

The ICRC Cold Chain

- Goods and destinations
- Problems with temperature control
- Cold boxes
- Freeze protection solutions

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Cold Chain Items

- Vaccines (Tetanus, Hepatitis, Meningitis)
- Diagnostic tests (Hepatitis, HIV)
- Drug products (Insuline, Oxytocin)
- Blood grouping serum

Total value shipped in 2005: CHF 655,000

Main Destinations

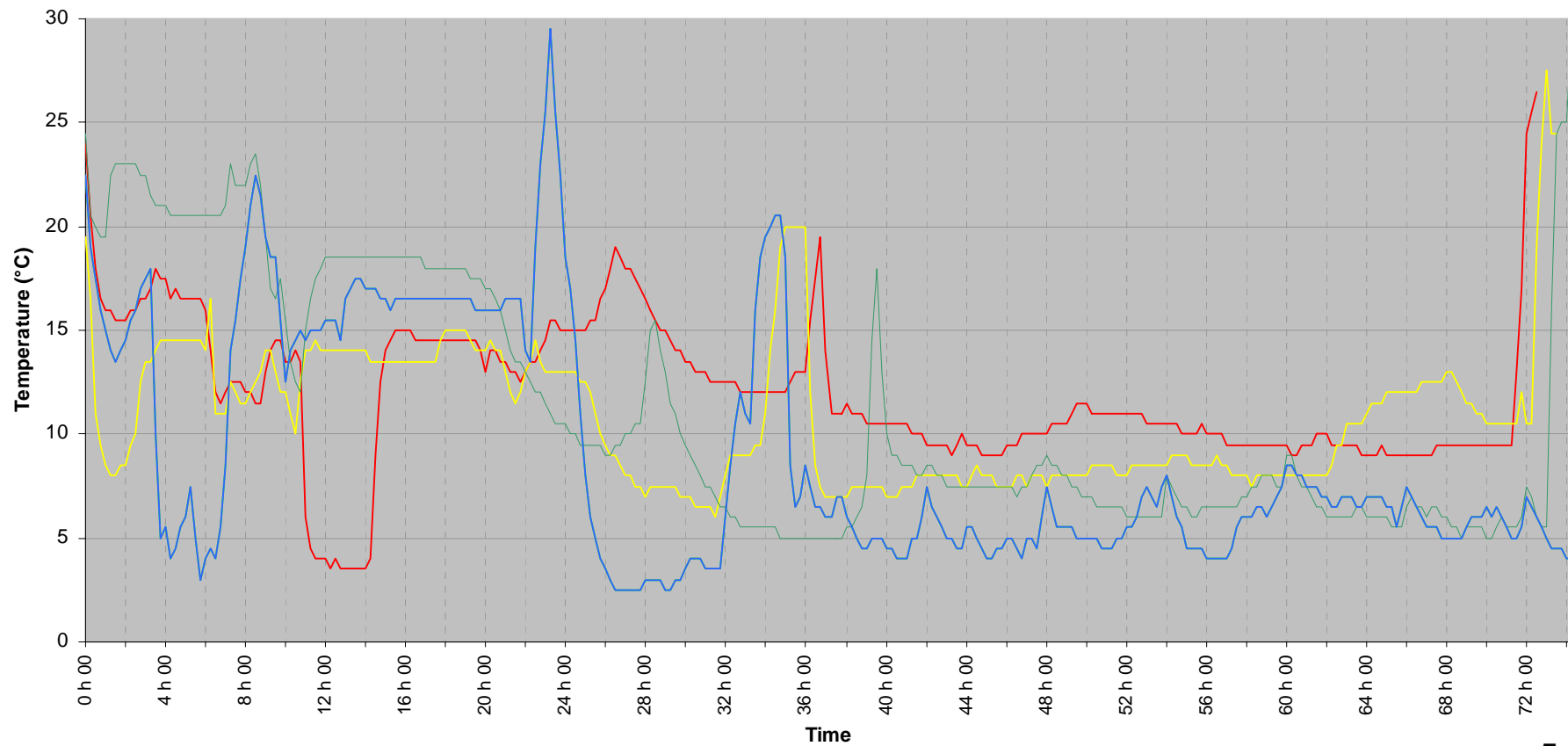
- Afghanistan
- Logistic Centre Nairobi
- Indonesia
- Sudan
- Uganda
- Liberia
- Eritrea
- Sri Lanka
- Philippines
- Chad
- Nepal

Temperature Gradient

For example 30° C temperature difference between Geneva and Khartoum, Djakarta and Kampala during winter.

