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DEPARTMENT OF BIOMEDICAL ENGINEERING

VII Semester

OBT357 BIOTECHNOLOGY IN HEALTH CARE

UNIT- 3 VACCINOLOGY

3.7 Instruments related to monitoring of temperature

- In vaccinology, maintaining proper temperature is critical to preserving vaccine potency, as exposure to incorrect temperatures can render vaccines ineffective. The following instruments are commonly used for temperature monitoring to ensure compliance with regulatory standards like those from the CDC and WHO:

1. Thermometers:

- **Digital Thermometers:** These are the most common and accurate tools for monitoring the temperature of vaccine refrigerators and freezers. They often have an alarm function that alerts staff if the temperature goes outside of the safe range. Some have a **"min/max" feature** to record the highest and lowest temperatures since the last reset, providing a historical log. A permanent temperature monitoring device that is built into cold rooms, freezer rooms, refrigerators and freezers. Temperature sensors monitor the temperature constantly, and the temperature is displayed digitally outside the room or refrigerator/freezer
- **Liquid-in-Glass Thermometers:** While less common now, these are simple thermometers that use a coloured liquid in a glass tube to indicate temperature. Liquid-in-glass thermometers rely on the principle of thermal expansion. When the temperature increases, the liquid inside expands and rises in a calibrated glass tube, indicating the temperature.

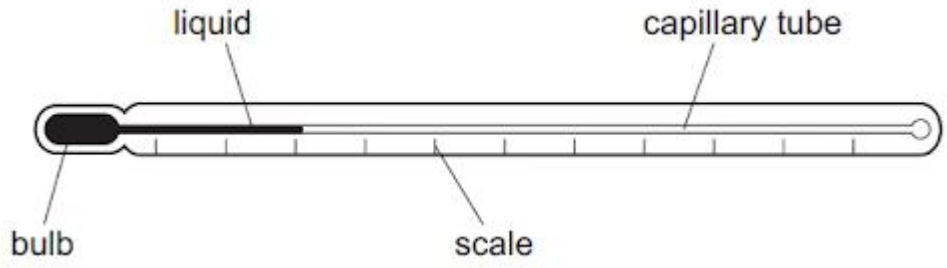


Fig. *Liquid-in-Glass Thermometer*

2. Data Loggers:

These are electronic devices that automatically record and store temperature data at set intervals (e.g., every 5-10 minutes).

❒ **Digital Data Loggers (DDLs)**:

❖ **Purpose**: Continuously monitor and record temperatures in vaccine storage units (refrigerators/freezers) with high accuracy (±0.5°C).

❖ **Features**:

- ✓ Buffered probes (e.g., glycol-filled) to measure vaccine vial temperatures accurately, not just air temperature.
- ✓ Record readings at least every 30 minutes, storing up to 4,000 readings.
- ✓ External display for current, min/max temperatures, and low-battery indicators.
- ✓ Audible/visual alarms for out-of-range temperatures.
- ✓ Downloadable data for compliance reporting, often cloud-based for remote access.

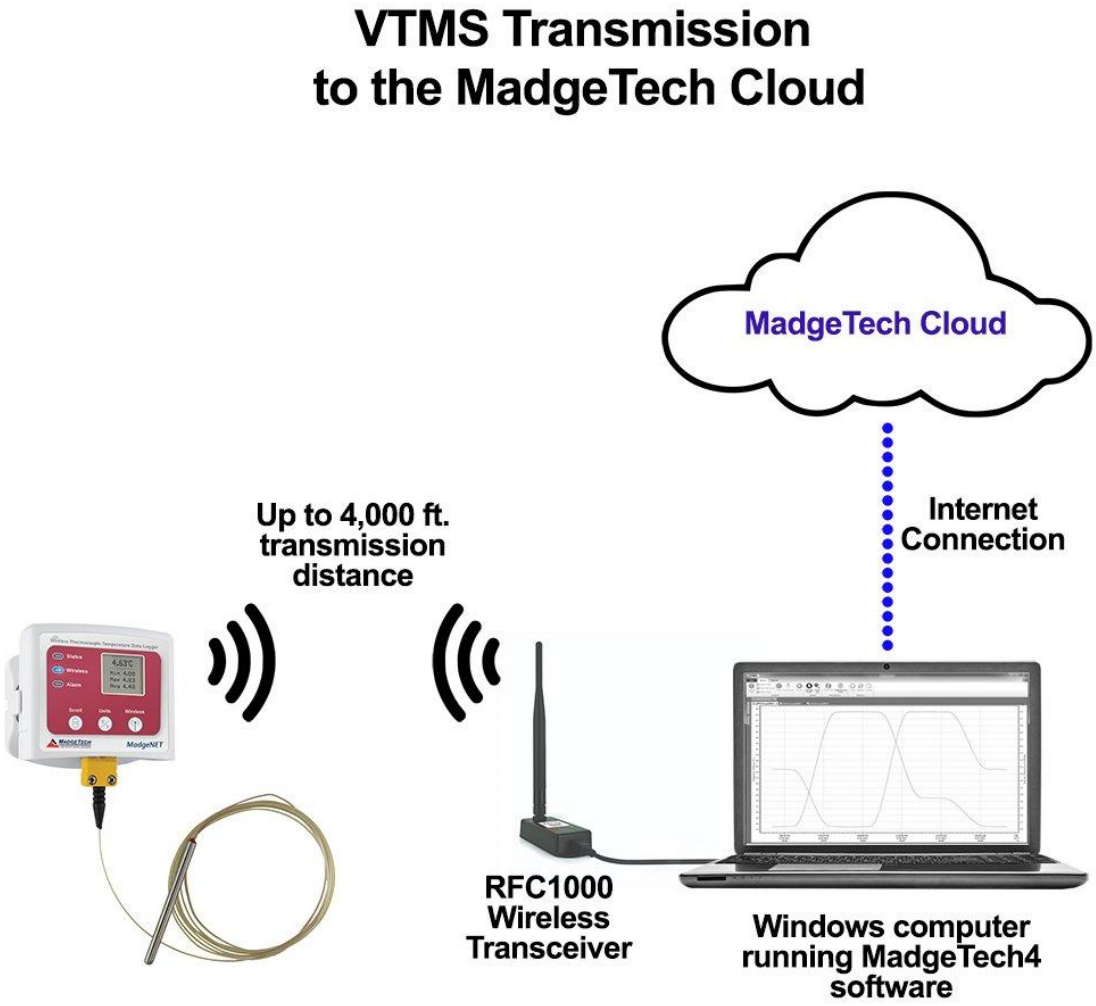
❖ **Examples**: Sensaphone Sentinel, Geoscientific systems, Monnit sensors, Dickson One loggers, Berlinger Smart System, MadgeTech VTMS.

