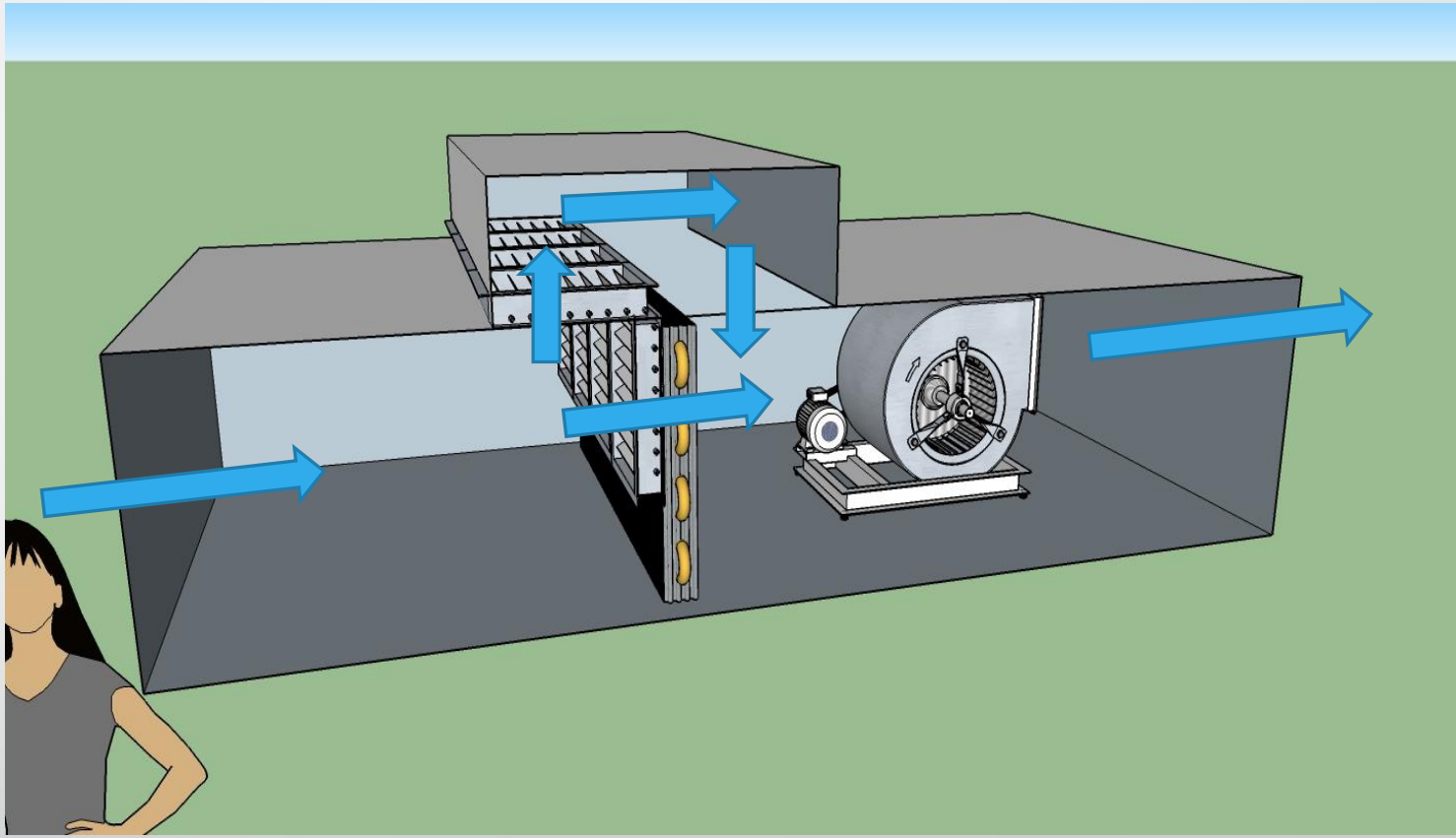
# AHU WITH FACE BYPASS DAMPER

BY: Ir.WAN SHAH

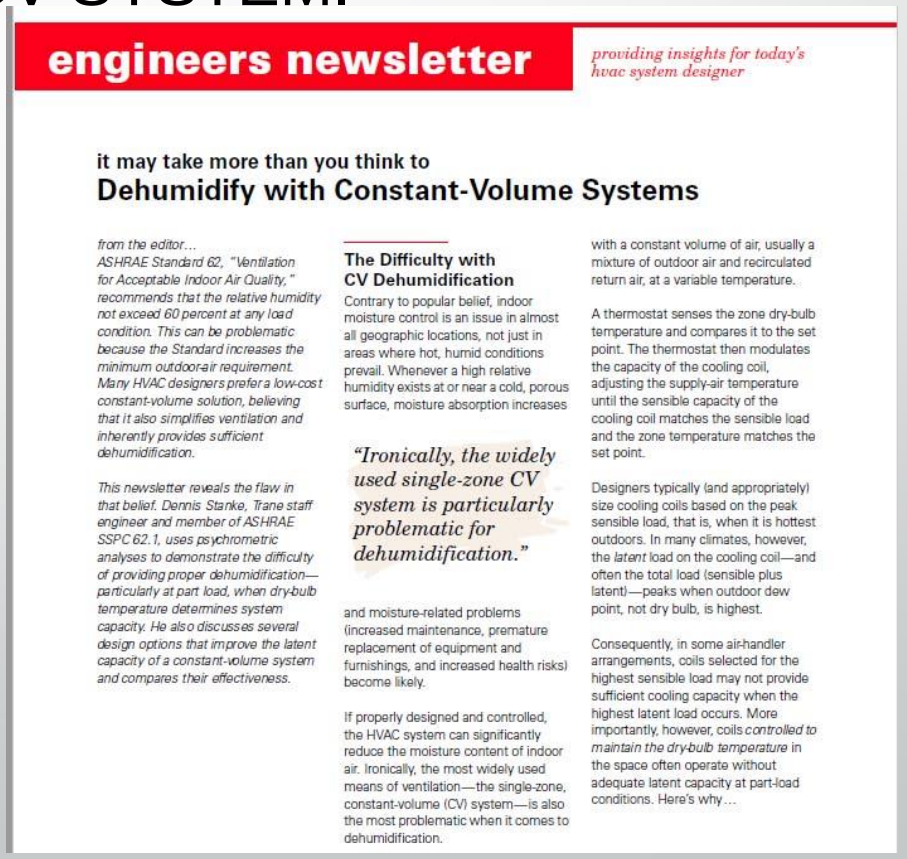
# TABLE OF CONTAIN





# A. INTRODUCTION & METHODOLOGY

- VARIOUS OPTIONS ARE USED TO IMPROVE THE INDIRECT DEHUMIDIFICATION OF A TYPICAL CV SYSTEM.
  - Total energy recovery
  - **Mixed-air (MA) bypass**
  - Return-air (RA) bypass



engineers newsletter

*providing insights for today's hvac system designer*

it may take more than you think to

**Dehumidify with Constant-Volume Systems**

*from the editor…*
*ASHRAE Standard 62, "Ventilation for Acceptable Indoor Air Quality," recommends that the relative humidity not exceed 60 percent at any load condition. This can be problematic because the Standard increases the minimum outdoor-air requirement. Many HVAC designers prefer a low-cost constant-volume solution, believing that it also simplifies ventilation and inherently provides sufficient dehumidification.*

*This newsletter reveals the flaw in that belief. Dennis Stanke, Trane staff engineer and member of ASHRAE SSPC 62.1, uses psychrometric analyses to demonstrate the difficulty of providing proper dehumidification—particularly at part load, when dry-bulb temperature determines system capacity. He also discusses several design options that improve the latent capacity of a constant-volume system and compares their effectiveness.*

**The Difficulty with CV Dehumidification**

Contrary to popular belief, indoor moisture control is an issue in almost all geographic locations, not just in areas where hot, humid conditions prevail. Whenever a high relative humidity exists at or near a cold, porous surface, moisture absorption increases

*"Ironically, the widely used single-zone CV system is particularly problematic for dehumidification."*

and moisture-related problems (increased maintenance, premature replacement of equipment and furnishings, and increased health risks) become likely.

