Peterson Control Union Group

POSSIBILITIES AND BOTTLENECKS FOR LONG DISTANCE TRANSPORT OF TORRIFIED MATERIALS

Biomass a challenge for Quality Control & Logistics Systems

Graz,
January 2011

Ger Ostermeijer
Peterson Control Union Group

CONTROL UNION WORLD GROUP

Ger Ostermeijer

- Managing Director Peterson Logistics Network
- 1984 until 11-2010 with the PCU-Group:
  - 1984-1996 director Belgium Offices
  - 1996-today director PABL
  - 2004-nov 2010
    - Chairman PLN division
    - Board member PCU MT
- 1968-1984 various companies:
  - Beckmann & Jörgensen, R'dam
  - Vanes Forwarding, R'dam
- 1954-1968 Secondary School HBS
- 1950 born in Rotterdam.

- Retired since November 2010.
- Officially work is now a hobby only.

Peterson Control Union Group

Groups identities in the **Biomass**

- Peterson Agricare & Bulk Logistics
  - (ARAG)(USA)(CANADA)
- Control Union World Group
  - (WW- offices in >55 countries)
- Control Union Certification
  - (WW – offices accredited in > 30 countries)
- Technical Laboratories
  - (ARAG + Satelites)

Ships agencies

Chartering, Freight Brokerage

Logic-Chart B.V.

PCU activities Biofuels

- Inspection and Quality Control services
  - sampling, weight, product, hold inspections
    - ISO 17020
- International auditing and certification
  - source of raw materials, processes, production, with respect to standards applied & sustainability
- Logistic Services(ISO 9000)
  - Chartering, Handling, Storage, Scheduling, Distribution, documentary support, contract support.
- Product Quality verification by means of laboratory services.
  - ISO 17025 accredited.

Quality Logistics

Our main product: we sell **a good nightrest**

Commodity Issues

- Product Quality
- Product Volume
- Production Process
- Quality analysis
- Sustainable Source verification/audits

MONITORING

CARGO CONDITION

Commodity Logistics

- Local Transport & Storage
- Shipping facilities
- Export documentation Support
- Delivery schemes
- Condition Protection
- Handling precautions
- Just in Time deliveries
- Import regulations

Commodity Monitoring

- Statement:

The monitoring of all movements reduces risks and secures the reliability of the product and the supply.

Hold inspection

Prior to loading

- Hold cleanliness inspection
- Hose test to secure water tightness
- All conveying equipment checked for cleanliness

- Cargo intelligence:
  - Stored since when
  - Any incidents during storage
  - Average daily temperature in the storage facility
  - Facts and figures

Hose Test

Draftsurvey

Bio Coal Torr. Pellets

Any large Torrified shipments available?

End of presentation?

Situation early 2011

- Biocoal pellets = BP.
  - No large volumes available
  - Actually No long distance transport
  - No handling and storage of large volumes

From the cookery room

- Start-up problems to realize good pellets, though also confidence it will work perfectly.
- Other projects still starting-up (delayed/under construction)
- Pellet machinery not fully adequate
  - Technical specs/dye problems
  - Processing time/economical costs
- Feedstock specifications raise problems (MC, Milling specs)
- Time will tell in 2011-2012.

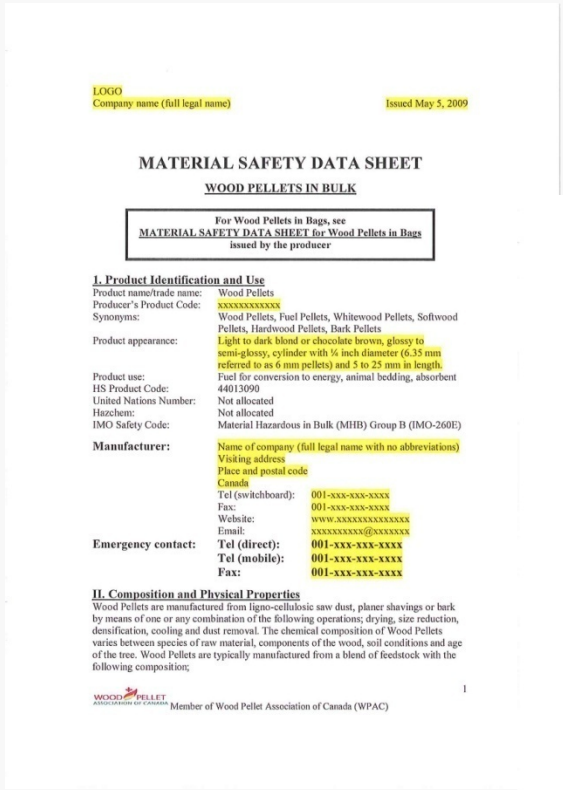
Alternatives observed

- To avoid pellets botttleneck
  - Bio coal **OVOIDS** (Egg coals)
- Various Binders are tested(biogenic)
- Trials are actually taking place now to produce Bio coal **OVOIDS**
- It looks like a promising alternative:

Economics	Easy handling
Angle of repose	Simple technics
Economics	

An outlook to be followed closely.

To be updated with a torrified fuel pellets MSDS, under construction.



