

# Use of shipping containers for short-term<sup>1</sup> storage of insecticide-treated nets after being delivered: operational concerns and considerations

May 2021

## 1. Summary

This document is written in response to concerns raised by a number of different stakeholder groups including members of the Alliance for Malaria Prevention (AMP) partnership, regarding storage of insecticide-treated nets (ITNs<sup>2</sup>) in shipping containers after they have been transported and the possible effects on product integrity and quality. AMP is comprised of national malaria programmes, private and public sector partners (including donors and procurers), as well as faith-based and humanitarian organizations.

Until now, recommendations on the use of shipping containers for in-country storage of ITNs, based on experiences to date, have not been consolidated in a document easily accessible to national malaria programmes and partners to aid in decision-making about ITN storage for mass campaign or continuous distribution.

### **Countries should prioritize other more permanent and controllable storage options before considering containers**

Given the potential risks of distributing ITNs that may have become sub-standard as a result of exposure to high temperatures and/or humidity and in the absence of data to support this storage option for longer duration, current operational recommendations from the World Health Organization (WHO) and AMP does not recommend storage of ITNs in containers **for more than two weeks** after delivery to final destination in-country.

## 2. Limitations regarding storage of ITNs in containers

The distribution of high-quality, safe and effective ITNs is critical to ensuring the protection of affected communities against malaria, to sustain progress in the fight against malaria, and to maintain the credibility of national malaria programmes, their implementing partners and donor agencies.

An intermodal container is a large standardized shipping container, designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport – from ship to rail to truck – without unloading and reloading their cargo. In recent years, a number of malaria-endemic countries have chosen to purchase and use intermodal containers, commonly referred to as shipping containers, to store ITNs prior to distribution through mass campaigns or continuous distribution channels.

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<sup>1</sup> No more than two weeks.

<sup>2</sup> For the purposes of this document, ITN is considered to include long-lasting insecticidal nets (LLINs), as well as all new and forthcoming net types (piperothrin butoxide [PBO], and new types of nets containing pyrethroid insecticide and other active ingredients).

National malaria programmes cite saved time, labour and costs, as well as ITN security, if shipping containers are used rather than having to identify and contract secure warehouses or other storage facilities to store ITNs. Where containers have been purchased for ITN storage, national malaria programmes also identify the advantage of not having to re-budget for extension of storage rental periods for weeks or months due to ITN distribution delays (largely for mass campaigns).

Storing ITNs in unventilated or unmodified shipping containers where the ITNs could be exposed, either for short periods of time or over a sustained period, to temperatures exceeding the recommended temperature threshold as well as to high humidity and moisture has not been well researched with respect to the impact on the quality and resultant efficacy of the ITN. In the absence of such data and the absence of ongoing monitoring of the conditions in which ITNs are stored in the containers, manufacturers of ITNs do not recommend using containers to store ITNs upon delivery to countries<sup>3</sup>.

Two national malaria programmes that have used containers for storage for extended periods of time (more than six months) have reported problems with staining of ITNs, damage to packaging, e.g. packaging sticking together and printing melting off packages<sup>4</sup>.

In spite of the lack of research, AMP and WHO recommend that national malaria programmes and partners should consider the use of shipping containers for ITN storage beyond 14 days **only** if there is a lack of other more appropriate and secure storage/warehousing options. The length of time that ITNs remain in containers should include the average time required for clearing once at port.

### **3. Points for consideration if shipping containers are to be used for short-term storage beyond 14 days**

The practice of using the actual shipping container that was used to ship ITNs from the manufacturer is not recommended, as the container quality cannot be assured in advance and modifications cannot be made immediately on delivery at the storage site. However, if the shipping containers are to be used as temporary storage, the following is recommended and should be included in the planning and procurement stages where possible:

- The containers are empty, intact, clean and are pre-positioned at the storage site, to be filled by hand (or forklift).
- The procurement of containers is organized in advance and separately from the procurement of the ITNs.
- In the short-term, measures to erect a temporary roof over the container to reduce direct sunlight and allow airflow between the roof and the top of the container should be considered. In the long-term, efforts should be made to improve in-country storage conditions and minimize potential impact on the quality of the ITNs.

