Needs for alternatives in wood preservation. Researches in the field in France

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Wood preservation

- When wood natural durabili ty is not enough to protect wood from decay and insect damage,
- Wood preservation has to be considered

- Wood preservative
  + Process to get the wood preservative into the wood

Regulations

Regulations

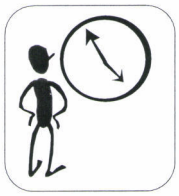
- Building sector
  - Law and statutory orders
  - Standards NF / EN / ISO
  - Unified technical documents
  - ...

Regulations

- Environnement & Public health

Regulations

- Environnement & Public health
- Timber & wood industry sector



Decisions...
...long and fastidious

The biocide directive

- European directive
  Application : May 2000
- All Biocides
- Active ingredients
  of wood preservatives

The biocide directive

- The active ingredients of the actual formulations will be studied
- Evaluation of
  - Efficacy
  - Risks and impacts
  - Ecotoxicity

The biocide directive

- Obtain a « positive list »
  - Maximum efficacy
  - Reduced risks and impacts
- Harmonisation through Europe

The biocide directive

- In 10 years time
  For all industrial sectors
- From 1500 biocides
  to 300/400 biocides

The biocide directive

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  For all industrial sectors
- From 1500 biocides
  to 300/400 biocides

Real need for alternatives

Today

- Forbidden for wood preservation
  - Lindane
  - Aldrine & Dieldrin

- Restrictions in use
  - Pentachlorophenol PCP
  - Creosote
  - Copper Chromium Arsenic CCA

The VOC directive

- Volatile Organic Compounds
  - All industrial sectors VOC volume reduced by 60 -70% in 2007
  - Toxic, carcinogenous, ... emissions