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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 producer

I. Product Identification and Use

Product name/trade name:	Wood Pellets
Producer's Product Code:	xxxxxxxxxxx
Synonyms:	Wood Pellets, Fuel Pellets, Whitewood Pellets, Softwood Pellets, Hardwood Pellets, Bark Pellets
Product appearance:	Light to dark blond or chocolate brown, glossy to semi-glossy, cylinder with ¼ inch diameter (6.35 mm referred to as 6 mm pellets) and 5 to 25 mm in length.
Product use:	Fuel for conversion to energy, animal bedding, absorbent
HS Product Code:	44013090
United Nations Number:	Not allocated
Hazchem:	Not allocated
IMO Safety Code:	Material Hazardous in Bulk (MHB) Group B (IMO-260E)
Manufacturer:	Name of company (full legal name with no abbreviations) Visiting address Place and postal code Canada
	Tel (switchboard): 001-xxx-xxx-xxxx
	Fax: 001-xxx-xxx-xxxx
	Website: www.xxxxxxxxxxxxx
	Email: xxxxxxxxx@xxxxxxx
Emergency contact:	**Tel (direct): 001-xxx-xxx-xxxx**
	Tel (mobile): 001-xxx-xxx-xxxx
	Fax: 001-xxx-xxx-xxxx

II. Composition and Physical Properties

Wood Pellets are manufactured from ligno-cellulosic saw dust, 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;

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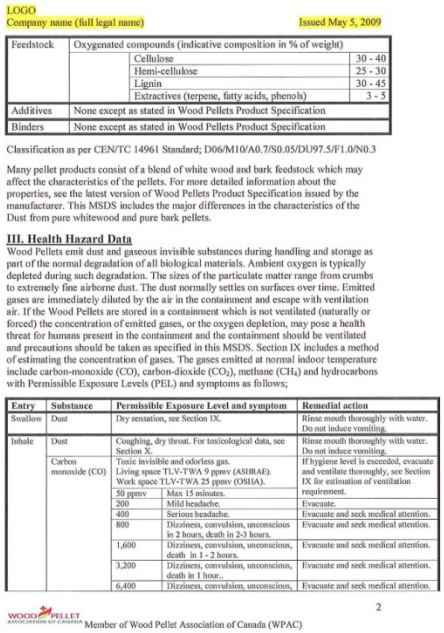

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Feedstock	Oxygenated compounds (indicative composition in % of weight)		
		Cellulose	30 - 40
		Hemi-cellulose	25 - 30
		Lignin	30 - 45
		Extractives (terpene, fatty acids, phenols)	3 - 5
Additives	None except as stated in Wood Pellets Product Specification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

Classification as per CEN/TC 14961 Standard; D06/M10/A0.7/S0.05/DU97.5/F1.0/N0.3

Many pellet products consist of a blend of white wood and bark feedstock which may affect the characteristics of the pellets. For more detailed information about the properties, see the latest version of Wood Pellets Product Specification issued by the manufacturer. This MSDS includes the major differences in the characteristics of the Dust from pure whitewood and pure bark 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. Emitted gases are immediately diluted by the air in the containment and escape with 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 includes a method of estimating the concentration of gases. The gases emitted at normal indoor temperature include carbon-monoxide (CO), carbon-dioxide (CO_2), methane (CH_4) 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 in 2-3 hours.	Evacuate and seek medical attention.
		1,600	Dizziness, convulsion, unconscious, death in 1 - 2 hours.	Evacuate and seek medical attention.
		3,200	Dizziness, convulsion, unconscious, death in 1 hour..	Evacuate and seek medical attention.
		6,400	Dizziness, convulsion, unconscious, death in 25 minutes.	Evacuate and seek medical attention.
		12,800	Dizziness, convulsion, unconscious, death in 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 well ventilated space. Minimum hygiene level is 19.5 % in work space (NIOSH)		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

2

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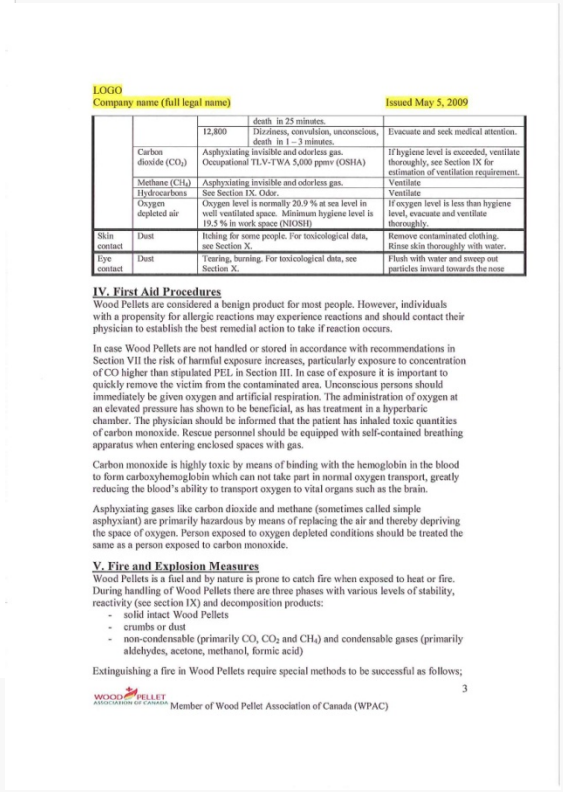

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IV. First Aid Procedures

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 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 carboxyhemoglobin which can not 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, CO_2 and CH_4) and condensable gases (primarily aldehydes, acetone, methanol, formic acid)

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

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State of Wood Pellets	Extinguishing measures	Additional 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/m³/hour (m³ 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/m³ for less severe fires and 30 – 40 kg/m³ for more advanced fires.	Recommended values developed by SP Technical Research Institute of Sweden Specific volume for N_2 is 0.862 m³/kg and for CO_2 0.547 m³/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 effected 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 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 to eliminate gas and odor.	Early warning sensors for heat and gas detection enhances the safety of storing Wood Pellets

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	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 th points of entry to storage containm or communicating spaces containin Wood Pellets with a sign such as "! 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.
	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, Code o Safe Practice for Solid Bulk Cargo 2004, IMO 260E.
	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, only AFTER ventilation has been concluded and measurement with gas meter has confirmed safe atmosphere in the space. 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 Pell with "Carbon monoxide Risk Area, Ventilate thoroughly before Entry"
	Install N_2 or CO_2 sprinklers as per applicable fire regulations.	A Shipper Cargo Information Shee (SCIS) must be used when shipping Wood Pellets in ocean vessels as p international regulations issued by IMO, see SCIS issued by Producer.
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 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 genera 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. Warning signs should be posted in areas where dust tends to remain suspended in air or settle on hot surfaces, see Section IX Explosibility.	Example of labels and pictogram: HIGH DUST CONCENTRATION ACCUMULATION ON SURFACI MAY CAUSE EXPLOSIONS OR FIRES. VENTILATE AND KEEP SURFACES CLEAN.