The recommendation remains that ITNs **should not be stored** for longer than two weeks in the shipping containers used to transport the ITNs from the manufacturer. The points in the table below should be considered where container storage of ITNs is required beyond two weeks **due to lack of any other storage options**.

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<sup>3</sup> See Annex 1 for findings from the supplier survey finalized in November 2019.

<sup>4</sup> Note that this is only from limited sources. More work is required to understand, qualitatively, what effects shipping container storage has had.

Concern	Consideration
<b>Container quality</b>	When containers are being purchased (as per above, separately from the containers used for shipping the ITNs), it will be important to specify the quality of the container desired, particularly where it is planned that containers will be used for storage of other items after the ITN distribution (see below). Where it is necessary to store ITNs in containers, it will be important to ensure that last shipment (end of life) containers are <u>not</u> used due to the strong possibility that they are in poor condition and may put ITNs at risk of damage pre-distribution. Container colour has been found to have an impact on both temperature and humidity <sup>5</sup> . Light colours will have a lower temperature and less fluctuation in humidity as a result. Better quality and newer containers will have a higher cost, as will specifying the container colour, which may not be a readily available option.
<b>Delivery levels and infrastructure</b>	Road and transport infrastructure must be considered when planning for delivery of containers to be used for ITN storage. For safe unloading of containers from trucks, a speciality vehicle like an intermodal tipper truck or a crane should be used, which may not be readily available and may be expensive. Trucks in good condition and of the appropriate size may be limited, increasing the transport time and the planning detail required for coordinating the arrival of trucks and the availability of special vehicles or cranes. The feasibility of container delivery prior to placing the order for ITNs and the shipping containers should be verified. Determine where container delivery is not possible and ensure planning and budgeting for appropriate warehousing/storage. Where available storage may not meet the procurement requirements in place within the Ministry of Health or the donor organization responsible for the warehouse costs, ensure that detailed requests for approval of identified storage are made early.
<b>Days planned for storage</b>	The number of days that the ITNs will be stored in containers prior to their transport to subsequent levels of the supply chain is important to take into consideration. As far as possible, the ITNs should get port or customs clearance as quickly as possible and then be moved to appropriate storage locations. When ITNs will need to be stored for longer than two weeks, measures to mitigate against risks related to heat, humidity and moisture exposure must be put in place (planned and budgeted) – see below. Alternatively and ideally, appropriate warehouses or storage locations should be secured early for those ITNs that will be stored for two weeks or longer.
<b>Preparation for container arrival</b>	It is important to plan for the arrival of the containers well in advance. This includes: <ul style="list-style-type: none"> <li>• Identification of the site(s) where the containers will be dropped. These sites should be far from water sources or areas that can pool water after rains. Given the difficulties and costs in moving containers, the delivery location should be the final resting location for the container.</li> <li>• Utilization of container stands to ensure that the containers do not sit directly on the ground in order to reduce risks related to dampness and humidity, particularly with wood-floored containers.</li> </ul>

<sup>5</sup> [https://eprints.usq.edu.au/27322/1/Carey\\_2014.pdf](https://eprints.usq.edu.au/27322/1/Carey_2014.pdf)

