



MATERIAL SAFETY DATA SHEET

WOOD PELLETS IN BULK

**For Wood Pellets in Bags, see
MATERIAL SAFETY DATA SHEET for Wood Pellets in Bags
issued by the Manufacturer**

I. Product Identification and Use

Product name/trade name: Wood Pellets
Manufacturer's Code: 10521-3
Synonyms: Wood Pellets, Fuel Pellets, Whitewood Pellets, Softwood Pellets, Hardwood Pellets, Bark Pellets.
Product appearance: Light to dark blond, glossy to semi-glossy, cylinder with ¼ inch diameter (6.35 mm referred to as 6 mm pellets) and 3.15 to 40 mm in length.
Product use: Fuel for conversion to energy, animal bedding, absorbent
Wood Pellets as biofuel: Compliant with one of the property classes under ISO 17225-2 Solid Biofuels Standard.
HS Product Code: 4401-31-00-00
IMO Safety Code: Material Hazardous in Bulk (MHB) Group B (IMSBC-IF260E).
MARPOL classification: Product not containing any additives and/or binders certified not harmful to the marine environment or humans or animals in accordance with IMO MARPOL Annex V (Conditions 1 to 7), 2012 Convention.

Manufacturer:

La Crete Sawmills Ltd.
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T0H 2H0
Canada
Tel (switchboard): 1-780-928-2292
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II. Composition and Physical Properties

Wood Pellets are manufactured from ligno-cellulosic sawdust, planer shavings or bark by means of one or any combination of the following operations; drying, size reduction, densification, cooling and dust removal. The chemical composition of Wood Pellets varies between species of raw material, components of the wood, soil conditions and age



of the tree. Wood Pellets are typically manufactured from a blend of feedstock with the following composition;

Feedstock	Oxygenated compounds (indicative composition in % of weight)		
		Cellulose	30 - 40
		Hemi-cellulose	25 - 30
		Lignin	30 - 45
		Extractives (terpenes, fatty acids, phenols)	3 - 5
Additives	None except as stated in Wood Pellets Product Specification		
Binders	None except as stated in Wood Pellets Product Specification		

Inclusion of additives and/or binders may change some of the characteristics and IMSBC and MARPOL Code classifications of the Wood Pellets.

III. Health Hazard Data

Wood Pellets emit dust and gaseous invisible substances during handling and storage as part of the normal degradation of all biological materials. Ambient oxygen is typically depleted during such degradation. The sizes of the particulate matter range from crumbs to extremely fine airborne dust. The dust normally settles on surfaces over time. The emitted gases are immediately diluted by the air in the containment and escape with the ventilation air. If the Wood Pellets are stored in a containment which is not ventilated (naturally or forced) the concentration of emitted gases, or the oxygen depletion, may pose a health threat for humans present in the containment and the containment should be ventilated and precautions should be taken as specified in this MSDS. Section IX prescribes a method of estimating the concentration of gases. The gases emitted at normal indoor temperature include carbon-monoxide (CO), carbon-dioxide (CO₂), methane (CH₄) and hydrocarbons with Permissible Exposure Levels (PEL) and symptoms as follows;

Entry	Substance	Permissible Exposure Level and symptom	Remedial action	
Swallow	Dust	Dry sensation, see Section IX.	Rinse mouth thoroughly with water. Do not induce vomiting.	
Inhale	Dust	Coughing, dry throat. For toxicological data, see Section X.	Rinse mouth thoroughly with water. Do not induce vomiting.	
	Carbon monoxide (CO)	Toxic invisible and odorless gas. Living space TLV-TWA 9 ppmv (ASHRAE). Work space TLV-TWA 25 ppmv (OSHA).	If hygiene level is exceeded, evacuate and ventilate thoroughly, see Section IX for estimation of ventilation requirement.	
		50 ppmv	Max 15 minutes.	
		200	Mild headache.	Evacuate.
		400	Serious headache.	Evacuate and seek medical attention.
		800	Dizziness, convulsion, unconscious in 2 hours, death within 2-3 hours.	Evacuate and seek medical attention.
		1,600	Dizziness, convulsion, unconscious, death within 1 - 2 hours.	Evacuate and seek medical attention.
		3,200	Dizziness, convulsion, unconscious, death within 1 hour.	Evacuate and seek medical attention.
		6,400	Dizziness, convulsion, unconscious, death within 25 minutes.	Evacuate and seek medical attention.
		12,800	Dizziness, convulsion, unconscious,	Evacuate and seek medical attention.