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VIII. Exposure Control and Personal Protection

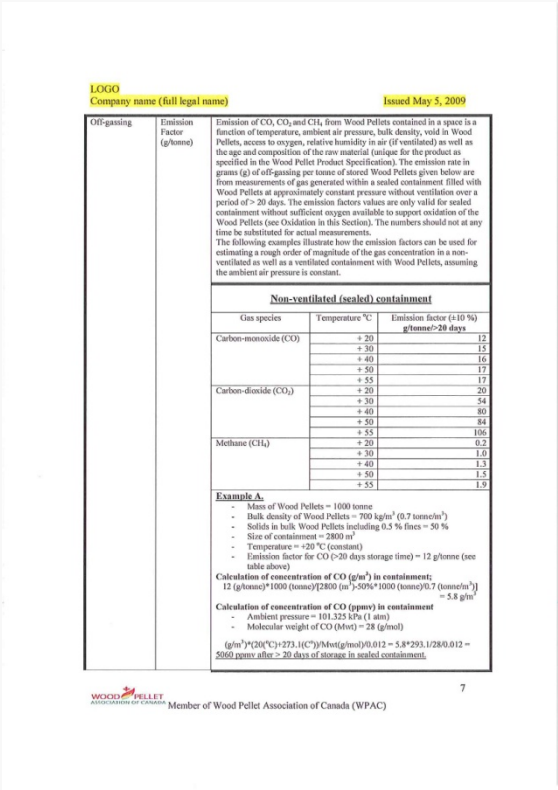
The following precautionary measures shall be taken for personal protection:

Activity	Precautionary measure	Additional information
Entering space containing Wood Pellets	Ventilate thoroughly all 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 well ventilated space. Space with carbon monoxide level > 25 ppmv shall not be entered into without caution, see Section III.
	When door to space is labeled with warning sign, make sure to follow instructions and obtain permit in writing to enter.	Examples of labels and pictogram: LOW OXYGEN RISK AREA. VENTILATE BEFORE ENTRY. ALWAYS MEASURE CARBONMONOXIDE AND OXYGEN.
	Use self-contained breathing apparatus if entry is required before proper ventilation has been completed.	CARBONMONOXIDE RISK AREA. VENTILATE BEFORE ENTRY. ALWAYS MEASURE CARBONMONOXIDE AND OXYGEN. 
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.



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Off-gassing	Emission Factor (g/tonne)	Emission of CO, CO_2 and CH_4 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. 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.

Non-ventilated (sealed) containment

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

Example A.
- 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)

Calculation of concentration of CO (g/m³) in containment;
12 (g/tonne)*1000 (tonne)/[2800 (m³)-50%*1000 (tonne)/0.7 (tonne/m³)] = 5.8 g/m³

Calculation of concentration of CO (ppmv) in containment
- Ambient pressure = 101.325 kPa (1 atm)
- Molecular weight of CO (Mwt) = 28 (g/mol)

(g/m³)*(20(°C)+273.1(C°))/Mwt(g/mol)/0.012 = 5.8*293.1/28/0.012 = 5060 ppmv after > 20 days of storage in sealed containment.

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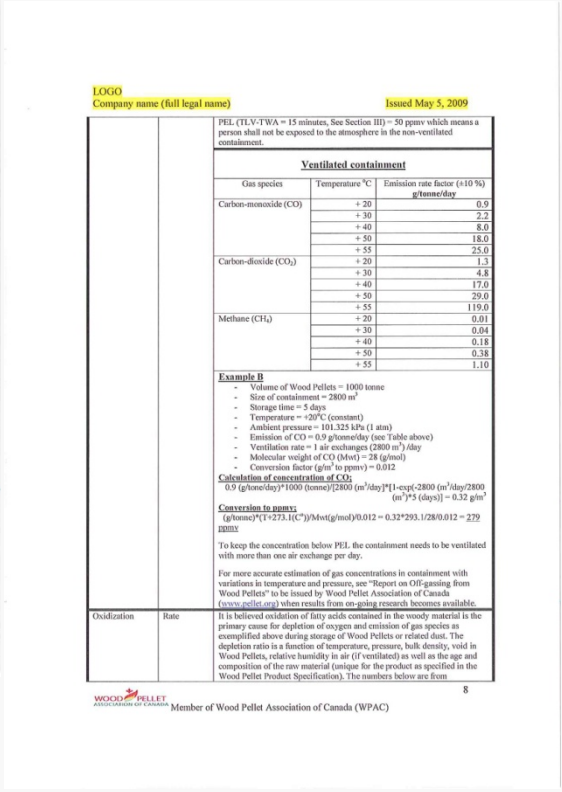

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PEL (TLV-TWA = 15 minutes, See Section III) = 50 ppmv which means a person shall not be exposed to the atmosphere in the non-ventilated containment.

Ventilated containment

Gas species	Temperature °C	Emission rate factor (±10 %) g/tonne/day
Carbon-monoxide (CO)	+ 20	0.9
	+ 30	2.2
	+ 40	8.0
	+ 50	18.0
	+ 55	25.0
Carbon-dioxide (CO_2)	+ 20	1.3
	+ 30	4.8
	+ 40	17.0
	+ 50	29.0
	+ 55	119.0
Methane (CH_4)	+ 20	0.01
	+ 30	0.04
	+ 40	0.18
	+ 50	0.38
	+ 55	1.10

Example B
- 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

Calculation of concentration of CO:
0.9 (g/tone/day)*1000 (tonne)/[2800 (m³/day)*[1-exp(-2800 (m³/day/2800 (m³)*5 (days)] = 0.32 g/m³

Conversion to ppmv:
(g/tonne)*(T+273.1(C°))/Mwt(g/mol)/0.012 = 0.32*293.1/28/0.012 = 279 ppmv

To keep the concentration below PEL the containment needs to be ventilated with more than one air exchange per day.