Variations in external temperature

EXTERNAL TEMPERATURE VARIATIONS
Transport of cold boxes from Geneva to Nairobi



Standard cold boxes

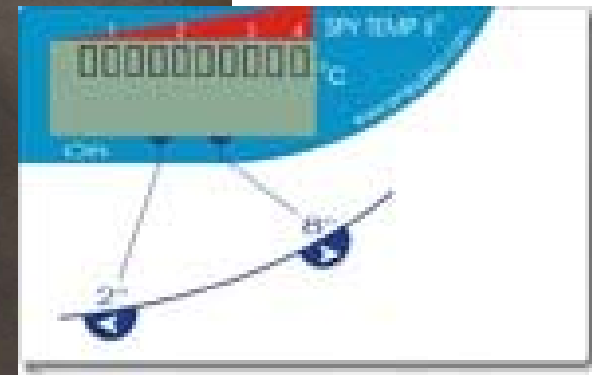
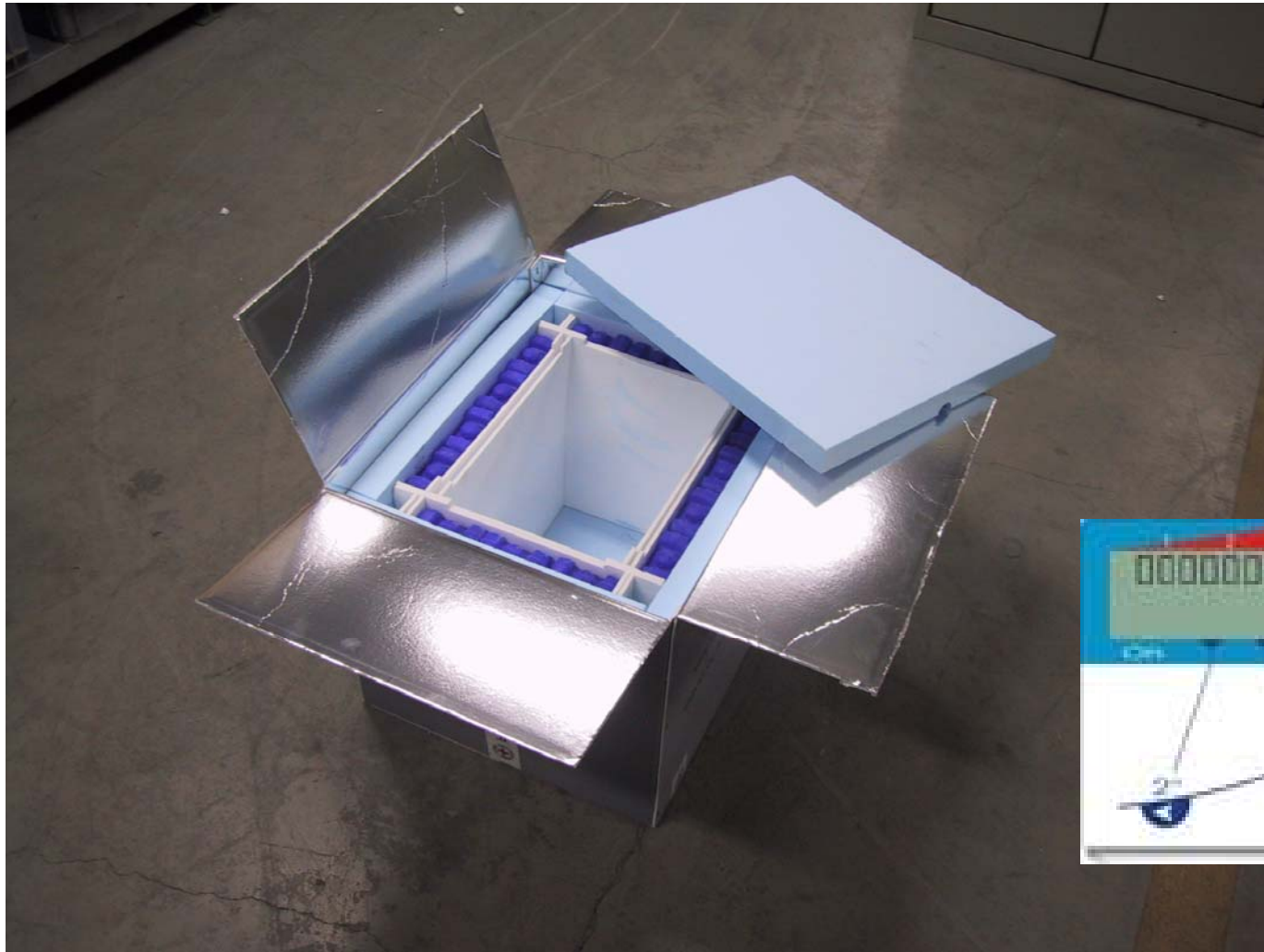
Electrolux RCW25