		death within 1 – 3 minutes.	
	Carbon dioxide (CO ₂)	Asphyxiating invisible and odorless gas. Occupational TLV-TWA 5,000 ppmv (OSHA).	If hygiene level is exceeded, ventilate thoroughly, see Section IX for estimation of ventilation requirement.
	Methane (CH ₄)	Asphyxiating invisible and odorless gas.	Ventilate.
	Hydrocarbons	See Section IX. Odor.	Ventilate.
	Oxygen depleted air	Oxygen level is normally 20.9 % at sea level in a well ventilated space. Minimum hygiene level is 19.5 % in workspace (NIOSH). See Section VIII.	If oxygen level is less than hygiene level, evacuate and ventilate thoroughly.
Skin contact	Dust	Itching for some people. For toxicological data, see Section X.	Remove contaminated clothing. Rinse skin thoroughly with water.
Eye contact	Dust	Tearing, burning. For toxicological data, see Section X.	Flush with water and sweep out particles inward towards the nose.

IV. First Aid Procedures

Wood Pellets are considered a benign product for most people. However, individuals with a propensity for allergic reactions may experience reactions and should contact their physician to establish the best remedial action to take if reaction occurs.

In case Wood Pellets are not handled or stored in accordance with recommendations in Section VII the risk of harmful exposure increases, particularly exposure to concentration of CO higher than stipulated Permissible Exposure Level (PEL) in Section III. In case of exposure it is important to quickly remove the victim from the contaminated area.

Unconscious persons should immediately be given oxygen and artificial respiration. The administration of oxygen at an elevated pressure has shown to be beneficial, as has treatment in a hyperbaric chamber. The physician should be informed that the patient has inhaled toxic quantities of carbon monoxide. Rescue personnel should be equipped with self-contained breathing apparatus when entering enclosed spaces with gas.

Carbon monoxide is highly toxic by means of binding with the hemoglobin in the blood to form carboxy-hemoglobin, which cannot take part in normal oxygen transport, greatly reducing the blood’s ability to transport oxygen to vital organs such as the brain.

Asphyxiating gases like carbon dioxide and methane (sometimes called simple asphyxiant) are primarily hazardous by means of replacing the air and thereby depriving the space of oxygen. Person exposed to oxygen depleted conditions should be treated the same as a person exposed to carbon monoxide.

V. Fire and Explosion Measures

Wood Pellets is a fuel and by nature is prone to catch fire when exposed to heat or fire. During handling of Wood Pellets there are three phases with various levels of stability, reactivity (see section IX) and decomposition products:

- solid intact Wood Pellets
- crumbs or dust
- non-condensable (primarily CO, CO₂ and CH₄) and condensable gases (primarily aldehydes, acetone, methanol, formic acid)

Extinguishing a fire in Wood Pellets require special methods to be successful as follows;

State of	Extinguishing measures	Additional
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Wood Pellets		information
General	Restrict oxygen from entering the space where the Wood Pellets are stored.	
	Cover exposed pellets with foam or sand to limit exposure to air.	
	Be prepared for an extended period of extinguishing work. An industrial size silo may take a week to fully bring under control.	
Storage in enclosed space	Seal openings, slots or cracks where Wood Pellets may be exposed to air.	
	Inject nitrogen (N ₂) or carbon dioxide (CO ₂) in gaseous form at the bottom or in the middle of the pile of Wood Pellets or as close as possible to the fire if exposed. N ₂ is preferred. Dosage of gas depends on the severity of the fire (how early detection is made). Recommended injection speed is 5 – 10 kg/m ² /hour (m ² refers to the cross section of the storage containment such as a silo) with a total injected volume throughout the extinguishing activity of 5 – 15 kg/m ³ for less severe fires and 30 – 40 kg/m ³ for more advanced fires.	Recommended values developed by SP Technical Research Institute of Sweden. Specific volume for N ₂ is 0.862 m ³ /kg and for CO ₂ 0.547 m ³ /kg (at NTP).
Storage in open flat storage	Cover the pile of Wood Pellets with foam or sand if available or spray water. Dig out the pile to reach the heart of the fire and remove affected material.	
During handling	Restrict oxygen from entering the space where the Wood Pellets are present	
	Cover the Wood Pellets with foam or sand if available or spray water. Dig out the material to reach the heart of the fire and remove effected material.	