For more accurate estimation of gas concentrations in containment with variations in temperature and pressure, see "Report on Off-gassing from Wood Pellets" to be issued by Wood Pellet Association of Canada (www.pellet.org) when results from on-going research becomes available.

Oxidization	Rate	It is believed oxidation of fatty acids contained in the woody material is the primary cause 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

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And so on till page 13

Developed by the Wood Pellets Assoc. Canada

Personnel & Cargo protection during loading

- All personnel carries personal protection equipment for Oxygen, Co, CO2 level monitoring
- Continuous monitoring of the Temperatures
  - Above 55-60 degrees Celsius not fit for loading?
  - Long sea-voyages versus short sea-voyages
- Regularly checking the moisture contents
- Are the pellets consistent in form and shape
- Discolorations? (heatdamage)

BP linked to safety & logistics

	Unit	WP	BP	Diff
GCV	Kcal	4915	5500/6800	15-30%
GCV	Gj/Ton	21	24-28	15/30%
Volatiles	%-o.d.	85	65-54	-20/31%
Oxygen	%-diff	41	23	-18%
Hydrogen	%-o.d.	6,5	5,4	-1%
Carbon	%-o.d.	52	65-70	15-18%

Quick conclusion

- Higher GJ/ton
- Is shipping density >=750 kg/ton

Interesting for the freight-ton/GJ!

- Durability > 98%?

Okay for breakage and dust!

- Anything positive on off-Gassing?
- Hydrofoob Yes or No?

Some tests indicate

O2 level/degr. C		25	35	50	65
Biocoal	%	20,9	16 *	0,6*	0,5*
Woodpell.	%	20,9	20,9	19	15*
CO level@degr. C		25	35	50	65
Biocoal	Ppm	**200/300**	**2200**	**2800**	**6000**
Woodpell.	Ppm	**200/300**	**300/400**	**1400**	**5000**

- Oxygen depletion and CO gasification relate much to MC
- For the CO2 levels some diference between BP and WP was observed, but not significant
- Methane Gas evaporation in BP lower.
- Also a test under nitrogen climate instead of O2!!

Testing necessary

- Tests were performed in CA-chambers, small volumes, short time.(ECO2 Holland facility)
- Research needs to be launched and financed for long term tests;
  - 30 days/60 days
  - Bigger volumes(2 tons abt)
  - Specific products(industrial product - final)
- Oxygen below 14% means no fire outbreak possible.
- Low MC(moisture) influences CO & O2 behaviour.

Fuel pellets Normal orTorr.

- Extracted from MSDS information
  - Off- Gassing: Mac Values in PpmV

    CO: 50 |CO2:5000| CH4
  - The off gassing accelerates at temperatures > 35 Degrees Celsius.
    - As from 55 Degrees Celsius the off- gassing effects is triplicated
  - Sea Voyage (closed hatches no ventilation)
    - CO after 20 days can be anything >5000 PpmV
    - CO2 ditto > 10.000 PpmV

This is why we monitor continuously ΔT

MSDS table of contents

Product information and use	General information
Composition and physical properties	What is it made off and how does it look
Health Hazard data	Risks to personnel and environment
First aid procedures	How to deal with
Fire and Explosion Measures	How to deal with
Release Measures	Spillage control
Safe Handling and Storage	Advisory information
Exposure Control and Personal Protection	How to prevent
Stability and Reactivity Data	Read this part careful!
Exposure and Toxicological Data	Read this part careful!

Personnel & Personal/You

	Cause	Type 1	Type 2	Risk 1/meas.	Risk 2/meas.
Dust	Breakage of pellets and normal presence of fines	Airborne	Settling on surfaces	Inhaling & Swallowing ***VENTILATE***	Clogging of dust & Dust heaps ***KEEP CLEAN***
	Cause		Types		Actions and measures
Gases & Oxygen depletion=	Presence of Oxygen and organic fermentation OXYDATION	Creates various types of gases	CO CO_2 CH_4 Hydrocarbons	Explosive Inert Explosive Explosive	*-Verify presence* *-Ventilate before entering space* *-Personal protection Device*
Short in O_2	OXYDATION	O_2<20,7%		Health Treat	*Verify & Ventilate*

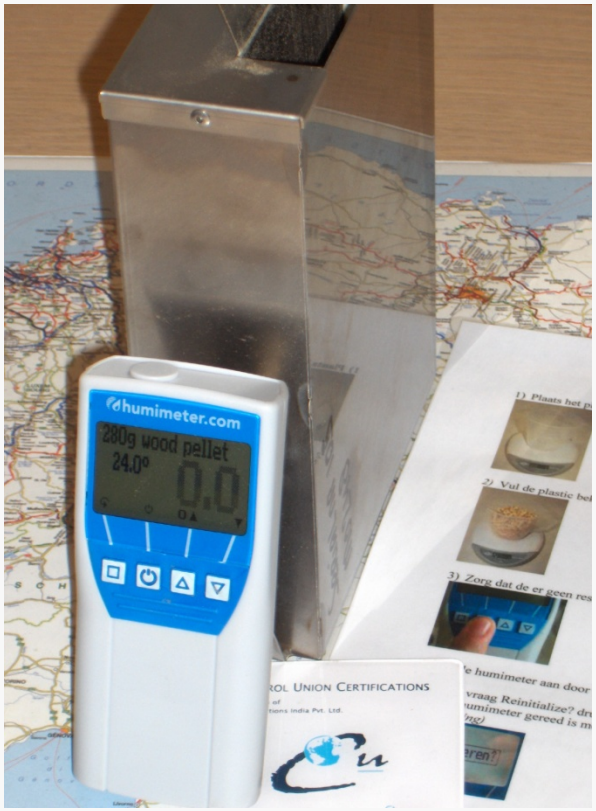
LOW OXYGEN RISK AREA. VENTILATE BEFORE ENTRY. ALWAYS MEASURE CARBONMONOXIDE AND OXYGEN.

To be maintained also for Torrified materials.