If properly designed and controlled, the HVAC system can significantly reduce the moisture content of indoor air. Ironically, the most widely used means of ventilation—the single-zone, constant-volume (CV) system—is also the most problematic when it comes to dehumidification.

with a constant volume of air, usually a mixture of outdoor air and recirculated return air, at a variable temperature.

A thermostat senses the zone dry-bulb temperature and compares it to the set point. The thermostat then modulates the capacity of the cooling coil, adjusting the supply-air temperature until the sensible capacity of the cooling coil matches the sensible load and the zone temperature matches the set point.

Designers typically (and appropriately) size cooling coils based on the peak sensible load, that is, when it is hottest outdoors. In many climates, however, the *latent* load on the cooling coil—and often the total load (sensible plus latent)—peaks when outdoor dew point, not dry bulb, is highest.

Consequently, in some air-handler arrangements, coils selected for the highest sensible load may not provide sufficient cooling capacity when the highest latent load occurs. More importantly, however, coils *controlled to maintain the dry-bulb temperature* in the space often operate without adequate latent capacity at part-load conditions. Here's why…

# - METHODOLOGY

- MEASUREMENT TEMPERATURE AT MAIN RETURN DUCT BY USING DATA LOGGER
- PERCENTAGE OPENING AIR BYPASS SUBJECT TO MODULATING CONTROL VALVE OPENING