VI. Accidental Release Measures

If Wood Pellets are released in a populated area, the material should be removed by sweeping or vacuuming as soon as possible. Wood Pellets are a fuel and should preferably be disposed of by means of burning. Deposition of Wood Pellets or related dust should be such that gas from the material does not accumulate. Wear a protective mask to prevent inhaling of dust during cleanup (see Section VIII).

VII. Safe Handling and Storage


Precautionary measures are recommended to avoid hazardous conditions by the reactivity as outlined in Section IX from developing when handling Wood Pellets.

State of Wood Pellets	Precautionary measures	Additional information
General	Always store Wood Pellets in containment with a minimum of one (1) air exchange per 24 hours at + 20°C and a minimum of two (2) air exchanges per 24 hours at + 30°C and above.	One air exchange corresponds to the volume of the containment.
	For long period storage in large bulk containment shall be as air tight as possible. Fires tend to migrate towards air (oxygen) supply. For shorter period open storage, ventilate	Early warning sensors for heat and gas detection enhances the safety of storing Wood Pellets.




	to eliminate gas and odor.	
	Protect the Wood Pellets from contact with water and moisture to avoid swelling, increased off-gassing, increased microbial activity and subsequent self-heating.	For large enclosed storage, label the points of entry to storage containment or communicating spaces containing Wood Pellets with a sign such as “Low Oxygen Risk Area, Ventilate thoroughly before Entry”.
	Always protect Wood Pellets and dust from exposure to heat radiators, halogen lamps and exposed electrical circuitry which may generate ignition energy and set off a fire or explosion.	See Section IX Explosibility and applicable ATEX directives or NFPA regulations.
	Always segregate the Wood Pellets from oxidizing agents (e.g. poly-oxides capable of transferring oxygen molecules such as permanganate, per-chlorate) or reducing agent (e.g. chemical compounds which includes atoms with low electro-negativity such as ferrous ions (rust), sodium ions (dissolved sea salt)).	Schedule for Wood Pellets, IMSBC Code, 2012 IF260E.
	Do not expose Wood Pellets to rain.	
	Do not smoke or extinguish cigarettes in the vicinity of Wood Pellets or wood dust.	Install heat and gas detectors with visible and audible alarm.
Storage in enclosed space	For large enclosed storage entry should be prohibited by means of secured lock and a well established written approval process for entry. Entry shall be permitted only AFTER ventilation has been concluded and measurement with gas meter has confirmed safe atmosphere in the space (see Section VIII). Alternatively, use self-contained breathing apparatus when entering space. Always make sure backup personnel are in the immediate vicinity monitoring the entry.	Label points of entry to enclosed storage areas containing Wood Pellets with “Carbon monoxide Risk Area, Ventilate thoroughly before Entry”.
	Install N ₂ or CO ₂ sprinklers as per applicable fire regulations.	The IMSBC Code of Practice for the Safe Loading and Unloading of Bulk Cargoes (BLU Code) stipulate that a Shipper Cargo Information Sheet (SCIS) or equivalent must be used when shipping Wood Pellets in ocean vessels (see SCIS issued by Manufacturer).
Storage in open space	For large storage spaces install water sprinklers. For smaller storage spaces, contact your local fire department for recommendations.	Sand or foam has proven to be effective to limit access of oxygen in case of fire.
During handling	Avoid breakage caused by dropping the Wood Pellets. Be aware of potential dust generation during high pressure pneumatic handling of pellets.	Monitor temperature at bearings, pulleys, augers or other heat generating machinery.
	Avoid friction generated by rough surfaces such as worn out conveyor belts as much as possible.	
	Suppress dust generation and accumulation at transfer points and in areas close to mechanical moving parts which may dissipate heat.	
	Apparatus exposed to dust generated during the handling should be rated accorded to applicable safety standards, see ATEX directives and NFPA regulations. Warning signs should be posted in areas where	Example of placards: HIGH DUST CONCENTRATION OR ACCUMULATION ON SURFACES MAY CAUSE EXPLOSIONS OR FIRES.