Handling-transport-storage

	Risk	Areas	Measure
Dust	**Dust** **Settling**	**Conveying systems &** **Electrical Appliances**	**Keep it clean** **ATEX protection level**
Heated cargo	**Warming up/ fire**	**Holds, Silos, warehouses** ***Determine your critical temperature for evacuation***	**On line 24/24-7/7 Temperature monitoring** ***∆T per 24 hours!***
CO/CH4/ **Hydrocarbons**	**Explosive if under pressure**	**Holds, Silos, warehouse**	**Measure the gas levels constantly and initiate ventilation***
Oxygen depletion	**Dangerous Entry**	**Holds, Silos, warehouse**	**Measure O_2 presence and *secure entry control***
Avoid water ingress by rain, snow, fog, etc.	**Swelling, extra off-gassing, heating progress**	**During the entire handling and storage process**	**Rain watch, stop all operations during rain exposure. *Avoid storage of moisturized cargo***

Higher Calorific value also on free flowing particles, spontaneous combustion risks, friction - heating up
Dryer material likely to built up Static Electricity?

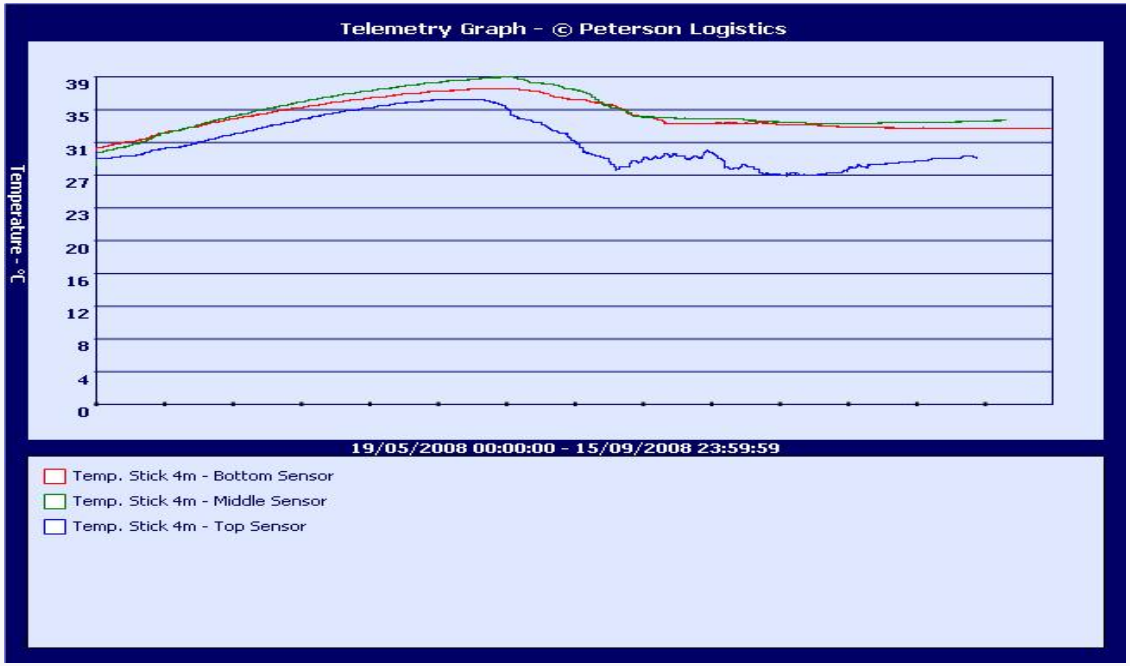


Moisture determination on the spot

Cargo Protecting & Monitoring

	Guideline	Findings	Measures if non Conf.
Installations	Clean, Free of foreign matters, dry	Certificate cleanliness	Cleaning, drying 2nd inspection
Temperature	Homogeneous, <60 degr. C	Certificate	Refusal, replacement
Fines presence	< 3% at a 3.15 mm Mesh?? Contract rules!	Certificate	Contractual issue
Dust presence	< 0,5 % at a 0.5 mm Mesh	Certificate	Contractual issue
Moisture contents	< 8% or as per contract	Certificate	Contractual issue
Colour and Shape	Homogeneous in colour, no discolorations	Certificate	Found the cause and verify, consultation
Hold Cleanliness	Clean, dry, free of foreign cargo/matters	Cleanliness Certificate	Cleaning, drying 2nd inspection
Hose Test	Securing water tightness of hatches	Hose test report	Repairs, Remnick tape, repeat test.

Temperature Control



Peterson &

Sensite Solutions,

Neth.

Monitoring via Internet

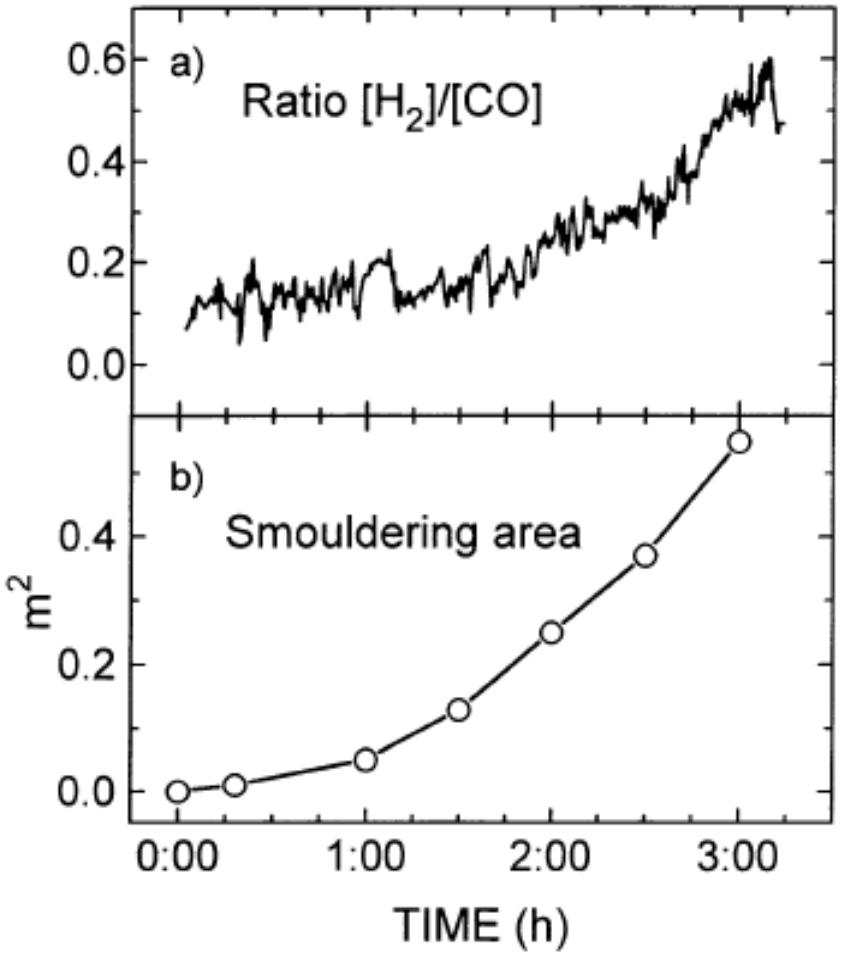
- Wireless communication through the internet – On line Database Reporting.
- Integrated sensor systems for:
  - Temperature
  - CO/CO2
  - CH4
  - RH
- Early warning systems through GSM/text Msg