The VOC directive

- VOC
  - Direct incidence on wood preservatives formulations

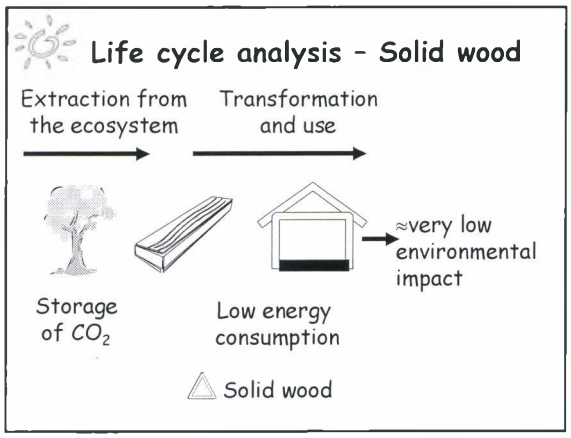
    Solvent base to water base

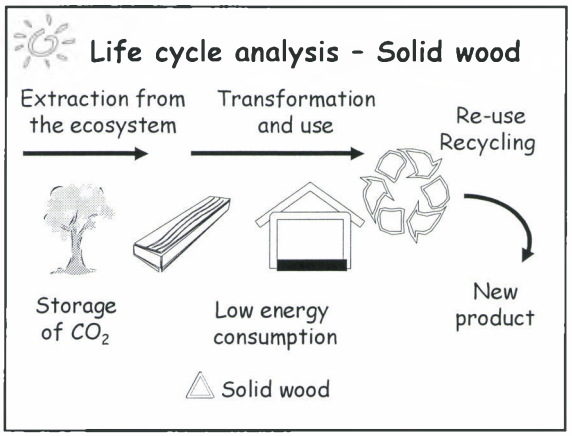
Wastes management

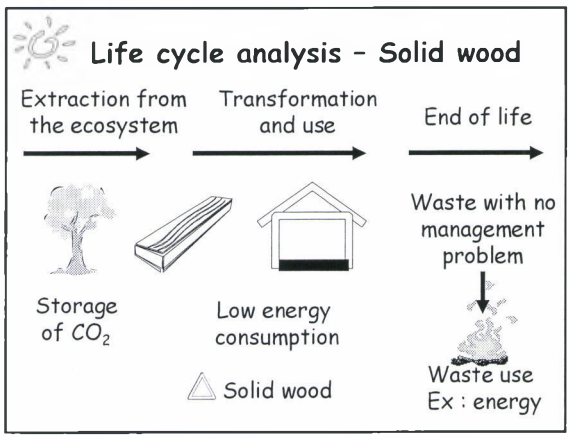
Life cycle analysis – Solid wood

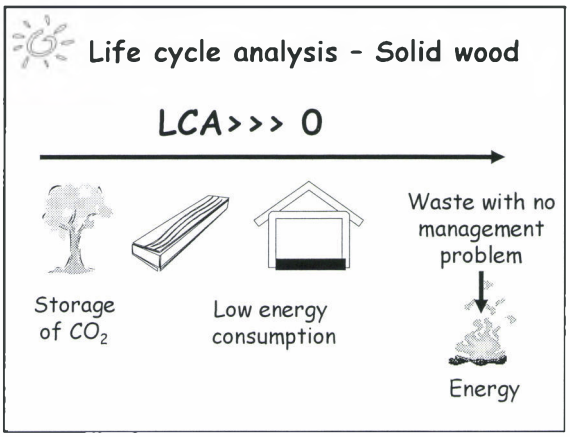
Extraction from the ecosystem

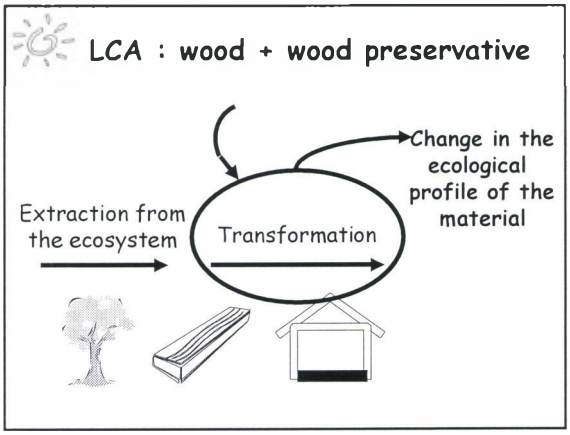
Storage of CO_2