	dust tends to remain suspended in air or settle on hot surfaces, see Section IX Explosibility.	<p>VENTILATE AND KEEP SURFACES CLEAN.</p> 
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VIII. Exposure Control and Personal Protection

The following precautionary measures shall be taken for personal protection:

Activity	Precautionary measure	Additional information
Entering space containing Wood Pellets	Ventilate thoroughly all the communicating spaces BEFORE entering.	For estimation of ventilation requirement, see Section IX.
	In the event the space is enclosed, always measure both level of carbon monoxide and oxygen.	Oxygen level at sea level shall be 20.9 % in a well ventilated space. Space with carbon monoxide level > 25 ppmv shall not be entered into without caution, see Section III. The IMSBC Code schedule for Wood Pellets stipulate that both oxygen and carbon monoxide levels shall be measured BEFORE entry is permitted unless the oxygen content has been restored to 20.7% and the carbon monoxide level <100 ppmv.
	<p>When door to space is labeled with warning sign, make sure to follow instructions and obtain permit in writing to enter.</p> <p>Use self-contained breathing apparatus if entry is required before proper ventilation has been completed.</p>	<p>Examples of labels and pictogram: LOW OXYGEN RISK AREA. VENTILATE BEFORE ENTRY. ALWAYS MEASURE CARBONMONOXIDE AND OXYGEN.</p> <p>CARBONMONOXIDE RISK AREA. VENTILATE BEFORE ENTRY. ALWAYS MEASURE CARBONMONOXIDE AND OXYGEN.</p> 
Exposure to dust from Wood Pellets	Wear protective glasses and dust respirator. Wear gloves during continuous or repetitious penetration.	

IX. Stability and Reactivity Data

The stability and reactivity properties of Wood Pellets are as follows:

Parameter	Measure	Value
Odor	°C	Above + 5 °C, fresh Wood Pellets in bulk smells like aldehydes in poorly ventilated space and more like fresh softwood in ventilated space.