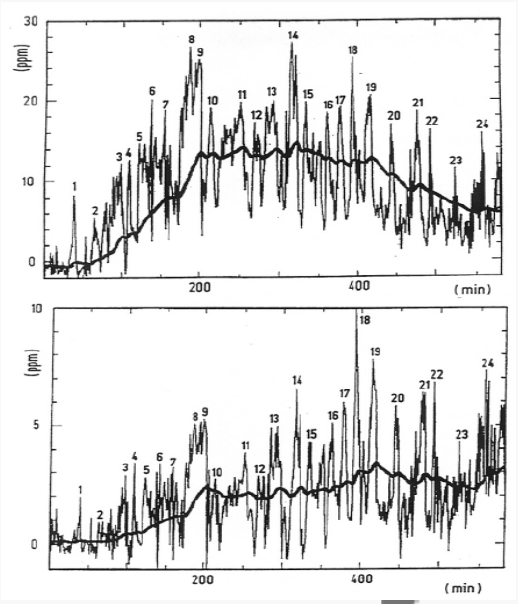
Orange status = 24 H- ΔT > 2 degrees

Red Status = T > 50 degrees C.

Gas detection suite

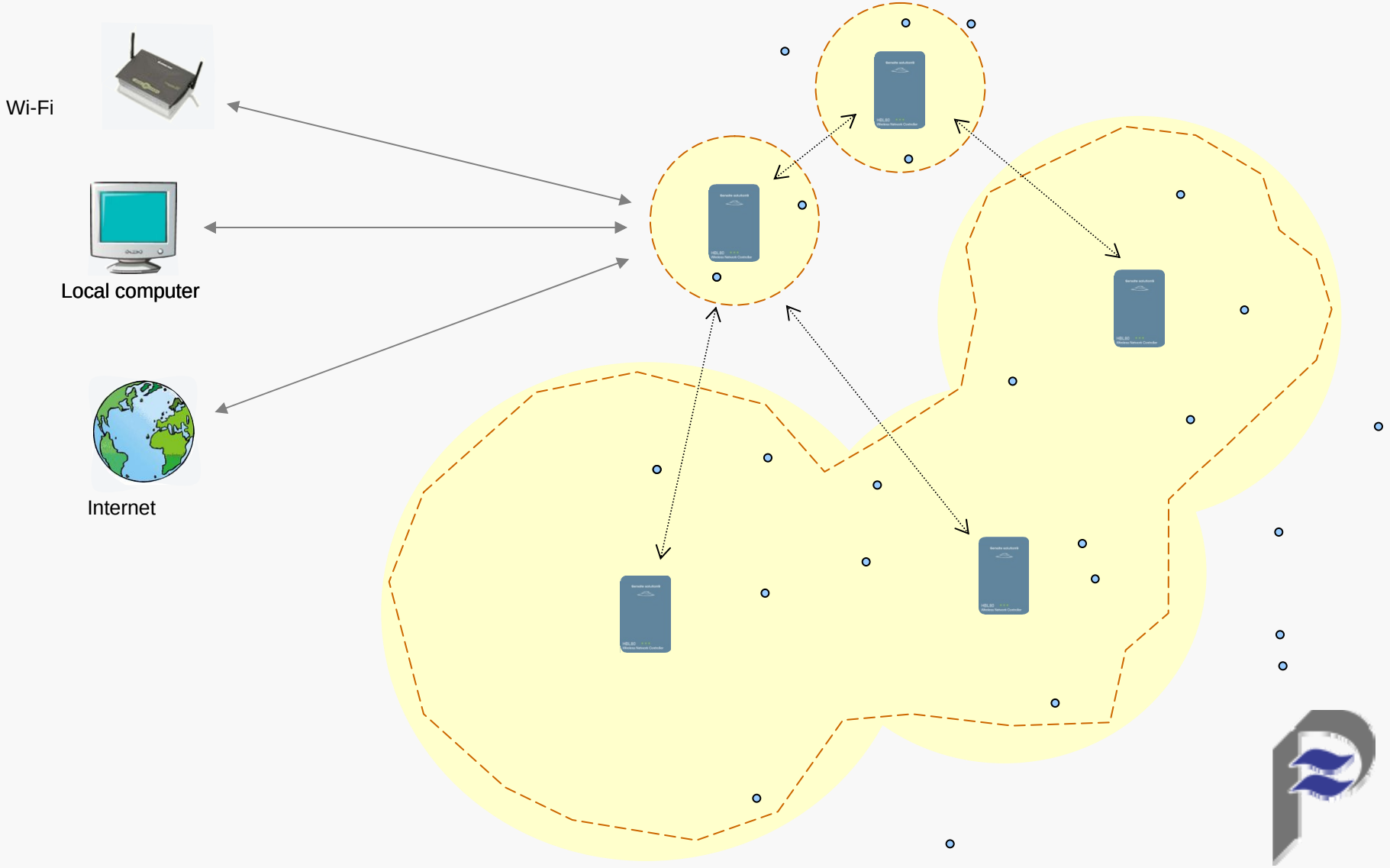
- Full range of gas sensors
- Includes CO, CO_2, H_2, CH_4 , NO_x





