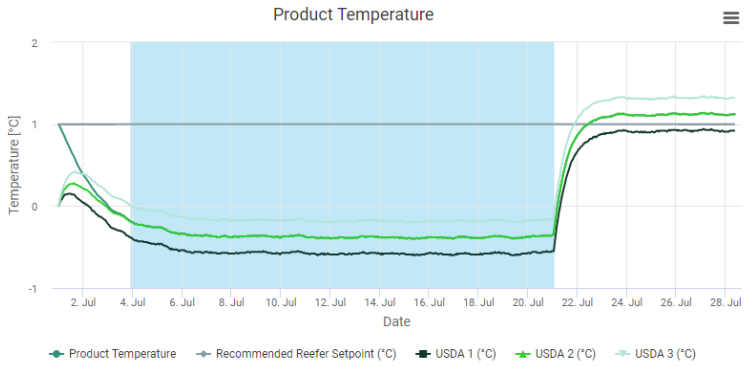
Cold Treatment Verification

Ver 1.0

Cold Treatment

Name	EU 2022/959
Product	Orange
Required	0 °C / 16 days
Actual	0 °C / 17 days, 4 hours
Protocol Verified	YES
Cold Treatment Risk	NONE



INTRODUCTION

Most countries can now import fresh produce all year round thanks to the international cold chain infrastructure. However, imported fresh produce may contain unwanted pests and invasive species that would be harmful to the ecosystem of the importing country.

Cold Treatment Sterilisation (CTS) is an effective process intended to destroy unwanted pests that may be contained in shipments of fresh produce.

CTS is often required by regulatory authorities to ensure that reefer container cargo is free from invasive pests.

CTS can be an effective process to protect ecosystems from unwanted pests and invasive species.

In this whitepaper, we look at the current method of verifying compliance with CTS protocols, as well as a proposed solution to automate the verification task, saving time and cost for exporters and shippers.

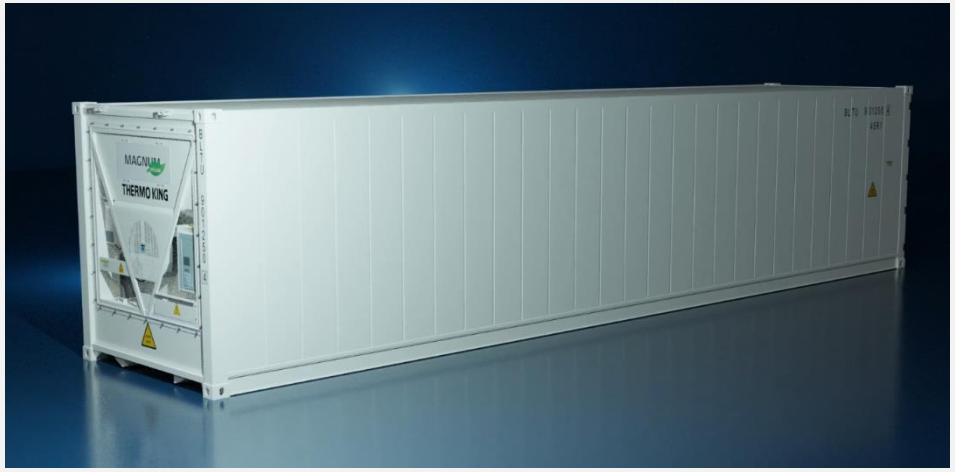
WHAT IS COLD TREATMENT?

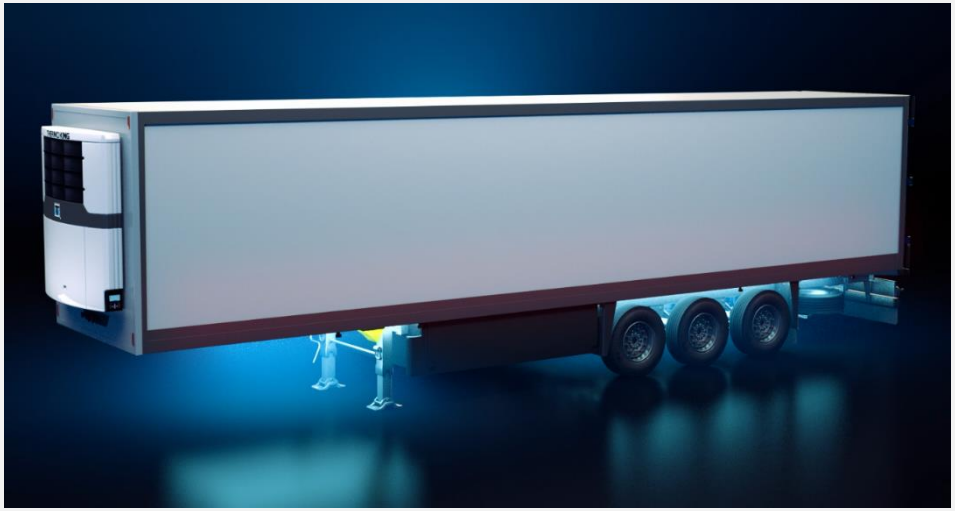
Cold Treatment Sterilisation (CTS) ensures that shipments of perishable produce meet specified phytosanitary import requirements.

