MSDS. • Flush vessels as required to establish safe entry conditions or use an approved self-contained breathing apparatus prior to entry. • Always have a standby attendant present and observe regulations regarding lockout/tagout procedures for confined space entry. • Collect and store contaminated waste material in sealed and labeled drums. • Wash all protective equipment immediately after use. Reuse all rinse waters for preparing treating solutions. • Shower after completion of cleanup tasks.
Removing treated charges from cylinders	• Wear gauntlets during door openings and when moving loads of freshly treated wood. • Avoid breathing preservative mists. Wear an approved respirator if airborne concentrations are unknown or at or above TLVs.* • Wear impermeable** gloves.

Table 11 Safety Precautions for Personnel Working with CA-B Solutions (continued)

Objective: To ensure safe workplace practices for each activity during the treatment process.	
Activity	**Recommendations**
Handling treated lumber	• Wear impermeable** gloves, apron, boots and eye protection, if there is potential for getting splashed by CA-B solution.
Handling and maintaining contaminated equipment	• Thoroughly flush equipment with water prior to handling. Reuse all rinse waters for preparing treating solutions. • Wear impermeable** gloves, apron, boots and eye protection if there is potential for getting splashed by CA-B solution.
Welding	Welding can produce toxic fumes. In addition to the precautions for handling and maintaining contaminated equipment: • Obtain the specific approval of the plant supervisor before welding. Follow all standard precautions for vessel entry and confined space (as per provincial health and safety regulations). • Block or disconnect lines from tanks before initiating welding operations. • Completely drain and thoroughly rinse tanks or lines prior to welding operations. • Ensure that equipment is completely dry from cleaning solvent residues. • Wear a respirator or provide effective, local exhaust ventilation during welding to prevent potential exposure to toxic fumes. • Assure good general ventilation of the work area. • Comply with all additional provincial workplace safety rules.

* An initial workplace monitoring program will have determined the need for respirator use. The results of the program are assumed to be indicative of conditions in subsequent facility operations, unless procedural or design changes have occurred.

** Heavy-duty, lined polyvinyl chloride, vinyl-coated, neoprene, NBR or rubber.

Note that the pesticide label may prescribe additional or more stringent requirements for personnel protective equipment for various activities than is indicated here. These label requirements must be followed.

7 Design Recommendations

The tables in this section deal with good design features specifically relating to CA-B plants. These recommendations must be used in conjunction with the basic design criteria listed in Part I, Chapter A - General Background Information and Recommendations, section 7. Their objectives are:

- to prevent or reduce direct contact of personnel with CA-B chemicals;
- to reduce releases to the environment;
- to enable prompt response to abnormal events to ensure worker safety and environmental protection.

Tables 12 to 16 outline these recommendations. Figure 6 in Chapter A presents an overview of the following sections and may be cross-referenced in each subject area.

Table 12 Recommended Design Features For Chemical Storage Areas

(See also Part I, Chapter A - General Background Information and Recommendations)

Delivery format	Design feature	Recommendations
Bulk CA-B liquids: • Concentrate • Working solutions • Contaminated surface runoff • Drip return	**Chemical tank unloading area**	• Unloading area should be contained with impermeable floors and sump. Spill catchment materials should be stored in vicinity.
	Chemical unloading pump and backflow prevention	• Use backflow prevention and locking caps on chemical delivery lines.
	Fresh-water supply line	• Install backflow preventers on all incoming water lines. • Use top entry for water lines to tanks as secondary backflow prevention. • Waterlines must comply to local codes.
	Emergency response	• Provide accessible storage for spill-response equipment, absorbents and personnel equipment.

Table 13 Recommended Design Features For Chemical Mixing Systems

(See also Part I, Chapter A - General Background Information and Recommendations)

Chemical form	Design feature	Recommendations
CA-B bulk concentrate	**Location/shelter**	• Locate in a contained, enclosed, heated area, particularly if subfreezing temperatures are encountered during operation.
	Spill prevention	• Interlock high-level alarms to mix and process systems to prevent tank overflow. • Provide for safe usage of drummed materials (equipment, pumps, enclosures, etc.) with minimum worker exposure. • Provide all applicable features for “spill containment of bulk liquids”(Chemical Storage Area, Table 12).

Table 14 Recommended Design Features for Treatment Process Systems

(See also Part I, Chapter A - General Background Information and Recommendations)

Design feature	Recommendations
Ventilation	• Provide adequate routine and emergency ventilation to control preservative component vapour levels in all work areas.
Process emissions to air	• Vent all air emissions (including tank vents and vacuum pump exhausts) to the building exterior with appropriate safeguards to prevent escape of liquids to the environment.