Source: Universität Giessen, Germany

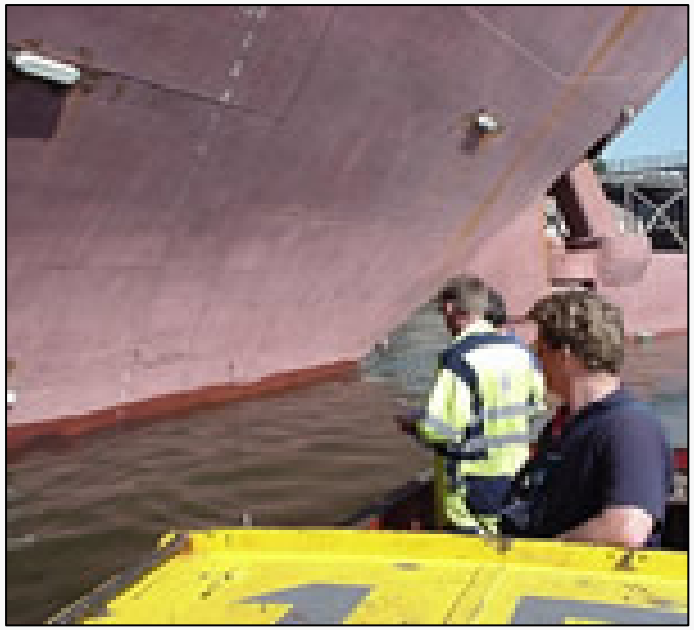
Wireless network



Checklist 1st shipment?

- Product related:
  - MSDS available
    - Safety, Health, Environment
  - SCIS established by the shipper/charterer:
  - Export/Import regulations:
    - Phyto – Dept. agriculture
    - Veterinary – Dept. Health
    - Nomenclature(duties, tariffs) – C&Excise
    - Certificate of Origin- Econ.
- Shipment related:
  - Bills of Lading
  - Loading permit
  - Rain instruction
  - Holds inspection
  - Hose test
  - Clean on Board
  - F&C Cargo
  - Density vs. Stowage F
  - Export declaration
  - Certificate of Origin/ Phyto required?
  - IS ALL THE CARGO IN THE PORT?

Draft reading



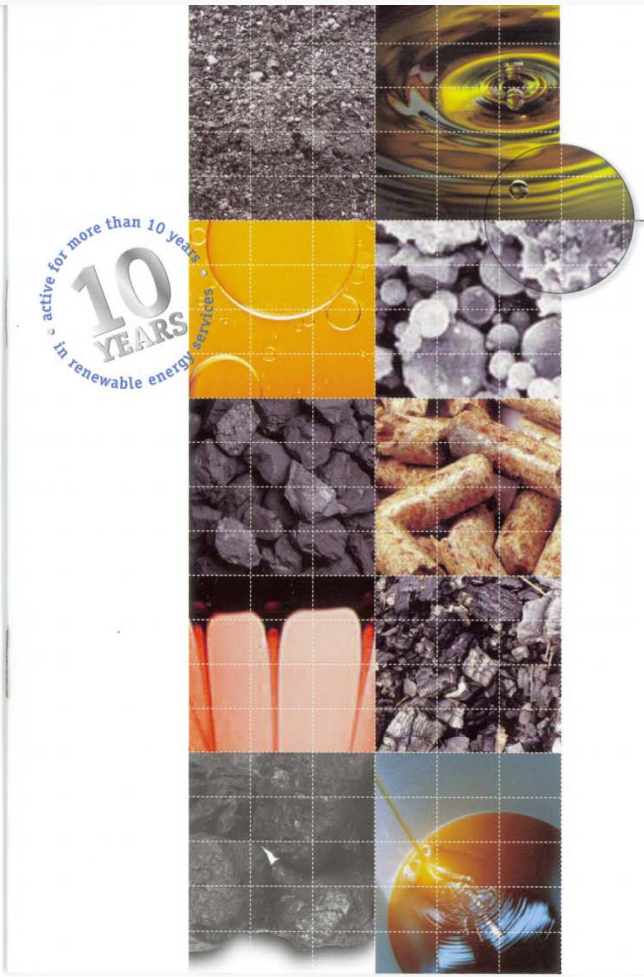
Anything missing sofar?

- Ships instructions:
  - No ventilation during sea voyage!
  - Keep holds and hatches closed
  - Monitor Air temperatures above cargo during voyage!
  - To sticker all holds entrances

  low oxygen area / do not enter
  - **At discharge port secure Gas Free prior to discharge operations.**

Valuable laboratorium info

- Moisture contents per lot
  - Homogeneous versus heterogeneous
- AW Value
  - Moisture saturation level
    - Triggers condensation and water activity
    - May trigger the warming up & heating process
- Fatty Acids Level –stable vs. unstable



ANALYSE THIS

TLR
international laboratories

Recent findings on WP

Woodpellets	From	Aw Value %	Temp.Celsius
Whites	South East USA	65/70	58 - > 60
Whites	East USA	55/60	35-40
Whites	South Europe	40/55	30 -37
Whites	Baltic	40/45	25-30
Whites	W – Canada	35/45/50	30-35-40
Whites bark	E – Canada	45	35-40

Aw Value may relate with the ambient T/Rh at origin, but also with the Temperature after Cooling down and ambient Temp./Rh.

Research continues (At PCU/TLR & UBC)

Specific Risks with Bio Coal

- Dust and particles will have a higher CV in comparison to WP.
  - Agglomeration of dust
  - Fire danger
- Airborne particles in enclosed environments need particular attention – ventilation.
- APEX and Clean Operations.