The CTS procedure involves bringing down the product temperature to a level that will kill unwanted pests regardless of their life-cycle stage.

The precise temperature and duration of the CTS process will depend on 3 factors: origin country, destination country, and produce that is to be shipped.

The correct CTS protocol to be followed for each product type is determined by a scientific process undertaken by the National Plant Protection Organisation (NPPO) of the destination country.





CTS PROTOCOLS

Thus, there are many different CTS protocols that exporters and shippers need to be aware of, depending on the destination country concerned.

CTS Protocol Example

A shipment of sweet oranges (Citrus sinensis) from Israel to Australia would require the product to be held at 1.1 °C for 14 days.

CTS Protocol Example

A shipment of table grapes (Vitis vinifera L.) from South Africa to USA would require the product to be held at -0.55 °C for 22 days.

COLD TREATMENT VERIFICATION

CTS can be performed prior to shipping at the origin country, or enroute by the carrier.

Performing CTS prior to shipping can add extra time to the journey, and this can have an impact on the remaining shelf life of produce. Increasingly, exporters are opting for carrying out the CTS process while enroute.

In either case, CTS verification is typically done manually, by verifying that the temperature readings from USDA sensors in the container met the requirements of the relevant CTS protocol.

Drawbacks to current approach

- costly manual process
- prone to human error
- not scalable
- not automated
- Transfer of verification data to the destination NPPO is not easily automated.

Manually checking temperature readings on a chart can be a tedious and error-prone process.

CTS VERIFICATION AUTOMATION

Hemdahl developed a system to automatically verify that CTS protocols have been followed correctly.

Automated process using USDA Sensors

- Automatically determine Port of Origin from GPS data or trip metadata.
- Automatically determine Destination Port from GPS data or trip metadata.
- Automatically determine product type from trip metadata.
- Using Product Type, Origin Port, Destination Port, automatically determine the correct CTS protocol that needs to be followed by referring to Hemdahl CTS protocol database.
- Automatically determine CTS Start time: The CTS process is considered to have started when all of the USDA sensor temperatures are below the required CTS temperature.
- Automatically determine CTS End time: The CTS process is considered to have ended when one or more of the USDA sensor temperature rise above the required CTS temperature.
- Automatically determine CTS Duration: Once the starting and ending times for the CTS protocol have been established, the treatment duration can be calculated.
- Automatically check the product temperature data against the time and temperature requirements determined by the CTS protocol.
- The outcome of the automated process is a PASS/FAIL indicating whether the CTS Sterilisation protocol was implemented correctly or not.

CTS VERIFICATION AUTOMATION

Automated process without USDA Sensors*

- Automatically determine Port of Origin from GPS data or trip metadata.
- Automatically determine destination Port from GPS data or trip metadata.
- Automatically determine product type from trip metadata.
- Using Product Type, Origin Port, Destination Port, automatically determine the correct CTS protocol that needs to be followed by referring to Hemdahl CTS protocol database.
- Automatically determine CTS Start time: The CTS process is considered to have started when all of the USDA sensor temperatures are below the required CTS temperature.
- Automatically determine CTS End time: The CTS process is considered to have ended when one or more of the USDA sensor temperature rise above the required CTS temperature.
- Automatically determine CTS Duration: Once the starting and ending times for the CTS protocol have been established, the treatment duration can be calculated.
- Automatically calculate product temperature in required container locations using air temperature data.
- Automatically check the calculated product temperature data against the time and temperature requirements determined by the CTS protocol.
- The outcome of the automated process is a PASS/FAIL indicating whether the CTS Sterilisation protocol was implemented correctly or not.