# B. INSTALLATION UNIT

# B. INSTALLATION UNIT

BYPASS DAMPER BOX


QUADRANT DAMPER


AHU WITH BYPASS DAMPER

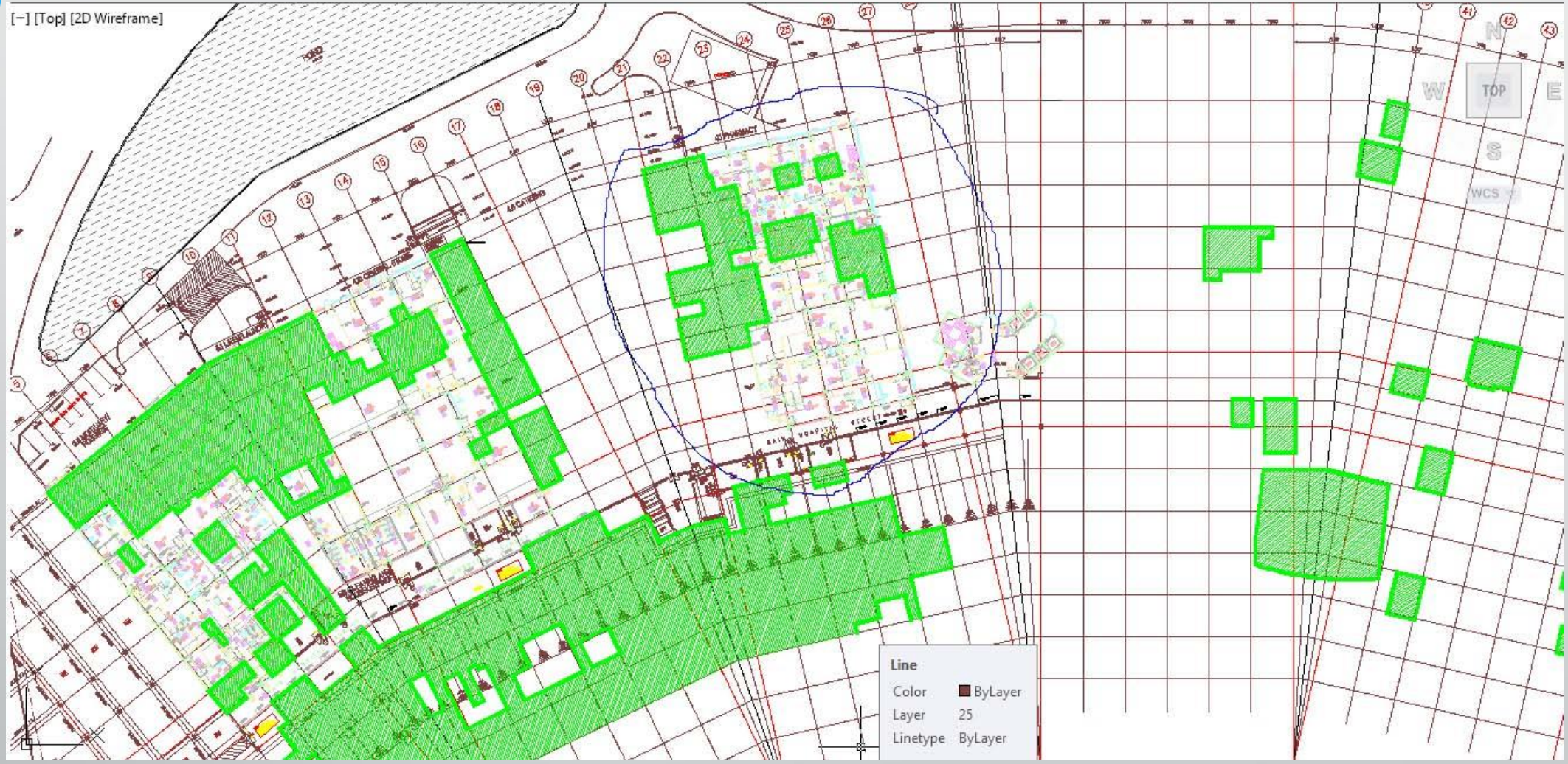
DAMPER INSIDE THE BYPASS BOX

# CONCEPT MIXED-AIR BYPASS

1. IT IS  ONE OF INDIRECT DEHUMIDIFICATION

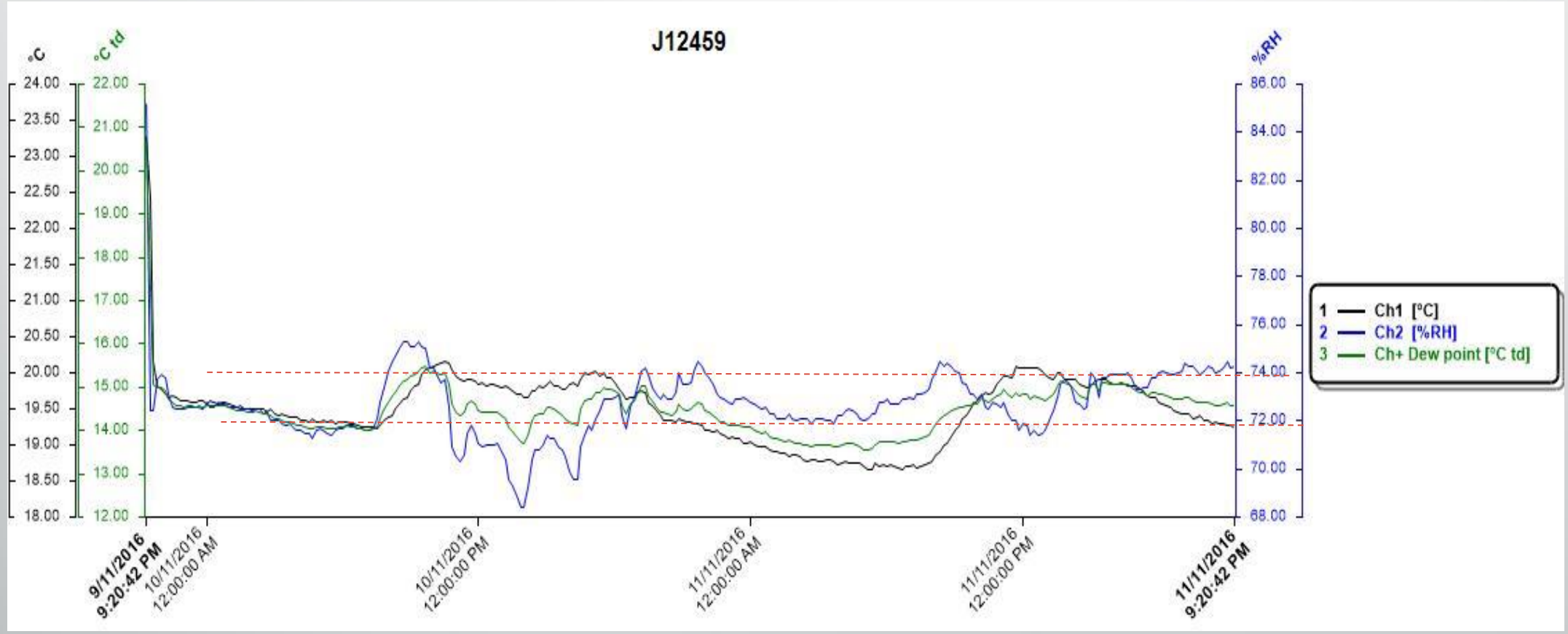
2. AHU CAV BYPASS DAMPER ALTER COIL CAPACITY BY ADJUSTING AIRFLOW RATHER THAN WATER FLOW. THIS MEANS THE COIL SURFACE CAN BE VERY COLD, ENHANCING THE ABILITY THE COIL TO DEHUMIDIFY THE ZONE WITHOUT DIRECTLY CONTROLLING HUMIDITY

