

Recommendations on the Sound Management of Packaging for Long Lasting Insecticidal Nets (LLINs)

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Background

More than 88 million long lasting insecticidal nets (LLINs) were delivered in 2009, over 145 million in 2010 and more than 45 million in the first two quarters of 2011.¹ In all, over 339 million LLINs have been distributed to sub Saharan Africa between January 2008 and July 2011. It is expected that similar volumes of nets and packaging will be distributed in the forthcoming years. Millions of LLINs are also distributed in other WHO regions. All of these nets will need to be replaced regularly.

Each single net typically comes in an individual bag which is then wrapped together with other bags in bales. Although each package weighs just a few grams, the aggregate result is several tones of packaging for every million nets distributed. There is therefore a growing awareness of potential health and environmental impacts that might result from exposures to millions of plastic bags that have been in contact with treated netting and may have absorbed pyrethroids, the class of insecticides present in LLINs.

This document was developed by the Global Malaria Programme (GMP) as a response to enquiries from WHO Member States and partners engaged in LLIN distributions. It is based on consultations with various partners, individuals and institutions with relevant expertise in this subject. Information on the fate of LLIN packaging is still insufficient and therefore this document only provides recommendations pending further research and evidence. This guidance addresses the specific question of what should be done with the LLIN waste packaging left from LLIN distribution.

These recommendations are drawn from two major documents: the *FAO/WHO Guidelines on Management Options for Empty Pesticide Containers*² and the *Basel Convention Technical Guidelines for the Identification and Environmentally Sound Management of Plastic Wastes and for their Disposal*.³

However, WHO recognizes that the options available in the field will sometimes make it not feasible to conform strictly to the practices recommended in the above mentioned guidelines. It is for this

¹ USAID, *Net Mapping Project*.

² *FAO/WHO Guidelines on Management Options for Empty Pesticide Containers*:

http://www.who.int/whopes/recommendations/Management_options_empty_pesticide_containers.pdf

³ *Basel Convention Technical Guidelines for the Identification and Environmentally Sound Management of Plastic Wastes and for their Disposal*: http://www.basel.int/meetings/cop/cop6/cop6_21e.pdf

See also *Basel Convention Technical Guidelines on Incineration on Land*:

<http://www.basel.int/meetings/sbc/workdoc/old%20docs/tech-d10.pdf>

reason that this guidance document also suggests temporary solutions while countries build suitable capacities to manage LLIN packaging waste.

Existing International Conventions and Recommendations

Both the bags for individual nets and the packaging used to wrap bales of nets are made of various materials⁴ including: *low density polyethylene* (LDPE), *LDPE coated with polyethylene terephthalate* (PET, polyester), *linear low density polyethylene* (LLDPE), *biaxially oriented polypropylene* (BOPP), *oxodegradable*⁵ (OXO) plastic bags, paper bags and various strapping bands.

Having been in direct contact with the pesticides present in the enclosed LLIN, an individual net bag is an "Empty Pesticide Container" as defined by the FAO/WHO *Guidelines on Management Options for Empty Pesticide Containers*.² The bags should therefore be handled in a manner consistent with that guidance. The Guidelines, which specify methods for the disposal of pesticide-contaminated packaging material, indicate that "unless empty pesticide containers are managed correctly, they are hazardous to both mankind and the environment". In particular, "burning plastics and pesticides in an uncontrolled fire will not destroy the hazardous components completely and may generate dangerous persistent toxins". The preferred methods are specified below.

It is widely accepted that the preferential order for waste-management options are: *avoid – reuse – recycle – energy recovery – dispose*, in that order. This hierarchy, together with the proximity principle that calls for managing waste close to its point of generation, may be regarded as the starting point for sound waste management practices.

WHO Recommendations for the Management of LLIN Packaging Material

Options for the management of LLIN bags and baling material must be evaluated on a case by case basis. "Reuse" is currently not an option since no manufacturer produces reusable LLIN bags and baling material and it is unsafe to use them for any other purpose as such. The following recommendations apply only to the safe disposal and recycling of LLIN waste packaging (bags and baling material) and do not cover the LLINs themselves.

Recommendations proposed in this document are based on the following:

LLIN individual bags of all kinds are exposed to the insecticide present in the net. The baling material is also exposed to the insecticide present in the net if the LLINs are baled without individual bags, and if they are baled with individual bags, then it is still possible that the baling material may have absorbed some insecticide. Therefore, as a precaution and until more is known on the issue, all these packaging material should be handled the same way, in accordance with the above-mentioned guidelines.

⁴ Up to 12 different types of polymer were identified during the WHO pilot study project to "identify and assess the feasibility of environmentally-sound options for collection, recycling and disposal of LLINs used for malaria control". This information is not included in any published report yet.