Off-gassing	Emission Factor (g/tonne)	<p>Emission of CO, CO₂ and CH₄ from Wood Pellets contained in a space is a function of temperature, ambient air pressure, bulk density, void in Wood Pellets, access to oxygen, relative humidity in air (if ventilated) as well as the age and composition of the raw material (unique for the product as specified in the Wood Pellet Product Specification). The emission rate in grams (g) of off-gassing per tonne of stored Wood Pellets given below are from measurements of gas generated within a sealed containment filled with Wood Pellets at approximately constant pressure without ventilation over a period of > 20 days. The emission factors values are only valid for sealed containment without sufficient oxygen available to support oxidation of the Wood Pellets (see Oxidation in this Section). The numbers should not at any time be substituted for actual measurements.</p> <p>The following examples illustrate how the emission factors can be used for estimating a rough order of magnitude of the gas concentration in a non-ventilated as well as a ventilated containment with Wood Pellets, assuming the ambient air pressure is constant.</p>																																				
<u>Non-ventilated (sealed) containment</u>																																						
<table border="1"> <thead> <tr> <th data-bbox="586 793 878 856">Gas species</th> <th data-bbox="878 793 1084 856">Temperature °C</th> <th data-bbox="1084 793 1421 856">Emission factor (±10 %) g/tonne/>20 days</th> </tr> </thead> <tbody> <tr> <td data-bbox="586 856 878 1024" rowspan="5">Carbon-monoxide (CO)</td> <td data-bbox="878 856 1084 888">+ 20</td> <td data-bbox="1084 856 1421 888">12</td> </tr> <tr> <td data-bbox="878 888 1084 919">+ 30</td> <td data-bbox="1084 888 1421 919">15</td> </tr> <tr> <td data-bbox="878 919 1084 951">+ 40</td> <td data-bbox="1084 919 1421 951">16</td> </tr> <tr> <td data-bbox="878 951 1084 982">+ 50</td> <td data-bbox="1084 951 1421 982">17</td> </tr> <tr> <td data-bbox="878 982 1084 1014">+ 55</td> <td data-bbox="1084 982 1421 1014">17</td> </tr> <tr> <td data-bbox="586 1014 878 1182" rowspan="5">Carbon-dioxide (CO₂)</td> <td data-bbox="878 1014 1084 1045">+ 20</td> <td data-bbox="1084 1014 1421 1045">20</td> </tr> <tr> <td data-bbox="878 1045 1084 1077">+ 30</td> <td data-bbox="1084 1045 1421 1077">54</td> </tr> <tr> <td data-bbox="878 1077 1084 1108">+ 40</td> <td data-bbox="1084 1077 1421 1108">80</td> </tr> <tr> <td data-bbox="878 1108 1084 1140">+ 50</td> <td data-bbox="1084 1108 1421 1140">84</td> </tr> <tr> <td data-bbox="878 1140 1084 1171">+ 55</td> <td data-bbox="1084 1140 1421 1171">106</td> </tr> <tr> <td data-bbox="586 1171 878 1339" rowspan="5">Methane (CH₄)</td> <td data-bbox="878 1171 1084 1203">+ 20</td> <td data-bbox="1084 1171 1421 1203">0.2</td> </tr> <tr> <td data-bbox="878 1203 1084 1234">+ 30</td> <td data-bbox="1084 1203 1421 1234">1.0</td> </tr> <tr> <td data-bbox="878 1234 1084 1266">+ 40</td> <td data-bbox="1084 1234 1421 1266">1.3</td> </tr> <tr> <td data-bbox="878 1266 1084 1297">+ 50</td> <td data-bbox="1084 1266 1421 1297">1.5</td> </tr> <tr> <td data-bbox="878 1297 1084 1329">+ 55</td> <td data-bbox="1084 1297 1421 1329">1.9</td> </tr> </tbody> </table>			Gas species	Temperature °C	Emission factor (±10 %) g/tonne/>20 days	Carbon-monoxide (CO)	+ 20	12	+ 30	15	+ 40	16	+ 50	17	+ 55	17	Carbon-dioxide (CO ₂)	+ 20	20	+ 30	54	+ 40	80	+ 50	84	+ 55	106	Methane (CH ₄)	+ 20	0.2	+ 30	1.0	+ 40	1.3	+ 50	1.5	+ 55	1.9
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<p><u>Example A.</u></p> <ul style="list-style-type: none"> - Mass of Wood Pellets = 1000 tonne - Bulk density of Wood Pellets = 700 kg/m³ (0.7 tonne/m³) - Solids in bulk Wood Pellets including 0.5 % fines = 50 % - Size of containment = 2800 m³ - Temperature = +20 °C (constant) - Emission factor for CO (>20 days storage time) = 12 g/tonne (see table above) <p>Calculation of concentration of CO (g/m³) in containment; $12 \text{ (g/tonne)} * 1000 \text{ (tonne)} / [2800 \text{ (m}^3\text{)} - 50\% * 1000 \text{ (tonne)} / 0.7 \text{ (tonne/m}^3\text{)}]$ $= 5.8 \text{ g/m}^3$</p> <p>Calculation of concentration of CO (ppmv) in containment</p> <ul style="list-style-type: none"> - Ambient pressure = 101.325 kPa (1 atm) - Molecular weight of CO (Mwt) = 28 (g/mol) 																																						