Concern	Consideration
	<ul style="list-style-type: none"> <li>• Preparation of the ground, to ensure that it is flattened, and that the container can be securely positioned. Ensure there is opportunity for water to dissipate around the containers to prevent humidity build-up.</li> <li>• Using natural shade, as far as possible. Temperatures inside containers in the direct heat of the sun at midday can rise 20°C or more than the outdoor temperature. Where natural shade is not an option, appropriate shading that protects the container from exposure to direct sunlight throughout the day should be constructed to reduce the effects of high heat. Construction of the shading structure should not contribute to any pooling of water.</li> <li>• Purchase of locks and chains for security since the containers will need to be opened and a physical inventory carried out (see below).</li> <li>• Purchase of lights (and battery packs as needed) that can illuminate the area around the container to reinforce security (where these do not already exist in the identified delivery site).</li> <li>• Keeping plants, brush, and debris away from exterior container walls.</li> </ul>
<b>Container modification</b>	<ul style="list-style-type: none"> <li>• Inexpensive turbine fans mitigate excessive levels of heat, dust build-up, moisture, carbon dioxide levels and other air pollutants and require no power to operate.</li> <li>• A small screen vent placed near the bottom of the container at the door end, combined with a turbine fan at the top of the opposite wall, will enable continuous air flow.</li> <li>• High quality, solar-reflective paint can be applied to containers to lower the surface temperature by about 3—6°C. If specialized reflective paint is unavailable, white paints typically reflect 80 per cent of visible light and can help mitigate heat. Painting the exterior of a 20ft (6 metre) container will require 20 litres of paint, or 35 litres for a 40ft (12 metre) shipping container.</li> </ul> <p>See <a href="https://www.ghsupplychain.org/use-containers-temporary-emergency-storage-tips-mitigate-temperature-and-humidity">https://www.ghsupplychain.org/use-containers-temporary-emergency-storage-tips-mitigate-temperature-and-humidity</a> for more details</p>
<b>Reception of ITNs and potential need for additional storage</b>	<p>To confirm that the containers contain the ITN quantities indicated on the shipping documents, the receiver (e.g. national malaria programme, implementing partner) and a reception committee (where part of the logistics plan and budget) must open containers at the point where custody of the ITNs is transferred to the receiver, unload bales, verify the quantities received and report any discrepancies. The transporter must be released as soon as possible to avoid incurring additional charges; therefore, the reception, offload (and reload to containers, preferably separate from the containers the ITNs were shipped in), physical count and verification and sign-off on tracking tools must be done in a timely manner<sup>6</sup>.</p> <p>After the arrival of the container at the delivery site where unstuffing of the containers for physical count of bales is conducted, it is likely that some bales will not fit into the container being used for storage. Since</p>

<sup>6</sup> The procurement agent responsible for the delivery of the ITNs will normally establish a timeline for the receiver to acknowledge reception of goods, after which any loss reported during the offload will not be covered through their contract and insurance.

Concern	Consideration
	bales are packed mechanically at point of origin, only an estimated 75—80 per cent of the bales can be manually repacked to fit in containers, thus requiring additional containers or storage sites for small quantities of bales, plus trucks and staff to transport those bales that cannot be replaced in the container to where they will be stored <sup>7</sup> .
<b>Container inspection</b>	During the unstuffing of the containers for the physical inventory of bales received, the container itself, if it will also be used for storage of the bales on arrival in-country, must be inspected to ensure that there are no leaks, holes or weak points. This same process of container inspection should take place where containers are purchased separately for ITN storage purposes. Where the container condition is not specified in the shipping documents (e.g. not end-of-life containers), any repairs needed to ensure safe, dry storage of the ITNs will need to be undertaken and paid for by the national malaria programme or implementing partner. Where repairs are needed, alternative storage for ITNs pending container availability will need to be identified until the containers are in good enough condition for ITN storage. This issue should form part of the risk assessment and mitigation planning and associated budgeting. Where the container condition is specified and the container does not meet specifications, the national malaria programme or implementing partner will need to work with the procurement agent to identify when repairs will take place and how they will be paid for.
<b>Security</b>	Storing ITNs in containers does not negate the need for security, particularly when a large quantity of ITNs is being stored in a single location. Budgets should include costs for guards (private or public) 24 hours a day for the area where the ITNs are stored in the containers. Where this is a large area/large number of containers, the number of security personnel should be planned appropriately. Keys for opening the containers should be kept with logistics and warehouse management personnel (clear standard operating procedures should be put in place detailing who should open containers and when) and not left at the container storage area or with security personnel.
<b>Physical inventories of stocks</b>	Based on the asset management plan in place within the Ministry of Health, the implementing partner or through the funding partner, regular physical inventories of stocks should be undertaken to ensure no loss or leakage of ITNs in storage. Budget considerations may include security and labourers during the unpacking and repacking of the containers.
<b>Monitoring of temperature and humidity during storage</b>	Where containers are necessary for storage of ITNs, strong consideration should be given to ensuring that budgets include purchase of data trackers to allow for registration and verification of the temperature and humidity conditions in the containers <sup>8</sup> on a regular basis. This would provide the data to make changes (for example, to move the ITNs to warehouses or other storage locations) where the temperature and humidity can be better controlled.

<sup>7</sup> Estimates by AMP logistics experts based on needs for space for inventories, bale volume and manual packing capacity.

<sup>8</sup> PQT guidance would be sought regarding the data trackers and the frequency of data collection, as well as its analysis.