❖ **Compliance**: Meet CDC's Vaccines for Children (VFC) requirements, including NIST-traceable calibration certificates (recalibrated every 2-3 years).

❒ **Thermocouple-Based Data Loggers**:

- **Purpose**: Monitor ultra-low temperatures (e.g., -100°C for certain vaccines like Pfizer's COVID-19 vaccine).

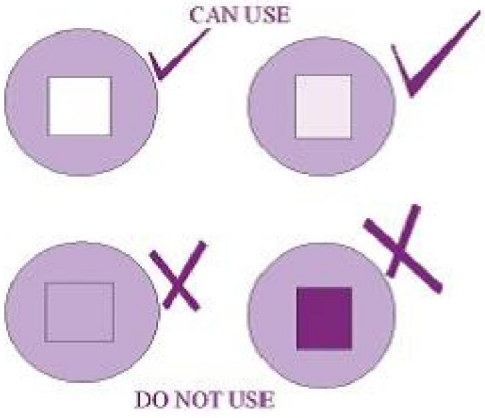
- **Features**: Wireless systems with glycol buffers for stable readings, real-time alerts via email/text, and compatibility with cloud platforms for remote monitoring.
- **Example**: MadgeTech VTMS for ultra-cold storage.

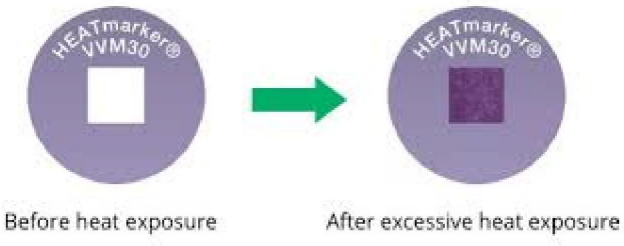


3 Temperature Monitoring Indicators

- **Freeze Indicators:** These are small, disposable devices that are placed with the vaccine shipment. They contain a liquid that changes color if the temperature drops below freezing (0°C), indicating that the vaccine has been damaged by freezing.

- **Warm Indicators:** These indicators show if the vaccine has been exposed to temperatures above its recommended range. They work on a similar principle, changing color when a certain temperature threshold is reached.
- **Vaccine Vial Monitors (VVMs):** These are a type of warm indicator used on vaccine vials. They are a heat-sensitive sticker that changes from light to dark over time and with heat exposure. A change in the VVM's color indicates that the vaccine has been exposed to a damaging amount of heat and should not be used.





4. **Alarm Systems (Digital/Smart Sensors)**

- Installed in refrigerators/freezers.
- Give **audible or visual warnings** when temperature goes outside the safe range (2°C–8°C for most vaccines).

5. **Infrared Thermometers**

- Non-contact devices used for **quick surface temperature checks** of vaccine carriers, cold boxes, or refrigerator walls.

6. Cold Chain Monitors (CCMs)

- Simple devices placed in vaccine shipments.
- Provide a **record of exposure** to excessive heat during transport.

7. 30-Day Temperature Recorders (30DTRs)

- Specifically designed for vaccine refrigerators.
- Continuously monitor and display **current, minimum, and maximum temperatures** over the past 30 days.
- Provide **visual alerts** if vaccines have been exposed to unacceptable conditions.

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