		<p>$(\text{g/m}^3) * (20^\circ\text{C} + 273.1(\text{C}^\circ)) / \text{Mwt}(\text{g/mol}) / 0.012 = 5.8 * 293.1 / 28 / 0.012 = 5060 \text{ ppmv}$ after > 20 days of storage in sealed containment.</p> <p>PEL (TLV-TWA = 15 minutes, See Section III) = 50 ppmv which means a person shall not be exposed to the atmosphere in the non-ventilated containment.</p>																																				
		<p><u>Ventilated containment</u></p>																																				
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		<p><u>Example B</u></p> <ul style="list-style-type: none"> - Volume of Wood Pellets = 1000 tonne - Size of containment = 2800 m³ - Storage time = 5 days - Temperature = +20°C (constant) - Ambient pressure = 101.325 kPa (1 atm) - Emission of CO = 0.9 g/tonne/day (see Table above) - Ventilation rate = 1 air exchanges (2800 m³) /day - Molecular weight of CO (Mwt) = 28 (g/mol) - Conversion factor (g/m³ to ppmv) = 0.012 <p><u>Calculation of concentration of CO:</u> $0.9 \text{ (g/tonne/day)} * 1000 \text{ (tonne)} / [2800 \text{ (m}^3\text{/day)} * [1 - \exp(-2800 \text{ (m}^3\text{/day)} / 2800 \text{ (m}^3\text{)} * 5 \text{ (days)})] = 0.32 \text{ g/m}^3$</p> <p><u>Conversion to ppmv:</u> $(\text{g/tonne}) * (T + 273.1(\text{C}^\circ)) / \text{Mwt}(\text{g/mol}) / 0.012 = 0.32 * 293.1 / 28 / 0.012 = 279 \text{ ppmv}$</p> <p>To keep the concentration below PEL the containment needs to be ventilated with more than one air exchange per day.</p>																																				
Oxidization	Rate	<p>It is believed that a combination of microbial decomposition of biological material, chemical oxidation of fatty acids contained in the woody material and thermo-dynamic moisture migration are the primary causes for depletion of oxygen and emission of gas species as exemplified above during storage of Wood Pellets or related dust. The depletion ratio is a function of temperature, pressure, bulk density, void in Wood Pellets, relative humidity in air (if ventilated) as well as the age and composition of the raw material (unique for the product as specified in the Wood Pellet Product Specification). The numbers below are from measurements of gas generated</p>																																				



		<p>within the space of the Wood Pellets at approximately constant pressure. The numbers should not at any time be substituted for actual measurements.</p> <table border="1"> <thead> <tr> <th>Temperature °C</th> <th>(±10 %) Depletion of oxygen in %/24h</th> </tr> </thead> <tbody> <tr> <td>+ 20</td> <td>0.7 – 1.2</td> </tr> <tr> <td>+ 30</td> <td></td> </tr> <tr> <td>+ 40</td> <td>1.5 – 2.5</td> </tr> <tr> <td>+ 50</td> <td></td> </tr> <tr> <td>+ 55</td> <td></td> </tr> </tbody> </table>	Temperature °C	(±10 %) Depletion of oxygen in %/24h	+ 20	0.7 – 1.2	+ 30		+ 40	1.5 – 2.5	+ 50		+ 55	
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+ 20	0.7 – 1.2													
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+ 55														
Melting temperature	-	Not applicable.												
Vaporization	-	Wood Pellets emit hydrocarbons as vapors above + 5 °C.												
Boiling temperature	-	Not applicable.												
Flash point temperature	-	Not applicable.												
Auto-ignition temperature	°C	Wood Pellets auto-ignite at temperatures > + 260 °C in the presence of oxygen. For dust, see Section Explosibility Dust deflagration below.												
Pyrophorocity	Rate	Wood Pellets or dust are not classified as pyrophoric solids as defined by UN MTC Rev.3, 2000, Division 4.2 Test N.4.												
Flammability of solids	Rate	Wood Pellets not containing any additives and/or binders are not classified as flammable solid as defined by UN MTC Rev. 3, 2000, Division 4.1 Test N.1.												
Flammability of gases	Rate	Off-gassing from Wood Pellets does not reach flammable concentrations as defined by UN MTC Rev. 3, 2000, Division 4.3 Test N.5 and determined by ISO 10156.												
Self-heating	Rate	Wood Pellets has a propensity to start self-heating in presence of oxygen. However, Wood Pellets not containing any additives and/or binders does not meet criteria for self-heating substance as defined by MTC Rev. 3, 2000, Division 4.2.												
Bio-degradability	%	100.												
Corrosivity		Not applicable.												
pH		The potential for Hydrogen ions (pH) varies depending on species of wood.												
Solubility	%	If penetrated by water Wood Pellets will dissolve into its feedstock fractions. Concentration of the water soluble metals has been determined not to be harmful to the marine environment under the MARPOL Annex V Convention (conditions 1-6) in accordance with generally accepted data bases for acute and chronic aquatic eco-toxicity as well as toxicity to humans and animals, including carcinogenicity, mutagenicity, reproductive toxicity and Specific Target Organ Toxicity Repeated Exposure (STOT).												
Mechanical stability	-	If exposed to wear and shock Wood Pellets will disintegrate into smaller fractions and dust.												
Incompatibility	-	Always segregate the Wood Pellets from oxidizing agents (e.g. poly-oxides capable of transferring oxygen molecules such as permanganate, perchlorate) or reducing agent (e.g. chemical compounds which includes atoms with low electro-negativity such as ferrous ions (rust), sodium ions (dissolved sea salt)). (Schedule for Wood Pellets, IMSBC Code, 2012 IMO IF260E), see Section VII.												
Swelling	Rate	If penetrated by water Wood Pellets will swell about 3 to 4 times in volume.												
Shock	Rate	The mechanically integrity of Wood Pellets will degrade if exposed to an external force as a result of for example a drop in height.												