Table 15 Recommended Design Features For Freshly Treated Wood Drip Areas

(See also Part I, Chapter A - General Background Information and Recommendations)

Design feature	Recommendations
Drip Protection	• Provide for sufficient contained and roofed storage area for freshly treated wood prior to application of accelerated or ambient fixation processes. • Provide completely contained and roofed drip area for material undergoing fixation at ambient conditions.
Fixation	• Where freshly treated wood is stored prior to removal to an accelerated fixation unit or a protected, contained storage area for fixation under ambient conditions, a paved (impermeable), contained and roofed area should be provided for such storage. • The storage area for fixation under ambient conditions should be paved (impermeable), contained and roofed, with provisions for recovery of drips and any infiltrating precipitation. • Provide the fixation chamber with an impermeable floor for collection of drips and a drip-collection system. • Provide adequate contained drippage area for all freshly treated wood. • Drippage should be complete before wood is moved to ambient or accelerated fixation (as determined by consideration of wood types, treatment processes, operational practices and other relevant factors).

Table 16 Recommended Design Features For Dry Treated Wood Storage Areas

(See also Part I, Chapter A - General Background Information and Recommendations)

Design feature	Recommendation
Storage areas	• Where practical, store all dry treated wood under roof or wrap. • Segregate treated wood storage areas from other storage areas and segregate contaminated from uncontaminated runoff water to minimize the need for water treatment and/or recycling.

8 Operational Recommendations

The recommendations for good operating practice listed in this section must be used in conjunction with those in Part I, Chapter A - General Background Information and Recommendations, section 8.

The objectives are to protect both workers and the environment from harmful exposure to CA-B solutions.

Table 17 Recommended General Operating Practices For CA-B Pressure Treatments

(See also Part I, Chapter A - General Background Information and Recommendations)

Operation	Recommendations
Procedures	• Prepare (and have readily available) explicit written instructions for all aspects of chemical use, facility operation, maintenance and emergency response. • Identify and communicate precautions for all other on-site handlers of treated wood (including quality control personnel, sorters and transporters).

Table 18 Recommended Operating Practices For Chemical Handling And Storage

(See also Part I, Chapter A - General Background Information and Recommendations)

Operation	Recommendations
Preservative concentrates	• Following complete rinsing, dispose of unusable containers only in an approved manner. • Sound containers may be reused for storage of wastes until disposal. • Label storage tanks with the identification of contents by chemical and concentration. • Post safety placards, with fire or spill emergency response procedures, personnel safety precautions and first aid procedures in prominent locations. • Restrict access of unauthorized personnel to the plant.

Table 19 Recommended Operating Practices For Freshly Treated Wood

(See also Part I, Chapter A - General Background Information and Recommendations)

Operation	Recommendations
Treatment process	• Apply sufficient final vacuum to remove as much excess liquid from the wood as possible.
Fixation	• Fixation is time- and temperature-related. • Aboveground treated material will be mostly fixed in the cylinder; more heavily treated material will require either accelerated fixation or ambient temperature fixation. Fixation times will depend on level of treatment. • Accelerated fixation is to be preferred to fixation under ambient conditions. • Where interim storage is necessary, freshly treated wood should be held in a protected, contained area, until moved into an accelerated fixation unit or to a protected area used for ambient fixation. • Fixation should be verified before removing material from protected contained areas. • Note: little is known about the leachability and fixation characteristics of freshly treated wood and no accepted test method had been identified at the time of the issuance of this TRD. The plant therefore must take all possible precautions to minimize drippage from the charge and hold freshly treated material for at least 24 hours on a protected drip pad and preferably longer, prior to removing it to an unprotected area.

9 Process Emissions and Disposal

9.1 Control, Treatment and Disposal

Potential process emission sources at CA-B wood preservation facilities were described in section 5.2 and Figure 3. The main categories of process wastes or emissions, which may be encountered at CA-B facilities, and recommended disposal methods, are presented in Table 18 of the general chapter (Chapter A).

9.2 Liquids Containing CA-B

Liquid Process Wastes

Liquid process wastes should not be discharged from CA-B plants. Liquid solutions (such as drips and washwaters) containing CA-B are routinely collected and reused as make-up waters in preparing new treatment solutions. If unusual circumstances (such as prolonged plant shutdown) prevent on-site reuse, transportation to another CA-B facility should be arranged. Disposal of process liquids should be considered only as a last alternative.

If disposal is unavoidable, specific approval must be obtained from the appropriate regulatory agency. If no suitable means of disposal are readily available, the solutions should be sealed in leak proof containers, labelled and stored in a secure area.

Contaminated Stormwater Runoff

Various approaches to prevent stormwater contamination can be used, including application of a proper final vacuum to remove excess treatment solution from the wood, maintaining clean solutions to minimize surface deposits, use of roofed areas for treated product storage and application of proper fixation prior to removal to storage in the open environment.

9.3 Solids with High CA-B Concentrations

For the purpose of this document, solids with CA-B include sludges from sumps and cylinders and disposable cartridge filters used to filter recycled waters. For general information on handling solid wastes, consult Part I, Chapter A - General Background Information and Recommendations, section 13.

