1. Context

In order to fight against the transfer of the quarantine insects between countries, the FAO secretary for the vegetables protection has developed a rule named ISPM15 (International Standard for Phytosanitary Measures N°15) for the regulation of the wooden packing materials in the international trading.
The aim is to treat the pallets before exportation to kill all the pests inside the wood. Two kinds of treatment are approved:

- The heat treatment
- The chemical treatment

The heat treatment consists to heat the core of the wood at 56°C during 30 min.
The chemical treatment uses a liquid or a gas.

2. Chemical treatment & Methyl Bromide presentation

Several chemicals exist for the phytosanitary treatments. But some organisms have been developing resistance to a good many of these substances. Methyl bromide (MB) is known as the most efficient substance to fight against noxious organisms.
FAO has chosen this gas for the treatment of the pallets that forward from country to country. This gas kills the insects; it must be considered as dangerous and must be used with rigorous precautions.
The MB use is recommended in closed area (example: container) equipped for this purpose. This closed area has to be equipped so that the MB is not a danger for the operators and the outside people during the treatment.

Two kinds of contacts are to be considered: the contact with the liquid phase or with the gaseous phase.

As this gas is used with bottle under high pressure, it is liquid inside the bottle. As soon as the liquid goes out of the bottle, it becomes gaseous if the outside temperature is high enough (MB boiling point: 3.6°C). In the temperate countries in winter, there is a risk of contact with the liquid phase. It cannot be the case in the tropical countries where the usual temperatures are so high that the gas cannot be liquid at the atmospheric pressure.

The long-lasting contacts of the gaseous phase with the skin and the inhalation may occur when the worker has to stay a long time inside a closed area filled with gas. In this case, he has to wear well-closed clothes, gas facemask (to protect also the eyes), gloves and boots. Being outside of the closed area, the worker can inhale gas if he is very close to a leakage of gas coming from inside the closed area. And even, being given that the pressure inside the closed area is not higher than the atmospheric pressure and that the gas, heavier than the air, tends to stay on the ground, he has to have "the nose on the leakage" to be intoxicated.
That possibility of contamination is real when the treatment is made under tarpaulin inside a warehouse badly ventilated.

The security concentration is 5 ppm, which corresponds to 20 mg of gas per m^3 of air. This is the concentration of gas we can inhale permanently without health effects.

It is considered that there is a real risk for the life from 500 ppm.
The Methyl Bromide is odourless before 50 ppm. This is the reason for what we will use a mix of MB(98%) + Chloropicrin (2%). This last gas is odorous even at low concentration.

3. Conditions of our treatment

We treat our pallets in a 20" container, outside of a building.

The loading of a container is about 150 pallets. The necessary quantity of gas is 1.5 kg to treat one container.

This container is installed outside, on an open place closed by a wired fence, the Security Area. The doors of the container and the doors of the Security Area will be padlocked during the fumigation step.

At any time, nobody will have to enter in the container when the gas will be present, even at the end of the fumigation when the concentration in the container will be low.
During some steps of the treatment procedures, the operator will have to wear specific Personal Protective Equipment (PPE). This is required above all to prevent accident or human error, but not really because he is exposed to high concentration of gas.

Two people have to work permanently and together: in case of problem, one can help the other. Each of them has to have the full Protection Equipment needed available and ready to be used. No treatment can be done by a lonesome worker.

The gas injection is done remotely: the gas bottle and the operators stay outside of the Security Area, the injection being done with a pipe from the bottle to the container.

The gas bottle in use is installed in a closed, secured and well-ventilated room. Very close, a shower is available, being given that, in case of severe contact with the skin or the eyes, the first aid is to wash thoroughly.

Some periodical and security controls of the concentration will be done inside and outside of the security area to be sure that nobody can be intoxicated. The safety limit is fixed at 5ppm, even inside the security area.

For additional security, everybody entering inside the security area must wear his full PPE.

After the required time of fumigation (24 hours), the container is mechanically ventilated with an extraction fan during 1 hour. The air from the inside of the container is sent by the fan at a height of 5 meters above the ground with a chimney. After that, the container can be off-loaded.

To handle the pallets during the off loading, the workers have to wear gloves. The fumigated pallets will be marked and will stay one day outside under a shelter (but not covered with a tarpaulin).