Mechanical wear	Rate	Wood Pellets are sensitive to friction between the Wood Pellets and a transportation causeway or conveyor belt and may generate dust.				
Dust Explosibility (typical values) Measured for dust sieved to sub 200 mesh (<75 µm @ <5% moisture)	Cloud	Auto-ignition Temperature (Godbert-Greenwald)	ASTM E1491	T _c	°C	450
		Minimum Ignition Energy	ASTM E2019	MIE	mJoule	17
		Maximum Explosion Pressure	ASTM E1226	P _{max}	bar	8.1-8.4
		Maximum Explosion Pressure Rate	ASTM E1226	dP/dt	bar/s	530-600
		Deflagration Index	ASTM E1226	K _{st}	bar.m/s	140-160
		Minimum Explosible Concentration	ASTM E1515	MEC	g/m ³	70
		Limiting Oxygen Concentration	ASTM E1515m	LOC	%	10
	Layer	Hot surface Ignition Temp (5 mm)	ASTM E2021	T _{s05}	°C	300-310
		Hot surface Ignition Temp (19 mm)	ASTM E2021	T _{s19}	°C	250-260
		Auto-ignition Temperature	ASTM E2021	T _L	°C	215-225
	Classification	Dust explosibility (K _{stmax})	ASTM E1226	>0 - 200	bar.m/s	St 1
		Location classification	NFPA 70	Class II Division 1 Group G		

X. Exposure and Toxicological Data

The feedstock is the basis of the toxicological characteristics of Wood Pellets. The available data does not make a clear distinction between whitewood and bark material. The toxicological data applies primarily to the material in form of dust.

Feedstock	PEL (OSHA)	REL (NIOSH)	TLV (ACGIH)	Health Effects
Softwood such as fir, pine, spruce and hemlock.	15 mg/m ³ Total Dust	TWA = 1 mg/m ³ for 10 hours @ 40 hours week	TWA = 5 mg/m ³ for 8 hours @ 40 hours week	Acute or chronic dermatitis, asthma, erythema, blistering, scaling and itching (ACGIH).
	5 mg/m ³ Respirable Dust		STEL = 10 mg/m ³ for 15 minutes, max 4 times/day, each episode max 60 minutes	
Hardwood such as alder, aspen, cottonwood, hickory, maple and poplar.	15 mg/m ³ Total Dust	TWA = 1 mg/m ³ for 10 hours @ 40 hours week	TWA = 5 mg/m ³ for 8 hours @ 40 hours week	Acute or chronic dermatitis, asthma, erythema, blistering, scaling and itching (ACGIH). Suspected tumorigenic at site of penetration (IARC).
	5 mg/m ³ Respirable Dust		STEL = 10 mg/m ³ for 15 minutes, max 4 times/day, each episode max 60 minutes	
Oak, walnut and beech.	15 mg/m ³ Total Dust	TWA = 1 mg/m ³ for 10 hours @ 40 hours week	TWA = 1 mg/m ³ for 8 hours @ 40 hours week	Suspected tumorigenic at site of penetration (ACGIH).
	5 mg/m ³ Respirable Dust			
Western Red Cedar.	15 mg/m ³ Total Dust	TWA = 1 mg/m ³ for 10 hours @ 40 hours week	TWA = 5 mg/m ³ for 8 hours @ 40 hours week	Acute or chronic rhinitis, dermatitis, asthma (ACGIH).
	5 mg/m ³ Respirable Dust	TWA = 1 mg/m ³ for 10 hours @ 40 hours week	STEL = 10 mg/m ³ for 15 minutes, max 4 times/day, each episode max 60 minutes	



Respirable Dust means particles with an AED < 10 µm capable of deposition in nasal, thoracic and respiratory regions.

