

# Temperature and humidity mapping of cleanrooms

Presented by Bernie Prendergast  
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# Temperature & Humidity mapping of cleanrooms

- Why are we discussing this?
- Where is it required?
- When should you do it?
- What testing should you do?
- What do we do with the data?

# Temperature & Humidity mapping of cleanrooms

So, why should we consider mapping cleanrooms?



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Insofar as CPPs go, these room environmental parameters are probably considered "less critical".

# Why should we consider mapping cleanrooms?

However, if these parameters are CPPs ...

**CPPs should be fully qualified/validated, and for HVAC parameters this should include mapping**

- If room temperature and/or humidity is critical to control of product quality, mapping is an indispensable part of demonstrating the validity of the controls



# Why should we consider mapping cleanrooms?

But what about when they aren't CPPs?

- GMP is a little vague on requirements:

3.12. Production areas should be effectively ventilated, with air control facilities (including temperature and, where necessary, humidity and filtration) appropriate both to the products handled, to the operations undertaken within them and to the external environment.

- So, temperature may not always be a CPP, but in accordance with 3.12, it is always GMP critical and needs to be controlled!
- Humidity does not need to be considered GMP critical except "where necessary" (where it is a CPP) and therefore does not always need to be controlled

# Why should we consider mapping cleanrooms?

The expectations of what “controlled” means has evolved over time

- For most facilities, the expectation now is that HVAC temperature and humidity is controlled through a BMS and that the system is monitored (to verify the control) through a validated EMS/FMS
- The outputs of the EMS are typically Quality reviewed regularly to confirm that the GMP critical data is maintained within limits

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- Regulatory inspections are increasingly asking for justification for EMS (or manual) sensor locations
- EMS installers are rarely experts in appropriate locating of sensors

# Why should we consider mapping cleanrooms?

Take home message ...

**Room mapping is the most effective way to justify sensor locations, when used in conjunction with a risk based assessment.**



# Temperature & Humidity mapping of cleanrooms

So, where should you perform cleanroom mapping?



# Where should you perform cleanroom mapping?

Wherever temperature sensitive material is 'stored' in cleanrooms (and the cleanroom is the primary environmental control), e.g.

- Consumable stores
- Staging rooms
- Any other classified area where temperature sensitive material is held for an extended duration before, during or after processing.



# Where should you perform cleanroom mapping?

Other clean areas where temperature / humidity is a CPP; for e.g.

- Processing of highly temperature sensitive materials, requiring tight control during manufacture
- Processing of humidity sensitive materials (many OSD products)
- Drying rooms / cabinets
- Pre-conditioning rooms (eg EtO sterilization)

# Where should you perform cleanroom mapping?

Where temperature is not a CPP, consider other production areas where temperature excursion is undesirable or the impact needs to be assessed

- Base on risk assessment
- Consider the implications on product of excessive temperature excursion (e.g. 27°C, 15°C) in processing rooms
- Intra-room temperature variations of up to 5°C are not improbable where heating/cooling sources are present

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- Whenever significant modifications to the system or the room have been made
- Whenever analysis shows unexplained variability outside normal operating limits
- Seasonal variation