The mark is made with a stamp wearing:

- **LR-002** (manufacturer code),
- **MB-DB** (for Methyl-bromide method & de-barked),
- **LAC – LIBERIA**
- The lot number

4. Steps and procedures for the treatment

1. Pallets reception & Container loading
2. Preparation prior to fumigation
3. Fumigation
4. Ventilation
5. Container Off-loading & Pallets Marking
6. Using of Multi-PID2 detector

- Equipments controls & maintenance
- Safety & Emergency procedure

End of Description & General procedure

Factory Department

Pallets Fumigation Report

Date: 21/10/05

Operator: Emm. Jimmy

Controller: Emm. Davis

Lot #: 31

Nbr of pallets: 150

BEFORE FUMIGATION

Container

	State	Check
Ventilation fan	Off	✓
Exhaust trap door	Closed	✓
2 ventilation trap doors	Closed	✓
Front doors	Locked	✓
Container security valve #A	Opened	✓

PPE (Personal Protection Equipment)

Full PPE for Operator	Worn	✓
Full PPE for controller	Available	✓

Fumigation room

Purge to atmosphere valve #B	Closed	✓
Upper valve dosificator	Closed	✓
Lower valve dosificator	Closed	✓

FUMIGATION

Dosification

Open gently the cylinder valve while monitoring the tank level on the dosificator
When stabilized, open gently the upper valve while monitoring the level
When the level reaches 3.3 lbs, close the cylinder valve and the upper valve

Injection

Open gently the lower valve on the dosificator
When all the liquid has left the dosificator, note the time

Date & Time: 21/10/05 / 9:54

(10 minutes later)

End of the Fumigation operation

Container security valve #A	Closed	✓
Lower & Upper valve dosificator	Opened	✓
Purge to atmosphere valve #B	Opened	✓
Cylinder room and Security area doors	Locked	✓

VENTILATION

Beginning — Date & Time: 22/10/05 – 11 00 Am

Operations sequence

			State	Check
	1	Ventilation fan	On	✓
	2	Full PPE Operator	Worn	✓
	3	Exhaust trap door	Opened	✓
	4	Container security valve # A	Opened	✓
	5	Purge to atmosphere valve # B	Opened	✓
(After 5 min)	6	2 ventilation trap doors	Opened	✓
		Time	11 05 Am	
(After 10min	7	Opening of the front doors-Time	11 15 Am	
(After 1h)	8	Ventilation fan	Off	12 15 pm
	9	Container security valve #A	Closed	✓
End of ventilation		Time	12 30 pm	

OFF-LOADING

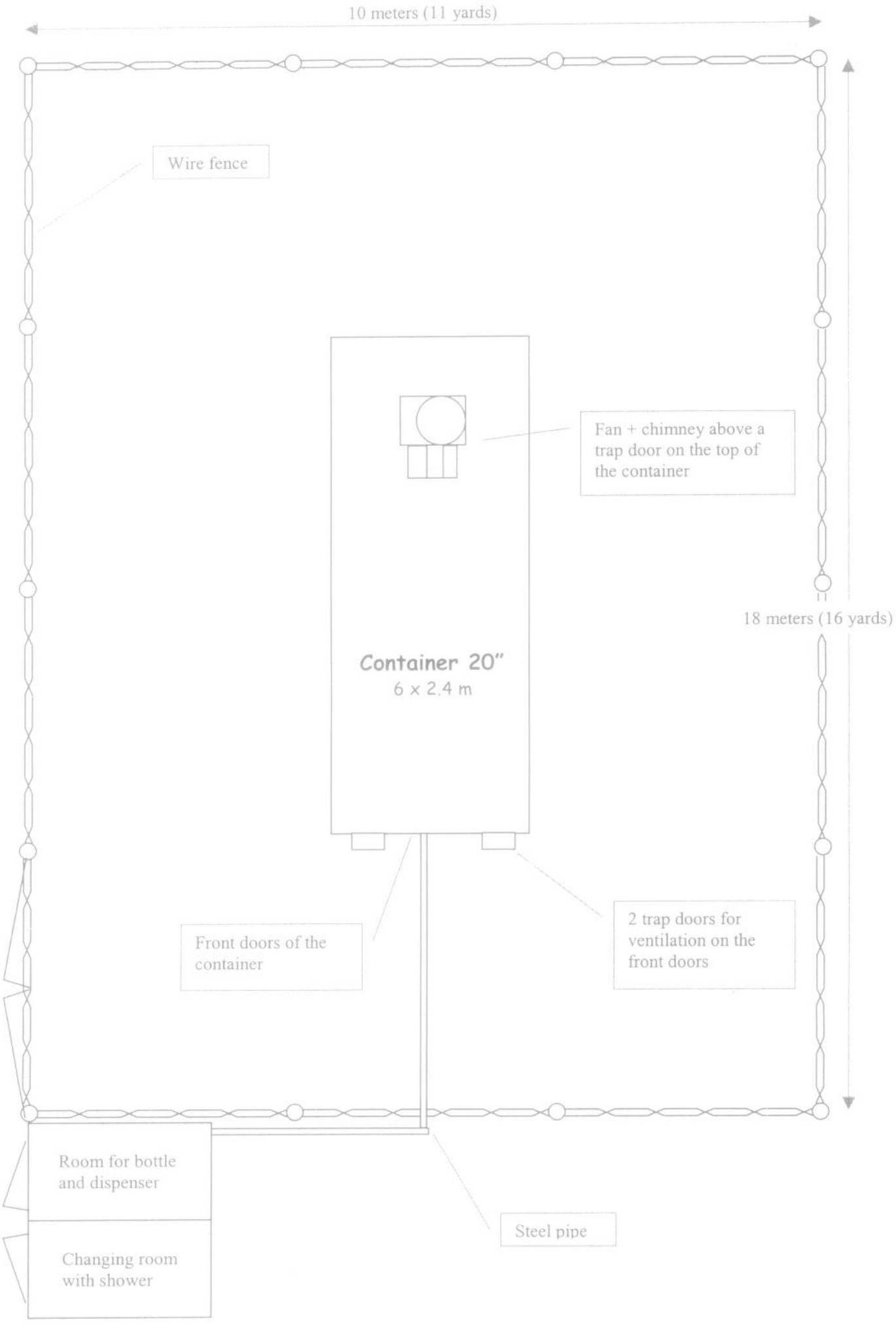
Ventilation fan	On	
Date & Time	22/10/05 ✓	