Dust from certain hardwoods has been identified by IARC as a positive human carcinogen. An excess risk of nasal adeno-carcinoma has been reported mainly in those workers in the industry exposed to wood dusts. Some studies suggest workers in the sawmilling, pulp and paper and secondary wood industries may have an increased incidence of nasal cancers and Hodgkin's disease. However, IARC concludes that the epidemiological data does not permit a definite assessment.

Dust from Western Red Cedar is considered a "Nuisance Dust" (= containing less than 1% silicates (OSHA)) with no documented respiratory carcinogenic health effects (ACGIH). Cedar oil is a skin and respiratory irritant.

XI. Notice to Reader

The information contained in this MSDS is based on consensus by occupational health and safety professionals, Manufacturers of Wood Pellets and other sources believed to be accurate or otherwise technically correct. It is the Reader's responsibility to determine if the information herein is applicable. This MSDS is updated from time to time, and the reader has the responsibility to make sure the latest version is used. We do not have an obligation to immediately update the information in the MSDS.

Product data available from the Manufacturer of the Wood Pellets includes;

- MSDS for Wood Pellets Packaged in Bag Smaller than 25 kg
- MSDS for Wood Pellets in Bulk
- Wood Pellet Product Specification
- Shipper Cargo Information Sheet (SCIS) or equivalent in accordance with IMSBC Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code), 2012 Supplement

Contact the Manufacturer to order the latest version of these documents.

Notice that some of the information in this MSDS applies only to Wood Pellets manufactured by the Manufacturer identified on the first page of this MSDS and may not necessarily be applicable to products manufactured by other producers.

While the Manufacturer have attempted to ensure that the information contained in this MSDS is accurate, the Manufacturer is not responsible for any error or omissions, or for the results obtained from the use of this information.

The Manufacturer is not responsible for any direct, indirect, special, incidental, or consequential damage, or any other damages whatsoever and however caused, arising out of or in connection with the use of the information in this MSDS, or in reliance on that information, whether the action is in contract, tort (including negligence) or other tortious action. The Manufacturer disclaims any liability for unauthorized use or reproduction of any portion of the information in this MSDS.



XII. Abbreviations Used in This Document

ACGIH	American Conference of Governmental Industrial Hygienists
AED	Aerodynamic Equivalent Diameter
ASHRAE	American Society of Heating Refrigerating and Air-conditioning Engineers
ATEX	ATMosphere EXplosible
atm	atmosphere pressure
bar	10^5 Pascal (Pa) or 100 kPa or 0.9869 atm
CCOHS	Canadian Center for Occupational Health and Safety
g	gram = 0.001 kg
mg	milligram = 0.000001 kg
HS	Harmonized System Code
IARC	International Agency for Research on Cancer
IMO	International Maritime Organization (UN)
ISO	International Standards Organization
m ³	cubic meter
µm	micrometer = 0.000001 meter
MSDS	Material Safety Data Sheet
NTP	National Toxicology Program
LEL	Lower Explosible Limit (MEC=LFL=LEL)
LFL	Lean Flammability Limit (MEC=LFL=LEL)
MARPOL	Marine Pollution Convention issued by IMO
MEC	Minimum Explosible Concentration (MEC=LFL=LEL)
NFPA	National Fire Protection Association (USA)
NIOSH	National Institute for Occupational Safety and Health (USA)
NTP	Normal Temperature and Pressure (+20°C, 101.325 kPa or 1 atm)
OSHA	Occupational Safety and Health Administration (USA)
PEL	Permissible Exposure Level
ppmv	parts per million on a volume basis. For example, 5,000 ppmv means 5,000 molecules per 1 million molecules of gas, which also corresponds to 0.5 %. A concentration of 10,000 ppmv corresponds to 1 % of volume
REL	Recommended Exposure Limit
SCIS	Shipper Cargo Information Sheet
s	second
STEL	Short Term Exposure Limit
STP	Standard Temperature and Pressure (0°C, 101.325 kPa or 1 atm)
TLV	Threshold Limit Value
tonne	1000 kg
TWA	Time Weighted Average
WPAC	Wood Pellet Association of Canada