20 litre of vaccines

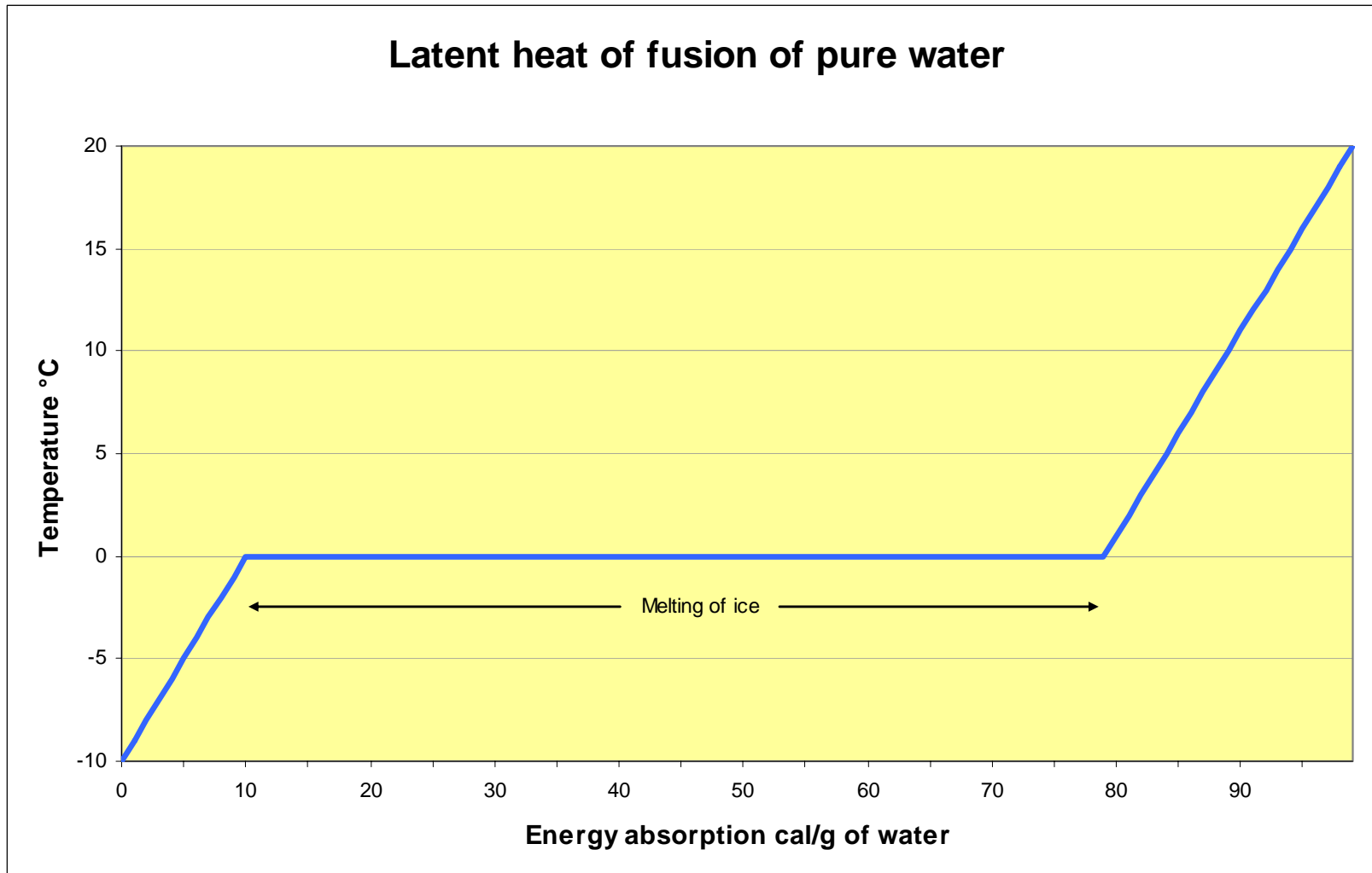
33 kg with ice packs



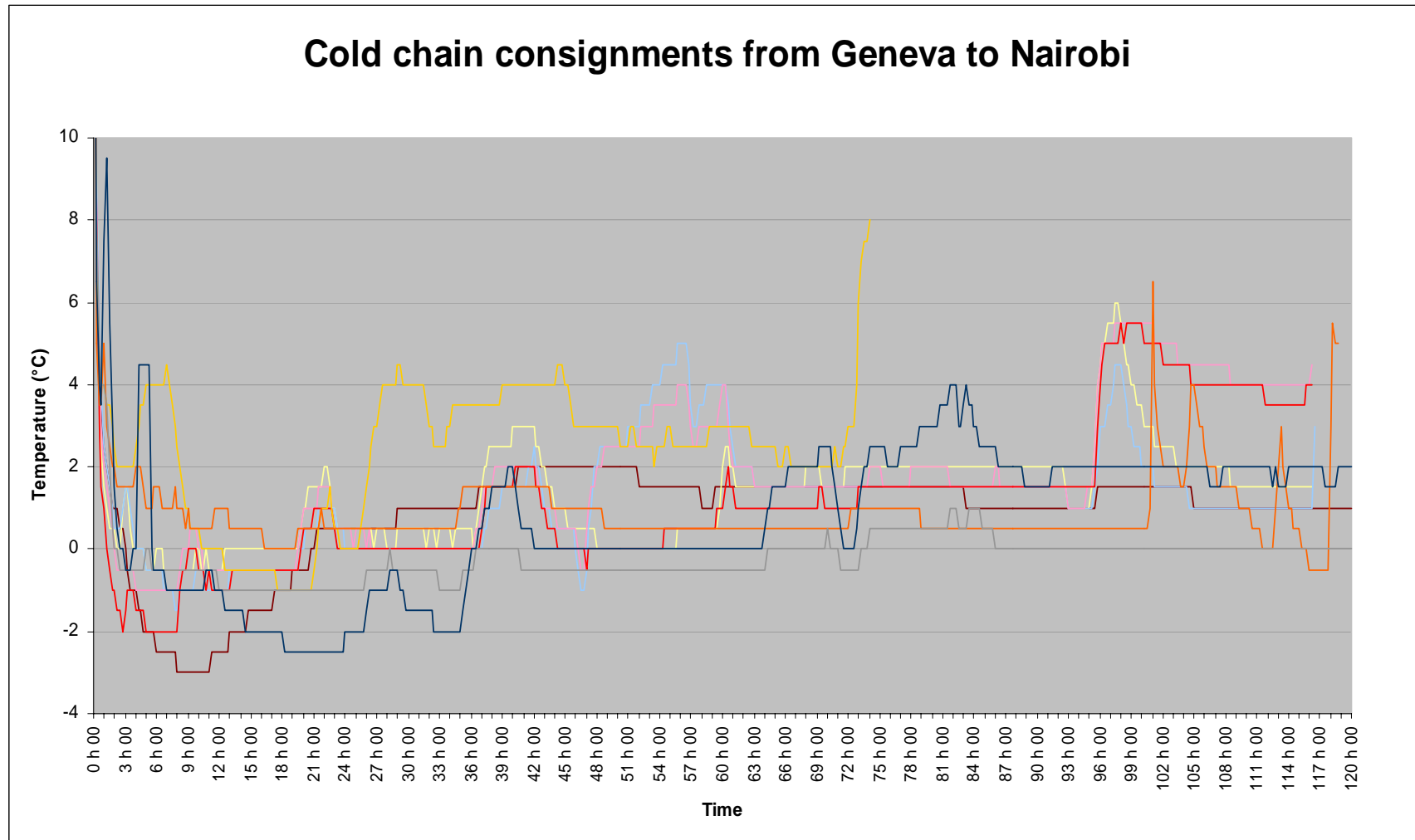
Commercial cold boxes



Latent heat of fusion of water



Problem of initial temperature drop



PATH Freeze protection research