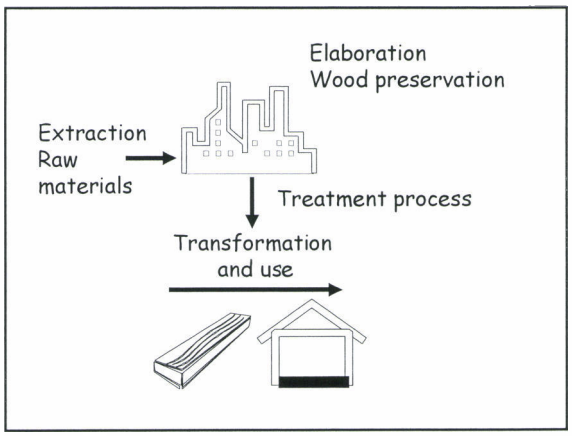


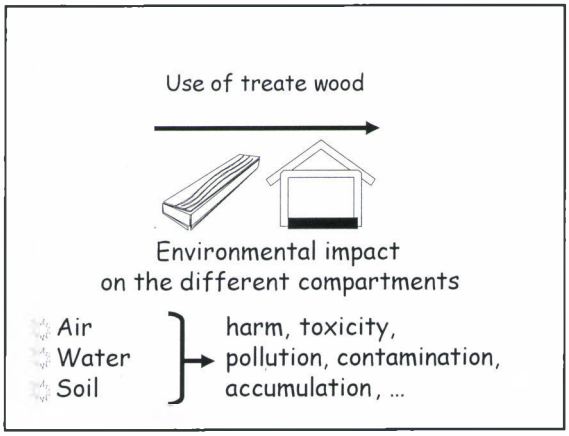


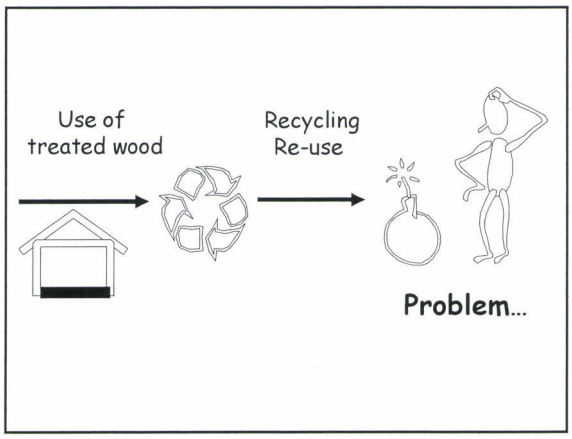


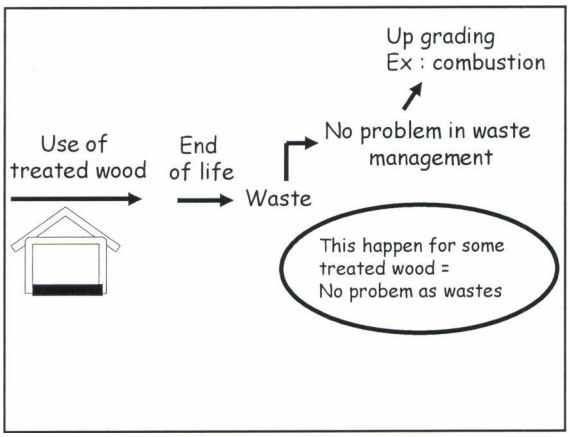


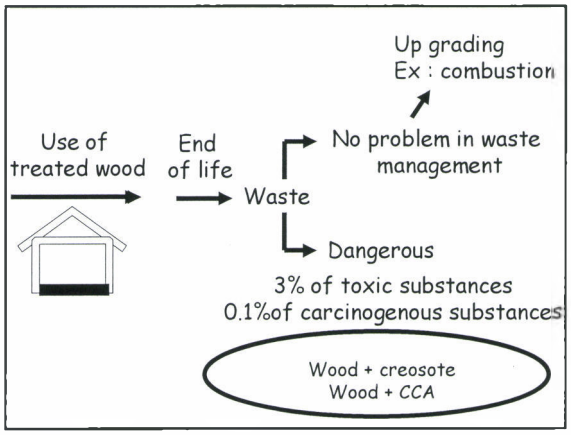


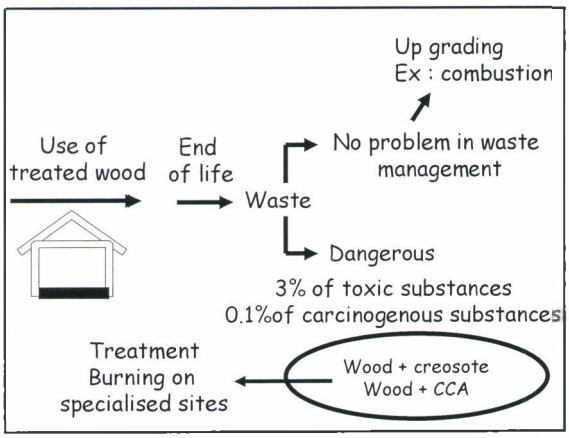


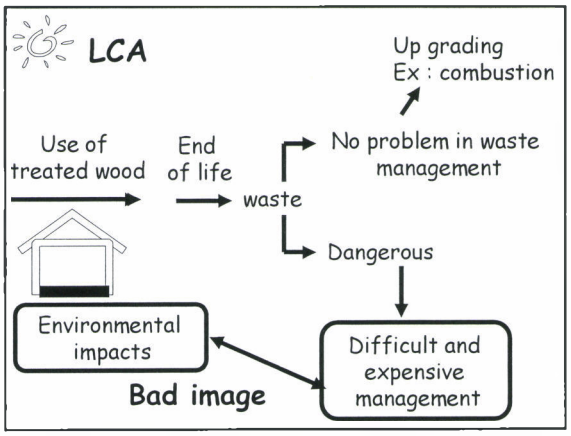

Use of treate wood
Environmental impact
on the different compartments
Air
Water
Soil
harm, toxicity,
pollution, contamination,
accumulation, ...