# Temperature & Humidity mapping of cleanrooms

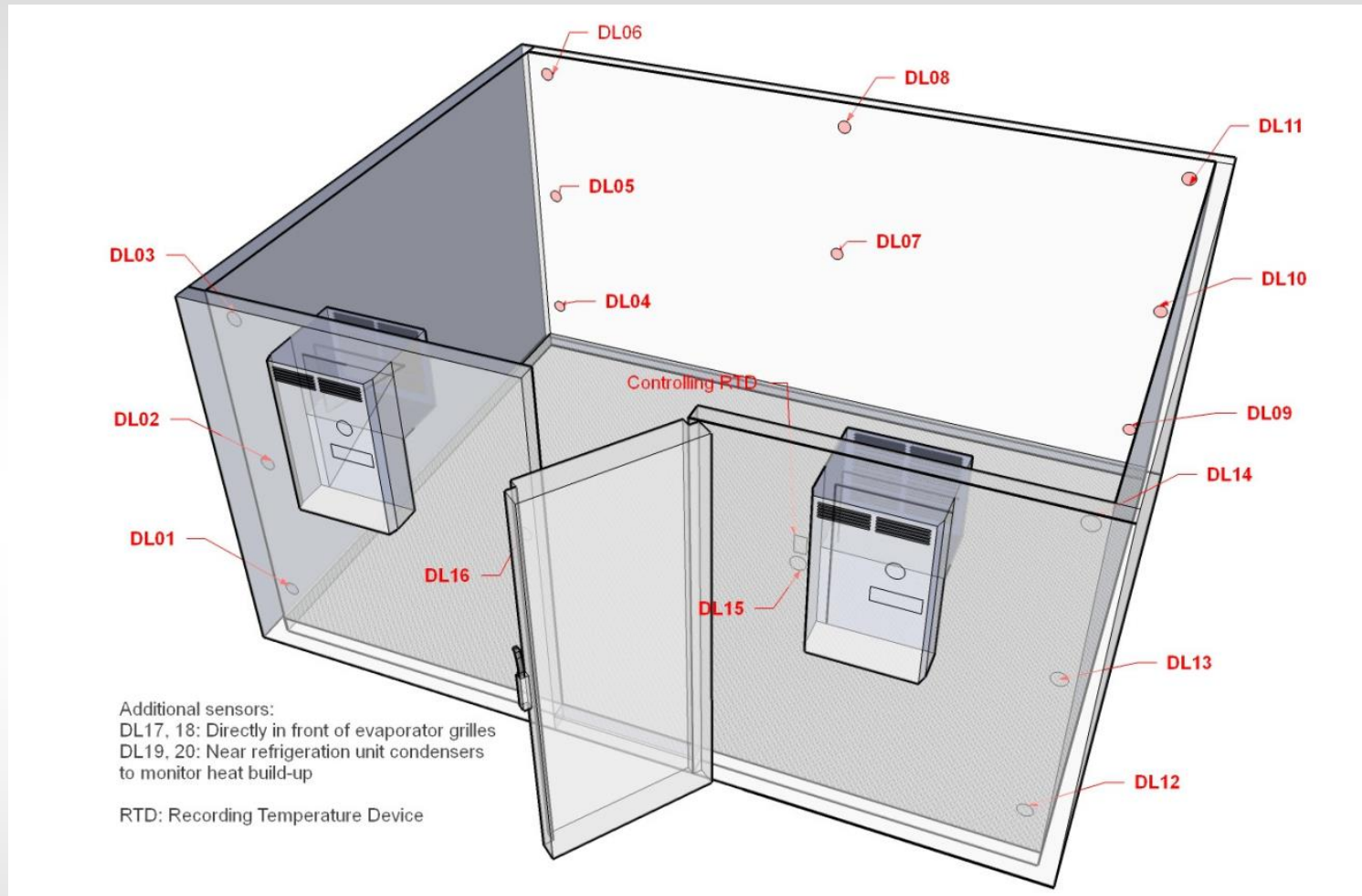
So, what testing is required for effective mapping?



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# Typical mapping arrangement



*From WHO Technical Supplement to TRS 961, 2011*

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Humidity requirements should basically follow temperature, although it may be justifiable to use fewer sensors, especially if used in conjunction with temperature mapping.



# What testing is required for effective mapping?

**Probe locations** should consider how the map may be affected by items such as:

- The location of the process / product
- The location of air supply registers (can be hot or cold spots)
- Heat sources (eg autoclaves, bag sealers, other large equipment)
- Cold sources (cooling systems)
- Areas of high / low airflow
- Areas of high traffic, etc ...

# What testing is required for effective mapping?

Temperature mapping of storage areas

WHO Supplement to Technical Report Series 961, Annex 9, 2011

ISPE Concept Paper on Temperature Controlled Storage Chambers, 2012 (currently ISPE are drafting a GPG based on this paper)

Qualification of temperature controlled storage areas

WHO Supplement to Technical Report Series 961, Annex 9, 2011

PIC/S PE011-1 Guide to Good Distribution Practice (requires mapping requirements to be determined by risk assessment)

# Temperature & Humidity mapping of cleanrooms

So, what do we do with the data?



# What do we do with the data?

## Analyse the data:

- Calculate mean / high / low results in each location at each time point
- Document the internal temperature / RH variations observed within the room

# What do we do with the data?

## **Assess the data:**

- Use the data analysis to assess the overall temperature / RH stability of the mapped space in relation to the stated acceptance criteria
- Assess the overall thermal stability of the space during the study period with specific reference to the high and low temperatures experienced
- Assess consistent and inconsistent temperature / RH variations, and fluctuations, within the space in terms of their potential impact on processes

# What do we do with the data?

## **Make recommendations:**

- Based on the observed temperature / RH fluctuations of mapped locations within the space, make recommendations about suitability of areas for active processing
- Based on the observed temperature / RH fluctuations of mapped locations within the space, provide recommendations or justification for the on the location of the temperature/RH sensor(s) used for routine temperature monitoring and the control sensors used to activate the heating and cooling systems.

Thank you for your time.  
Questions?

**Bernie Prendergast**

Senior Consultant

[Bernie.Prendergast@pharmout.net](mailto:Bernie.Prendergast@pharmout.net)

[www.pharmout.net](http://www.pharmout.net)