QUALITY ASSURANCE CONTROL

Fumigation time: 24 hours

Q/A Supervisor: Rievor

LAC - Area layout for gas treatment (elevation view)



WRC

WEALA RUBBER COMPANY

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NOTES REGARDING PALLET TREATMENT AT WEALA RUBBER COMPANY, LIBERIA.

Weala Rubber Company decided to use Heat Treatment for treatment of its wooden pallets to meet ISPM-15 specifications because the alternative Methyl Bromide treatment is not appropriate for a small site within a compact community.

1. Our pallets are built to a specification that is detailed in our Quality Assurance manual and the relevant pages and drawings are annexed hereto.
2. The specification states that all pallets shall be free from wood bark, splinters etc. This is of great importance to us as rubber producers because of the potential to damage the rubber if we allow wood bark to be present.
3. Every pallet is inspected by QA on receipt at the factory.
4. The ISPM stamp is shown on the attached sketch. It includes the IPPC logo, the letters 'LR' which is the ISO symbol for Liberia; '001', which is the processor number allocated to us by the Liberian Ministry of Agriculture; 'HT', which indicates heat treatment and 'DB' which indicates that the wood is debarked. Also included are the words 'Weala' and 'Liberia'. These are the only items allowed on the stamp under the IPPC standards.
5. One of the main reasons for choosing HT as opposed to MB is that HT is intrinsically better at killing plant pests because its determining parameter is that the core of the wood must reach a temperature of 56 Celsius for a minimum of 30 minutes. This ensures a total kill of all living matter within the wood.
6. With MB it is not possible to guarantee that the treatment reaches the core of the wood and it is therefore possible for borers or fungus to resume attack after treatment. It is also difficult to measure the actual chemical dosage to which the wood is subjected.
7. Like HT, the MB treatment leaves no protective residue to prevent subsequent attack but HT does guarantee complete Phytosanitary protection within the wood core.
8. Weala Rubber Company has developed its own pallet heat treatment oven because no commercially available unit could be found. It has been found easy and economic to use and has a very acceptable processing rate.
9. Heat Treatment is intrinsically safe because there is no residue from the process that requires disposal. It can be performed in any environment with no hazard to people in immediate proximity to the treatment equipment.
10. The pallet treatment oven is calibrated by use of thermocouples inserted in holes drilled into the thickest part of the wood sections. The thermocouple output is down loaded though a data logger system on to a computer. The computer prints out the results in either a graphical or spreadsheet form. A sample of a typical chart is attached. From this it is easy to see when the coolest wood section reaches 56 Celsius and for how long it is held at that temperature. Every pallet so treated is recorded together with its relevant treatment chart.

SPECIFICATIONS FOR WOODEN PALLETS.

All pallets shall conform to the dimensions shown in Annex 20.

All pallets shall be free from splinters, rough surfaces, wood bark and any infestation. Nails shall be below the wood surface and shall not split the wood. There shall be no sign of fungal attack.

All pallets shall be inspected by QA on receipt and only pallets that comply with the specification shall be accepted.

All acceptable pallets shall be heat treated to ISPM 15 requirements in the pallet oven.

The ISPM 15 specification requires that the core temperature of the wood shall attain a minimum of 56 Celsius for a minimum of 30 minutes. This requirement shall be met by all pallets and evidence of this shall be in the form of a temperature record for a selected pallet which calibration tests have established as the coolest section of the pallet oven. This record shall be retained by QA and shall include the pallet numbers of each treated batch of pallets.

On completion of heat treatment each pallet shall have a white paint area on each of the two narrow ends. The pallet shall then be stamped with the approved ISPM stamp which shows the treatment details as agreed with the Phytosanitary Office of the Government of Liberia.

WEALA RUBBER COMPANY

SCHEMATIC OF PALLET HEAT TREATMENT OVEN.