Concern	Consideration
<b>Use of containers for storage after ITN distribution</b>	The use of the containers after the ITN distribution should be planned from the time the decision to procure containers is made. Many products – such as case management supplies, etc. – cannot be safely stored in containers due to the risks associated with high temperature and/or humidity exposure without the container being sufficiently modified. Future use of containers should be only considered for products that have no heat or humidity exposure risks.



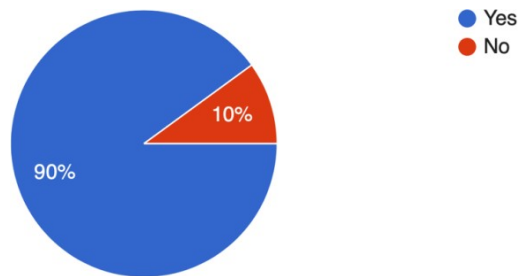
*Containers lifted from the ground on blocks*

*© Containers First, Sydney Australia*

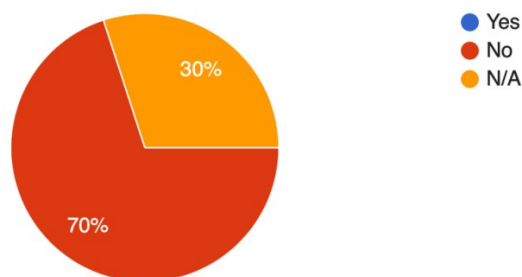
## Annex I - ITN manufacturer packaging and shipment specifications survey – September 2019

### Manufacturers' responses to questions related to storage in shipping containers<sup>9</sup>.

Do you have recommendations on how your ITNs are stored upon delivery to the recipient? [10 responses]



Do the recommendations differ by type of product [10 responses]

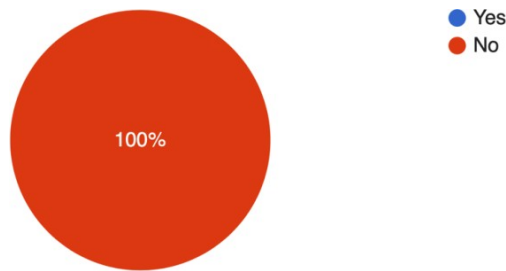


If you answered yes to the question above, please describe your storage recommendations by type of product.

- Cool (as possible), dry and out of direct sunlight.
- No exposure to light, high humidity or very elevated temperatures.
- All ITNs should be stored in a normal condition temperatures and not high temperatures.
- Store in cool and dry place.
- Out of direct sunlight. To be stored in a dry ventilated place under normal indoor temperature; bales should be stacked on pallets.
- As per our safety data sheet: Store in ambient temperature and at atmospheric pressure in original packaging. Do not store near highly flammable materials. Store product in closed packing in a cool area away from direct sunlight.
- We recommend not to have container storage. For standard storage: always keep the product in the shade and also dry.

<sup>9</sup> The whole survey and responses from manufacturers can be found in *ITN manufacture packaging and shipment specifications survey*. AMP.

Do you recommend storage of your ITN products in containers upon delivery in a country? [10 responses]



How long after port clearing can your ITNs be stored in containers at increased temperatures with limited risk of package and product deterioration? [one response]

- As short as possible, but not longer than four weeks.

Please describe any particular precautions or preparatory actions you would highlight to the recipient if they decide to store the ITNs in containers upon delivery? [one response]

- Put the containers in the shade.
- We do strongly recommend NOT to store the ITNs in containers

Are there any additional packaging or storage conditions that would make your warranty null and void? [five responses]

- Storage in hot, wet, or high humidity for extended periods of time.
- No.
- Storage under direct sunlight or in temperatures exceeding 40°C for more than eight weeks.
- N/A.
- High temperature and humidity, exposure to sunlight.

AMP wishes to extend its gratitude to the following manufacturers who took part in the survey:

- A to Z Textile Mills Ltd
- BASF SE
- Disease Control Technologies LLC
- Life Ideas Biological Technology Co. Ltd
- Mainpol GmbH
- Shobikaa Impex Private Ltd
- Sumitomo Chemical Co. Ltd
- Tianjin Yorkool International Trading Co. Ltd
- Vestergaard S.A.
- VKA Polymers Pvt. Ltd