⁵ Oxo degradable packaging includes chemical additives that accelerate, in the presence of light and oxygen, the degradation of the plastic films into small fragments. Landfilling oxo degradable bags and bale wraps dramatically slows this fragmentation process due to the unavailability of oxygen and moisture.

I. Practices to be strictly avoided

1. Re-use of LLIN bags for any purpose;
2. Burning LLIN bags and baling material in open air as there is a risk of emission of harmful substances that mainly pollute local air, surface water, soil and food;
3. Disposing of LLIN bags and contaminated baling material as ordinary waste or in improper sanitary landfills.

II. Best practices

a. For LLIN manufacturers

1. Provide detailed information on the exact composition of materials used in the manufacture of LLIN packaging. This can be a label recommendation on the bag itself;
2. Provide guidance on the disposal and/or recycling of LLINs packaging following Best Available Techniques (BAT) and Best Environmental Practices (BEP);

b. For LLIN distribution projects

3. Where possible, and with no reduction in the public health benefit, distribute LLINs without leaving any packaging with the intended LLIN user;
4. Recycle LLIN packaging: recyclers processing used LLIN bags and baling material should apply proper controls of their materials and processes to ensure the bags are only recycled into appropriate products which have "limited potential for human contact⁶ and are not likely to be recycled again;"⁷
5. Ensure proper personal protective equipment (PPE) are used and measures strictly followed by workers involved in all stages of operations for collection, sorting, recycling and disposal of LLIN bags and baling material;⁸
6. Incinerate LLIN bags and baling material ONLY if specified high temperature incineration conditions for pesticide-tainted plastic can be assured⁹ following *Basel Convention Technical Guidelines* and in accordance with national regulations and requirements;
7. Store used LLIN packaging awaiting future safe recycling, disposal or other processing in dry, well ventilated and secure facilities;

⁶ No food, beverage packaging or household items.

⁷ Page 29 *FAO/WHO Guidelines on Management Options for Empty Pesticide Containers*.

⁸ Minimal PPE includes but is not limited to: daily changed long sleeve shirts+ frequently changed rubber gloves. If dust is noticed from any operations a certified particulate respirator is advised. Recycling operations involving heating resins beyond the melting point require either evacuated air from the breathing space of workers or certified pesticide respirators.

⁹ *Basel Convention Technical Guidelines for the Identification and Environmentally Sound Management of Plastic Wastes and for their Disposal* specify that "The condition for the optimal incineration of material is: Temperature of 850°C-1100°C for hydrocarbon wastes and 1100°C-1200°C for halogenated wastes; sufficient (gas) residence time in the incinerator (EU legislation requires 2 seconds as a minimum): good turbulence; and excess of oxygen": http://www.basel.int/meetings/cop/cop6/cop6_21e.pdf

See also *Basel Convention Technical Guidelines on Incineration on Land*: <http://www.basel.int/meetings/sbc/workdoc/old%20docs/tech-d10.pdf>

8. If recycling or incineration is not possible, and if LLIN producers provide directions on methods for safe disposal, follow the manufacturer's recommendations. Alternatively, landfilling of bags and baling material in a properly engineered landfill is an option, as detailed in the *FAO/WHO Guidelines on Management Options for Empty Pesticide Containers*;²
9. National pesticide registration authority to make mandatory that manufacturers provide recommendations on the safe disposal and/or recycling of LLIN packaging. This will include information on labels of LLIN bags regarding the material used in the production of such bags;
10. Assure that disposal of LLIN packaging is included as a condition in the procurement of LLINs;
11. Develop national LLIN packaging management protocols for these wastes and assure that all stakeholders are aware of proper packaging disposal procedures that is aligned with national regulations and requirements;
12. Integrate good practice recommendations on the sound management of LLIN packaging into the existing national malaria strategy and related frameworks; and ensure that recommendations are aligned with national regulations concerning the safe handling and disposal of chemical waste (or pesticide-tainted waste).

III. Temporarily acceptable practices for LLIN distribution projects

As WHO recognizes that under field conditions it might not always be feasible to conform strictly to the above mentioned best practices, the following options are considered as **temporarily acceptable** while countries are building capacity for the sound management of LLIN packaging:

1. Empty LLIN packages should be made impossible to reuse, i.e. by cutting, puncturing or the equivalent;
2. Bury LLIN Packaging. At the moment, there is no consensus about the exact conditions for burial and this point needs to be further assessed. In the meantime, until further evidence has been collected, WHO recommends the following: bury in soils with low permeability, away from any residences, at least 100 metres away from any wells or surface water source and at least 1.5 metres above the water table.¹⁰ Sloped or domed compacted soil should cover the buried plastic to a depth of one metre or more.

¹⁰ *Domestic & Refugee Camp Waste Management Collection & Disposal*; Oxfam 21 May 2008.