*: Some jurisdictions will accept data from non-USDA sensors as proof of product temperature for CTS verification.

VERIFICATION EXAMPLE 01 - PASS

Cold Treatment

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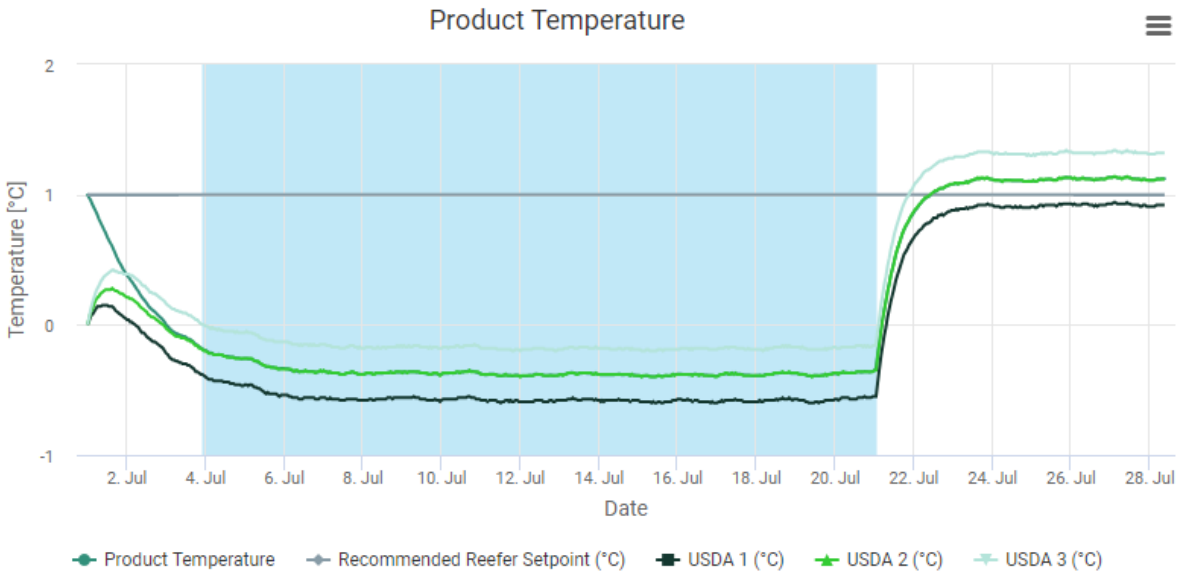


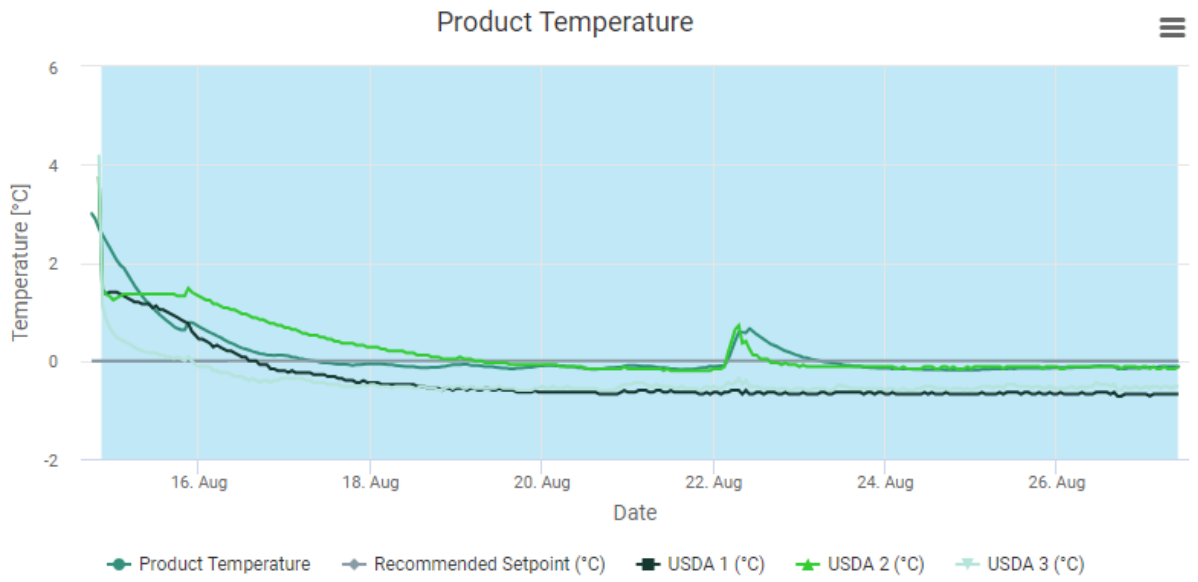
Here we see an example of a shipment of oranges from South Africa to EU which successfully met the required CTS criteria:

0 °C for 16 days.

