THE NEED FOR OFF-GRID VACCINE STORAGE.

Existing products did not address this need

**Solar direct drive fridges**

- High equipment and installation costs
- Deployment requires skilled technicians and takes 1 to 2 days.
- In high ambient temperatures, significant energy consumption.
- In urban locations, may not be a suitable place to fit PV array.

**Absorption fridges – kerosene or LPG**

- Poor temperature control and are not frost free.
- Fuel costs.

**Vaccine carriers using ice packs**

- Only maintain a safe temperature for a few days in hot ambient.
- High risk of freezing the payload.

High density urban

First response emergency relief, or for covering 1 day's supply for 100 people.

High risk of freezing the payload.

High equipment and installation costs.

Poor temperature control and are not frost free.

Vaccine carriers using ice packs

- Not suitable.

**Advanced modelling**

Following success of the proof of concept, BMGF and the Bill & Melinda Gates Foundation commissioned further work to develop the LTPD.

Using ice as energy storage in high ambient temperatures without active cooling was a challenge. A 1:1 scale prototype was developed using state of the art insulation using vacuum insulation panels (VIPs) on an innovative arrangement of vacuum insulation panels to isolate the cold section from ambient.

A COMSOL-Multiphysics model was developed by Brunel University to simulate the performance of the LTPD and examine the impact of variations in storage conditions on the performance of the prototype LTPD.

**Product development**

- Improved insulation and added Sure Chill freeze protection to allow use of ice packs under any ambient conditions.
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**Quantitative data from the trial revealed:**

- The ambient temperature ranged from 20 - 37°C inside the health posts.
- The vaccine compartment remained between 2 - 8°C except when the vaccine compartment door was opened. This is seen as spikes in the vaccine compartment temperature profile.
- Minimum temperature observed over 3 months was 4.1°C, clearly demonstrating the freeze-free safety inherent in the Sure Chill technology.
- Freeze-tag® monitors were installed in LTPD units to record cumulative temperatures occurring in the vaccine chamber.

**Objective**

- Simple to use
- Robust and reliable
- No power required, “passive” operation
- Maintain stable, safe vaccine storage temperatures for up to 35 days in hot conditions
- Guaranteed freeze free
- No ice pack conditioning required
- Quick and easy to set up

**Device Format**

- Robust and durable polyethylene casing.
- Pack compacted – only the ice remains closed for reusing.
- Easy access to vaccine compartment with good visibility of payload.
- Easy portability.
- Internal Sure-Chill elements transferring cooling from ice packs to vaccine compartment whilst preventing freezing.
- External solar powered temperature display.

**Results**

Outreach: An enhanced vaccine carrier has been developed with improved insulation and added Sure Chill freeze protection to allow use of ice packs under any ambient conditions.

**Accessories**

- On-site ice generation: A simple 120 litre absorption fridges manufactured for Bangladesh to create use of ice packs under any ambient conditions.

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**Phase 2 Field Trials**

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- Freeze-tag® monitors were installed in LTPD units to record cumulative temperatures occurring in the vaccine chamber.

**Perfect applications**

**Small off-grid rural:** Providing safe vaccine storage with monthly deliveries of vaccine and ice packs

- Vaccine storage where grid is unreliable and PV is not available.
- Rapid deployment: No remote service, no for covering equipment break down in established cold chain

**High density urban:** Vaccine storage where grid is reliable and PV is available.

**Acknowledgements**

Sure Chill is keen to hear from countries interested to trial the new device. Contact us at hello@surechill.com