The preferred means of disposal for CA-B-contaminated cartridge filters and wastes is solidification and burial in a secure (hydrogeologically isolated) approved, chemical landfill. It is the responsibility of the waste generator to obtain and comply with approvals required by the jurisdiction in which the disposal site/facility is located.

Solids with high concentrations of CA-B should be drained and stored in leak proof containers while awaiting disposal. Contaminated solids should be stored in a specially designated secure contained area. The area should be roofed to protect the wastes from precipitation.

9.4 Miscellaneous Solid Wastes

Miscellaneous solid wastes (e.g. empty concentrate drums or cuttings and debris from treated lumber) from CA-B wood preservation plants may be disposed of as approved by the provincial regulatory agency. The additive drums (moldicide and defoamer) should be thoroughly triple-rinsed with water prior to disposal, and the rinse water should be used for the preparation of work solutions. These drums should only be either returned to supplier if appropriate or disposed of with the appropriate disposal company.

9.5 Air Emissions

The use of an amine formulation at ambient temperature will have minimal tank emissions from normal operation. Typically no controls are necessary for ambient temperature solutions with the CA-B product. There should be no in-plant emissions from storage tank vents or vacuum pump exhausts, as these must be vented to the plant exterior with liquid release protection.

The use of heated solutions may imply some potential for amine emissions at the CA-B facility, if proper controls are not in place. Consult the chemical supplier.

Table 20 Recommended Disposal Practices For CA-B Contaminated Wastes

(See also Part I, Chapter A - General Background Information and Recommendations)

Waste category	Examples	Recommendations
Liquid CA-B solution	• CA-B concentrates • CA-B work solutions • Drips from freshly treated lumber • Washwaters	• Reuse as make-up for work solutions (standard practice at wood preservation plants)

10 Emission and Site Monitoring

Site monitoring and assessment are required at CA-B facilities, in accordance with the design and operating objectives described in this document, to verify that wood preservative chemicals are being properly managed at the site and to ensure environmental and worker health protection. Assessment records also will allow orderly site decommissioning if a plant is shut down.

Environmental monitoring requirements for most CA-B facilities would normally be developed in consultation with the appropriate provincial environmental regulatory agency. Additional consultation would be required with Environment Canada if a facility has a potential to impact on federally managed land or if a facility is located adjacent to waters frequented by fish). Worker health monitoring requirements would be developed in consultation with a provincial workers' compensation board and/or department of labour.

A monitoring program must be designed to ensure that there are adequate monitoring sites and that the frequency of monitoring and the detection limits of the preservative constituents are defined. The appropriate components of a site environmental and worker exposure monitoring program are suggested in Table 8 of Part I, Chapter A - General Background Information and Recommendations.

11 Transportation of CA-B Components, Solutions and Wastes

The transportation of CA-B concentrate solutions and CA-B wastes are regulated under the federal *Transportation of Dangerous Goods* (TDG) *Act*. The act does not apply to the transportation of treated wood or treated wood wastes. The regulation of intraprovincial movement of dangerous goods is a provincial responsibility.

The stipulated transportation procedures are abstracted in Part I, Chapter A - General Background Information and Recommendations, section 11.

12 Spill and Fire Contingency Planning

Preparedness for emergencies is essential in any wood preservation plant. Hence, facilities using CA-B should prepare and have readily available detailed contingency plans to ensure that response to spills and fires is quick, safe and effective. It is recommended that the individual facility plans be filed with the authorities having jurisdiction.

12.1 Spill Contingency Planning

In addition to the recommendations in the corresponding section 12.1 of Part I, Chapter A - General Background Information and Recommendations, the following recommendations apply to CA-B facilities if a spill occurs:

- Immediately put on all appropriate personal protective equipment as outlined in the MSDS for the product;
- Remove all unauthorized personnel from the scene of the spill;
- Spills and leaks outside of containment –
    - Concentrate
        - Use absorbent material such as vermiculite, kitty litter or absorbent pads (not sawdust)
        - Use pump to pick up liquid
    - Treating solution
        - Use absorbent material such as vermiculite, kitty litter or absorbent pads (not sawdust)
        - Use pump to pick up liquid
- If tanks other than normal work tanks are used for salvage purposes, assure compatibility of materials (e.g. do not use galvanized or aluminum tanks).

12.2 Fire Contingency Planning

In addition to the recommendations in the corresponding section 12.2 of Part I, Chapter A - General Background Information and Recommendations, the following recommendations apply to CA-B facilities in case of a fire.

CA-B is not flammable, but precautions should be taken in the event that a fire occurs. Toxic gases could be released from the preservative materials if these are excessively heated.

Use an extinguishing agent appropriate for the type of fire encountered. Consult local fire department.

> **Extinguishing agents:** Use water, dry chemical or other common extinguishing media.
> **Firefighting procedures**: Fire from a separate fuel source may be intense enough to cause thermal decomposition releasing toxic fumes and/or gases. Wear complete fire service protective equipment, including full-face NIOSH- and NFPA-approved self-containing breathing apparatus.

13 References

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