Torrification gives Extra advantages/possibilities

- Density versus Gj/Ton
- Hydrofobic aspect:
  - Ease up handling and storage
  - Remark:
    - Water ingress will still increase T-moisture
    - Unsure as yet if under pressure and time cargoes remain hydrofoob/intercellular space.
- Less off-Gassing probably correct for LEL, but not for CO.
- Durability of the Torrified pellets will be decisive if all advantages will score.

Integrated Quality Logistics - Conclusion

- Biomass is for YOU a valuable commodity and not a residual product
- Fuel Pellets Regular or Torrified are A BIOGENE ORGANIC PRODUCT WITH ALL INHERENT ASPECTS & VICES OF NATURE.
- Make use of RELIABLE partners both in Shipping, Logistic Agent, Superintendence, Sampling and Analysis and verify the Quality & Condition by monitoring
- Make use of good facilities
- Develop your own standards linked with your national standards, contract integration, product know how
- Your Logistic Arrangements Prior to Shipment are the most important issue. (LAPS)

Renewable research

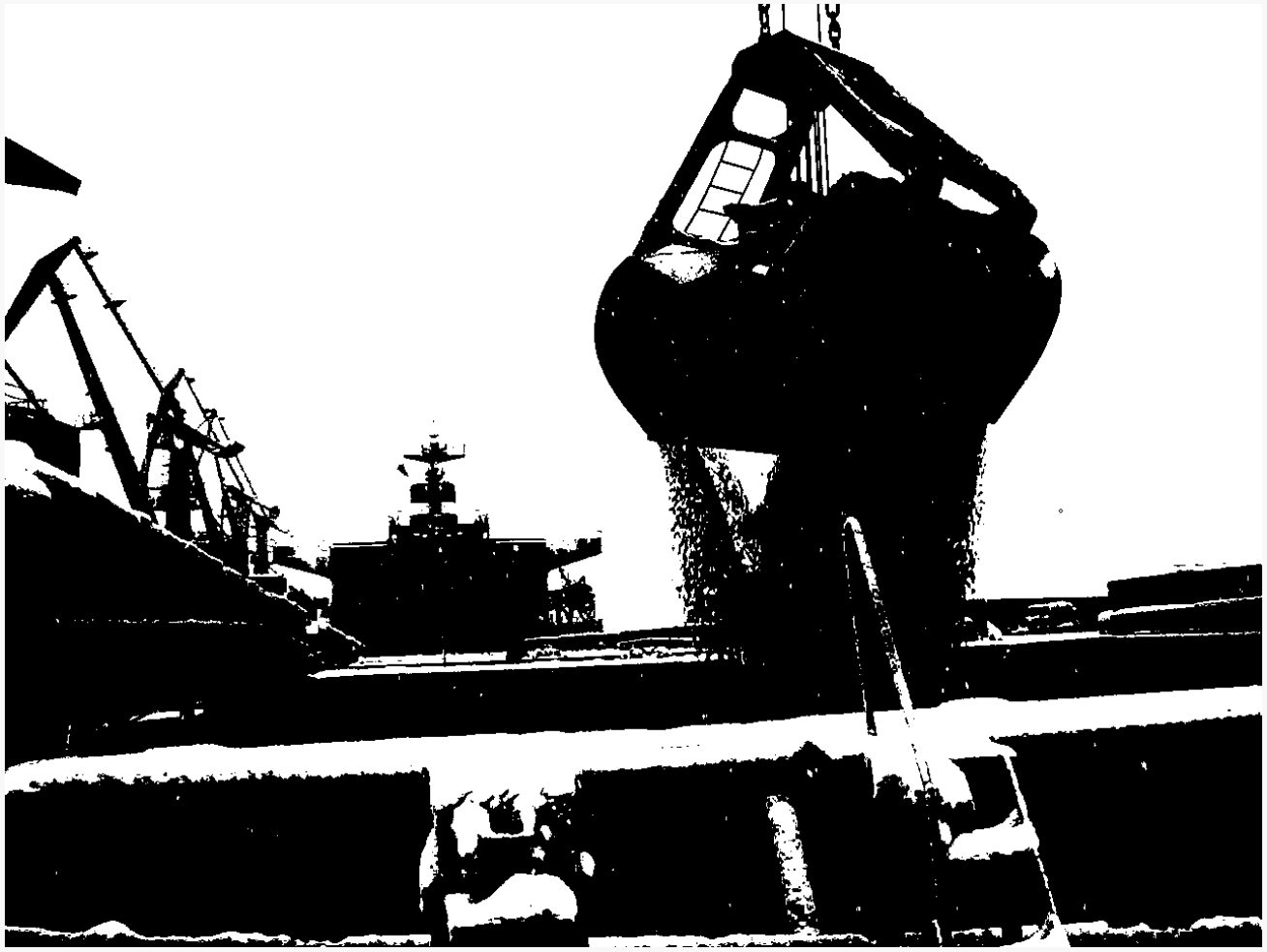
- The influence of **Temperature and the Aw-Value**(Water-activity) during storage/transport.
  - Litterature indicates Aw>60,T>25, likely to ferment and causing decreased conservation time(mould,fungi,bacteria) and heating
- The **Hydroscopic aspects** on requirements for transport, handling and storage infrastructure and Good Management Practices.
- **Off-Gassing of Torrified material** during long haul transport and storage: 7 days – 365 days.
  - The presence of certain volatiles in fuel pellets does accelerate processes
    - Aldehydes(Terpenes, etc), Lignin(both not present in torrified).
  - So specific research is required.
- **Durability of torrified pellets or OVOIDS – long term.**

Peterson-Control Union World Group & Biomass

- CANADA
- USA
- Brasil
- Argentina
- Mexico
- Colombia
- South Africa/Mozambique
- Ethiopia
- Thailand
- Malaysia
- Russia
- Baltic States
- Netherlands/Belgium
- Germany
- Poland
- France
- Spain
- Portugal
- Tunisia
- Morocco
- Scandinavia(No/Sw/Fi/Dk)
- United Kingdom/Eire

Everywhere and always

"We dare to care"



Everywhere and always

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