VERIFICATION EXAMPLE 02 - PASS

Cold Treatment

Name	NZUS02
Product	Grape
Required	2 °C / 12 days
Actual	1.5 °C / 12 days, 13 hours
Protocol Verified	YES
Cold Treatment Risk	NONE

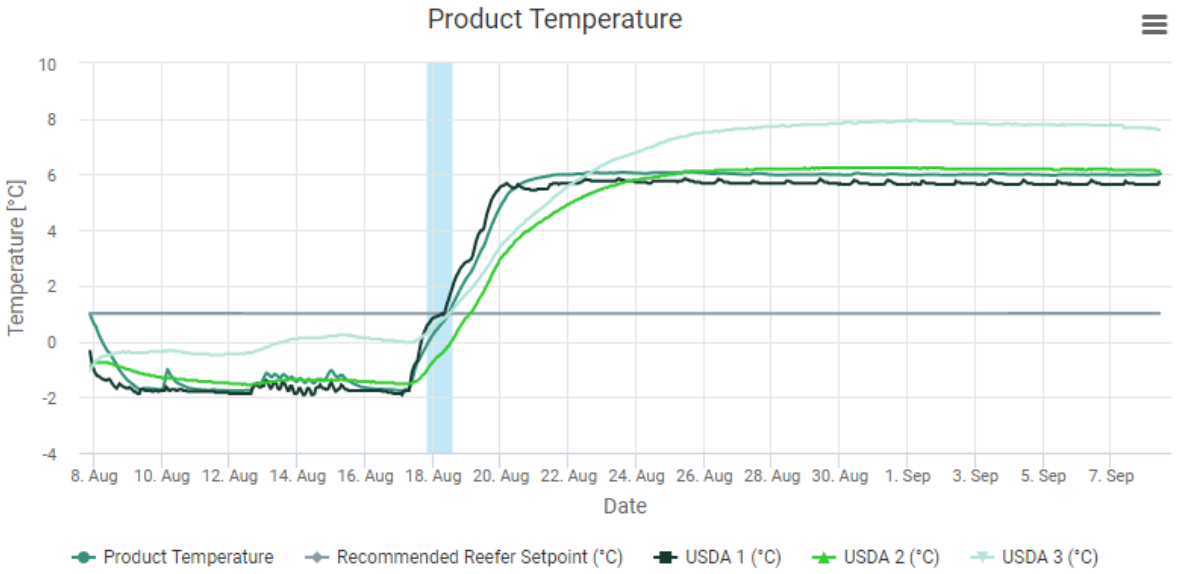


Here we see an example of a shipment of grapes from United States to New Zealand which successfully met the required CTS criteria: 2 °C for 12 days.

VERIFICATION EXAMPLE 03 - FAIL

Cold Treatment

Name	EU 2022/959
Product	Orange
Required	2 °C / 20 days
Actual	2 °C / 18 hours
Protocol Verified	NO
Cold Treatment Risk	HIGH



Here we see an example of a shipment of oranges from South Africa to EU which failed to meet the CTS criteria:

2 °C for 20 days.

CONCLUSIONS

A system to automatically verify that CTS protocols have been followed correctly has been developed. The system is fast, scalable, automated, and promotes information sharing among all stakeholders the cold chain.

The use of automated, data-driven CTS verification provides a scalable means to apply CTS verification to fresh produce shipments globally, thus reducing costs, removing human error, and providing better protection for indigenous ecosystems from invasive species.

Hemdahl's predictive algorithms for cold treatment sterilisation verification, pathogen growth, product temperature, temperature-related injury, and product shelf life can be used for all transport modes (marine, rail, road, and air) and are independent of the reefer make, datalogger type, telematics system, etc.

ABOUT HEMDAHL

Hemdahl provides a SaaS platform that analyses logged data for perishable products to provide unique, actionable insights into product quality and safety. Our mission is to make the world's perishable products safer, cutting waste and reducing carbon footprints. More information is available at www.hemdahl.com.