Use of
treated wood
Recycling
Re-use
Problem...

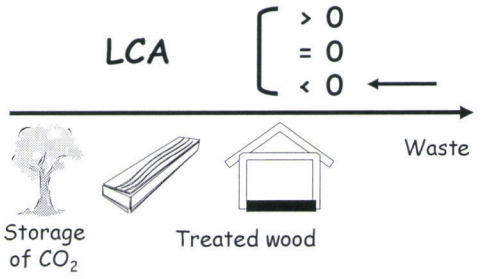

Up grading
Ex : combustion
Use of
treated wood
End
of life
Waste
No problem in waste
management
This happen for some
treated wood =
No probem as wastes


Up grading
Ex : combustion
Use of
treated wood
End
of life
Waste
No problem in waste
management
Dangerous
3% of toxic substances
0.1%of carcinogenous substances
Wood + creosote
Wood + CCA


Up grading
Ex : combustion
Use of
treated wood
End
of life
Waste
No problem in waste
management
Dangerous
3% of toxic substances
0.1%of carcinogenous substances
Treatment
Burning on
specialised sites
Wood + creosote
Wood + CCA


LCA
Up grading
Ex : combustion
Use of
treated wood
End
of life
waste
No problem in waste
management
Dangerous
Environmental
impacts
Bad image
Difficult and
expensive
management

LCA : wood + wood preservative



Needs for alternatives

- New way of protecting wood
- New products
- New active ingredients

Getting better

- Formulations
  - Creosote
  - CCA Type C
  - « New formulations »
- Process
  - Treatment
  - ex : cycles for the vacuum-pressure treatment
  - Product fixation

Researches in the field of wood preservation

Informations

- Research and new developments
- European action COST E37
  (COoperation in Science and Technology)
  Sustainbility through new technologies to enhance wood durability

  http://www.bfafh.de/cost37.htm

  Working groups
  WG1 Principles
  WG2 Performance
  WG3 Properties
  + Many documents on regulations, standardisation, ...

Informations

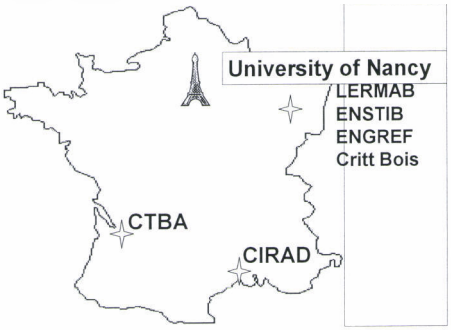
Research and new developments

Identification of all the research institutes, universities, groups.... working in the field

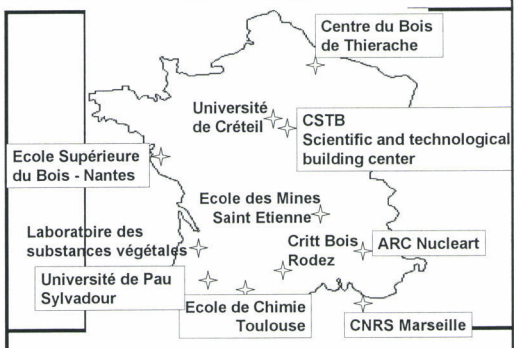
A questionnaire was filled by each of them :
What are the interests and the researches on going in the field of wood preservation

...when not top secret, of course ....