75% of vaccines in Indonesia exposed to sub-zero temperatures

- Ice packs, ice and water combinations
- Ice-pack conditioning
- Insulating barriers (urethane, polystyrene, fiberglass)
- Thermal mass barriers (water, water gels, phase change materials powder) placed *between* ice packs and payload
- Combinations (insulation with thermal mass)
- Phase change materials (eutectic solutions)

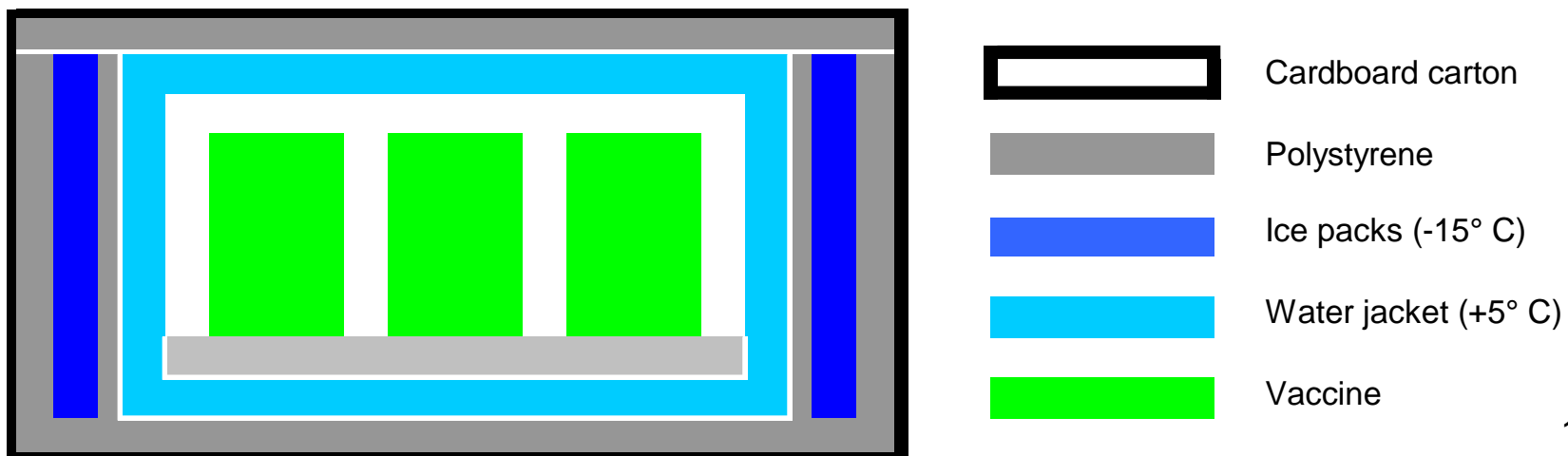
Program for Appropriate Technology in Health (PATH): Approaches to Eliminating Freezing in Vaccine Carriers – Testing report summary (March 16, 2004). www.path.org