« Traditionnal » organisations in the field of wood preservation



Other important organisations



Working Group / Activity / Institute	Principles					Performance					Properties				
	Scaling up of non-biocidal treatments	Metal free wood preservatives	Sustainability benefits	Durability mechanisms	Biocentrol	Quality characterisation of modified wood	Realistic test methods	Predicting service life	Coating systems and maintenance	Comparative evaluation of commodities	Health and safety indicators	Emissions and environmental impact	Waste management	Biodegradability	Regulation, legislation and approval
CTBA	•	•				•	•	•	•	•	•	•	•	•	•
CIRAD	•	•		•		•	•	•	•	•					
"Nancy"	•	•		•		•	•		•	•		•	•		•

Working Group / Activity / Institute	Principles					Performance					Properties				
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CBTh	•	•		•		•	•								
CRITT Rodez	•					•	•			•					
CSTB						•	•	•		•					
ESB		•		•			•								

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Ensiacet	•	•		•		•									
LCSV	•	•				•	•			•					
LMGC	•					•	•			•					
Sylvadour		•		•			•								
Arcnuclear	•	•		•											

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LEI					•										
Cnrs Tours					•										

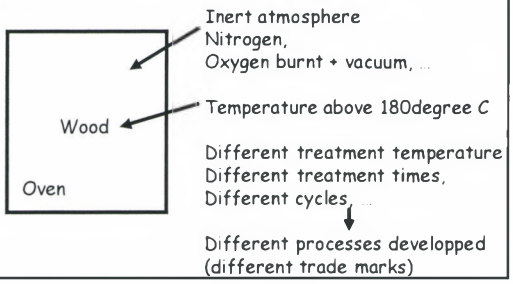
Research on-going

Non biocidal alternatives

Instead of treating wood,
the wood is modified
so that the wood destroying organisms
can not recognize and-or use it

Heat treated wood

Wood treated at high temperature



Heat treated wood

Above 180 degree, the hemicelluloses are degraded

Hemicelluloses contain a lot of -OH groups

The increasing temperature is affecting the lignin
= incrustant material = like plastic material

In general the temperature does not
exceed 220 degree C

Heat treated wood

The properties of heat treated wood :

- Change in chemical composition
- Increase in dimensional stability
- Change of colour (brown to dark brown)
- Change in physical + mechanical properties
More brittle
- Less mechanical resistance
(losses depending on the treatment)
- Corrosion of common fastener is more severe
(mild steel, zinc-coated steel, aluminium -
stainless steel is performing better)

Heat treated wood

The durability of heat treated wood :

- No clear evidence of increasing durability against
wood destroying larvae (coleopterea)
- So far, no increasing durability against termites

- Many papers are reporting a highly improved
durability against Basidiomycete fungi
(white and brown rots)

- Some papers describe that there is no benefit
in durability against fungi

Heat treated wood

Heat treated wood is already on the market in Europe

There are still some needs :
- define clear treatment cycles used
- have a quality control of the end-product
- product certification could be considered
- have a clear classification in terms of durability class
- consumer information for the use of this product

-New standards to make tests and qualify
these new products

- Life cycle assessment

Heat treated wood

- Heat treatment +
  Wood compression

  = Thermo-compression of wood

Chemical modification of wood

- Graft a chemical onto the wood surface
  So that the wood destroying organisms
  will not be able to use it as a substrate.
- Different methods studied :
  -Acetylation
  - Furfurylation
  - O-alkylation
  -Silicones compounds
  - Citric acid,...

Oil and Waxes

- Wood teated with oil and waxes
  + the use of temperature
  + the use of different baths (hot and cold oil)
  + the different treatment time.
- Active ingredients can be added
  to the oil bath
- High hydrophobic action
  Durability generally improved

Boron compounds

- Boron compounds known for their
  low environmental impacts and their low toxicity
  (boric acid = teratogenic ?)
- Boron are fungistatic and can protect wood against
  insects including termites
  BUT it is highly leachable
- Need to find a way to fix it into the wood for a
  long term.