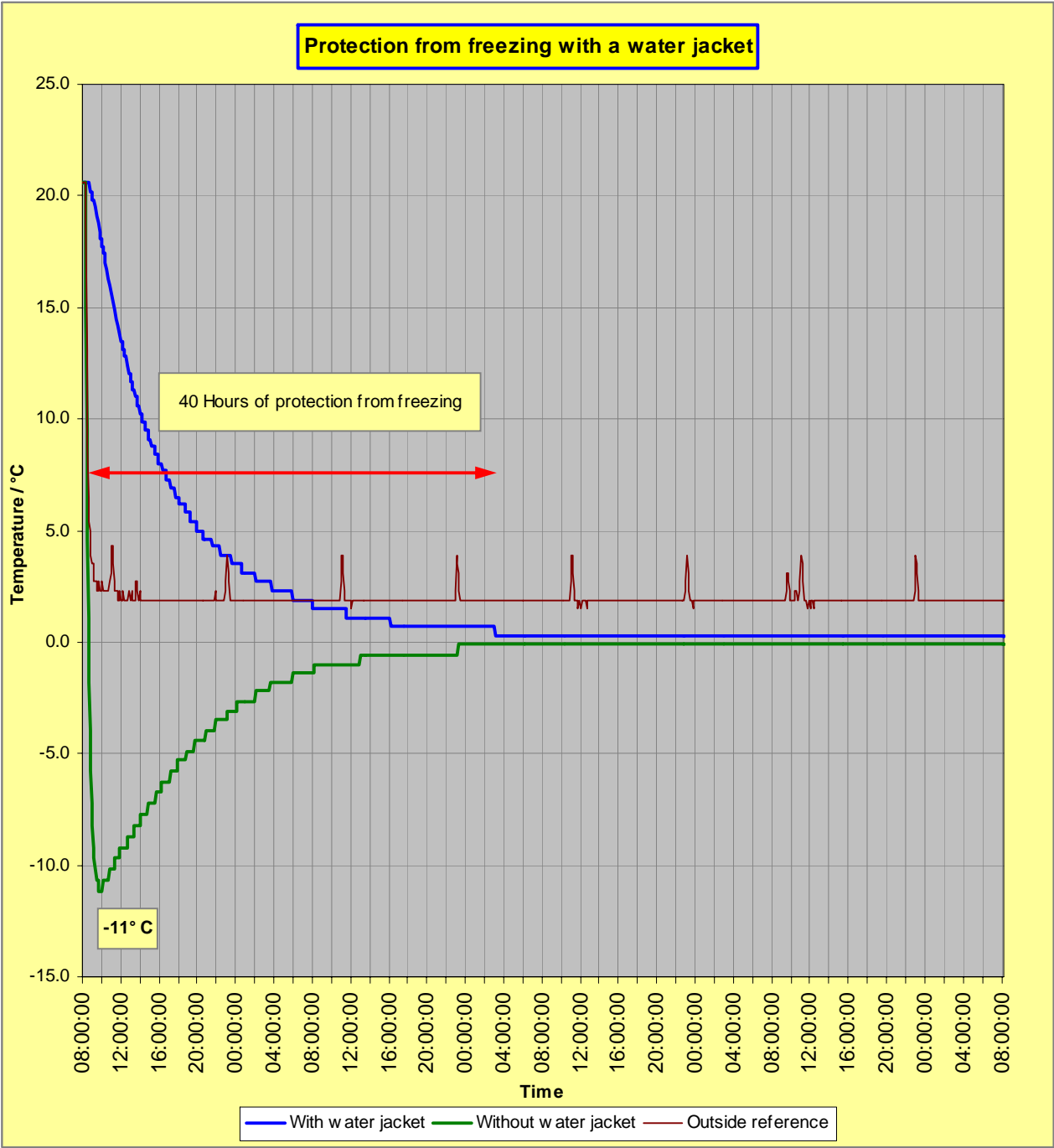
PATH Conclusions

- ". . . putting frozen ice packs directly into the vaccine carrier with vaccines was shown to cause significant freezing conditions".
- Ice-pack conditioning eliminates freezing but is not practical.
- Combining frozen and warm water packs prevents freezing but halves cold life.
- Insulation and thermal mass barriers not effective.

Freeze protection with "water jackets"

- Surrounding of cold chain goods with an *uninterrupted* layer of water.
- Water jackets must freeze before interior can freeze.
- 80 cal/g of water have to be absorbed from the ice packs before the water jacket starts freezing
- Principle of a "reverse cold box"





Technical realization

Requirements for a device:

- Disposable
- Simple
- Cheap
- Resistance to breaking and leaking