Boron compounds

- Boron fixation with
  - protein (egg albumin)
  - different types of polymers
  - resins like melamine, ...

Other methods

- Modified chitosan treated wood
- Wood treatment with plasma
- Wood treatment with hydrophobation agents
  Ex : paraffin + N-methylol
- Wood treatment with polyethyleneglycol (PEG)
- Use of natural extractives

Other

- New active ingredients
- + New associations/formulation

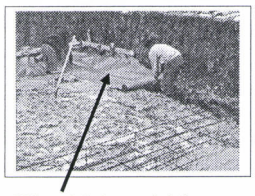
Developped by the industry,
but as the subject is highly confidential,
No information was gain from the industry.

The fight against termites...

- Before...
- Preventive treatments
  - Very heavy duty products
  - Large environmental impact

Termites

- Since
  - Preventive treatment



Film with insecticide molecules graft onto it

Granules where the film can not be put

Termites

- Bait systems

Termites

workers

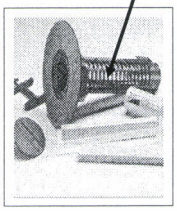
Food : Cellulose

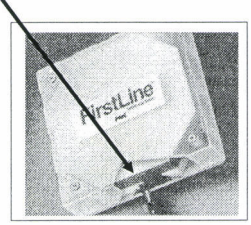
Feed the other termites

Termites

- Bait systems

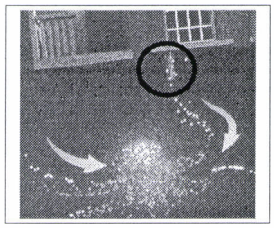
Untreated cellulose



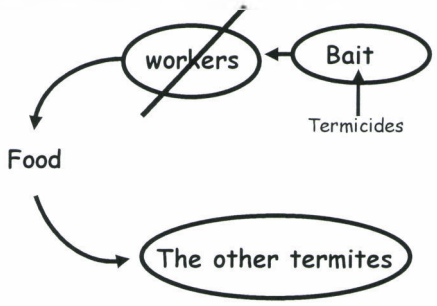


Termites

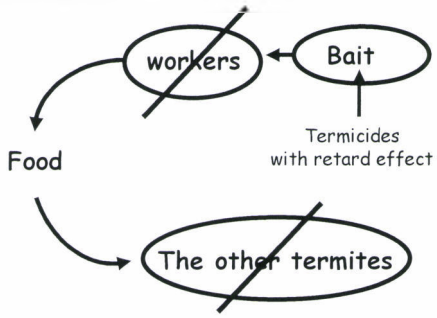
- Bait systems



Termites



Termites



Biological control

- Biological antagonisms
  Ex : Fungi used against blue-stain
- Entomopathogenous fungi against termites
  Ex : Fungi grown on a cellulose media + eaten by the termites.
  Once eaten, they grow in the termites and kill them
- Better knowledge of the biology of the insects to know better how and when to treat.

More Informations

- IRG : International Research Group on Wood Protection
  www.irg-wp.com

Working groups

WG1	Biology
WG2	Methods
WG3	Products
WG4	Process
WG5	Environment

+ Free papers on line
+ Many interesting links on the web site

More Informations

- Thematic network on wood modification
  www.woodmodification-network.org

Informations on all types of wood modification

More Informations

- Environmental impacts
  French agency for the defense of environment and the control of energy
  ADEME
  www.ademe.fr

- Informations on all european regulations
  www.eurlex.com

Wood preservation is useful

...but it should be done
in a way it does not impact
the environment
nor the human health

行政院農業委員會林業試驗所主管科技計畫
九十四年度細部計畫說明書

加強與法國之木材科學交換合作研究(5/5)

The project for strengthening the cooperation in wood science technology between R.O.C. and France(5/5)

農委會林業試驗所
中華民國九十四年一月

RI