# C. AHU PERFORMANCE DATA



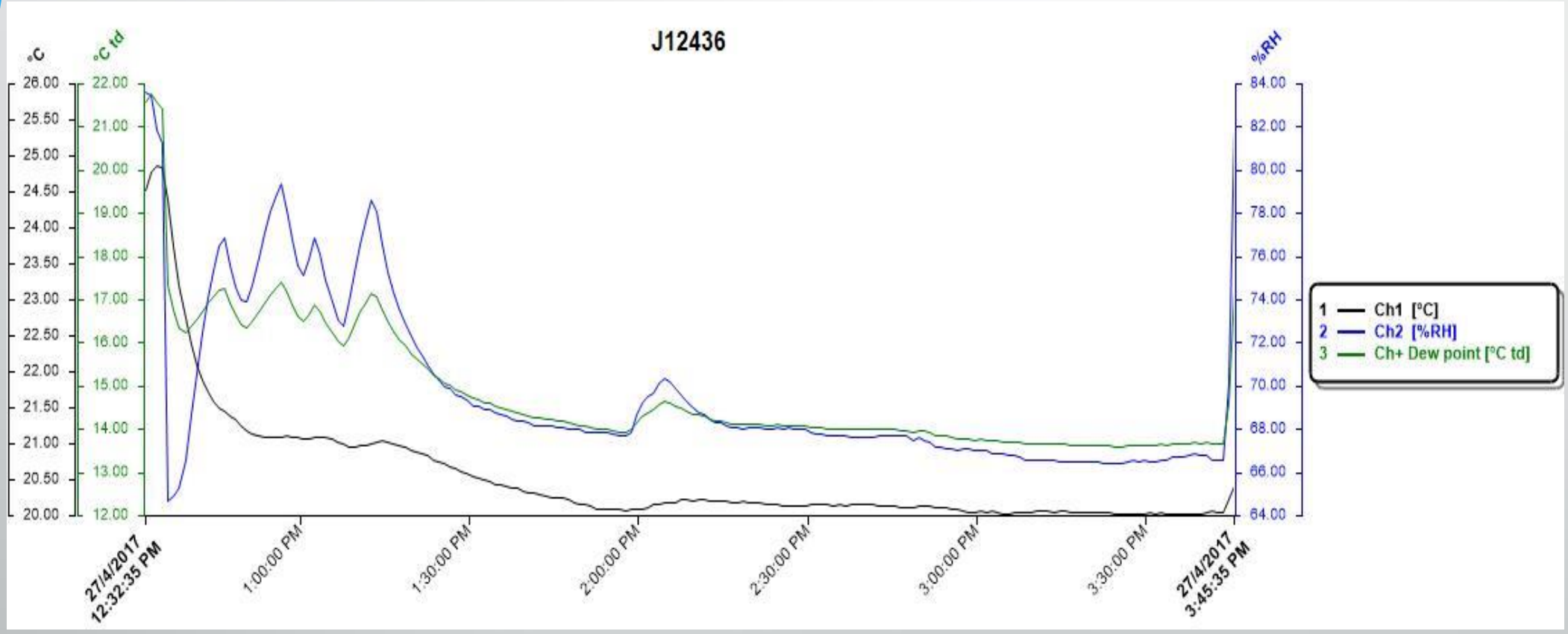

PHARMACY PLAN – GROUND FLOOR

# ZONE PHARMACY- **(0% BYPASS)**

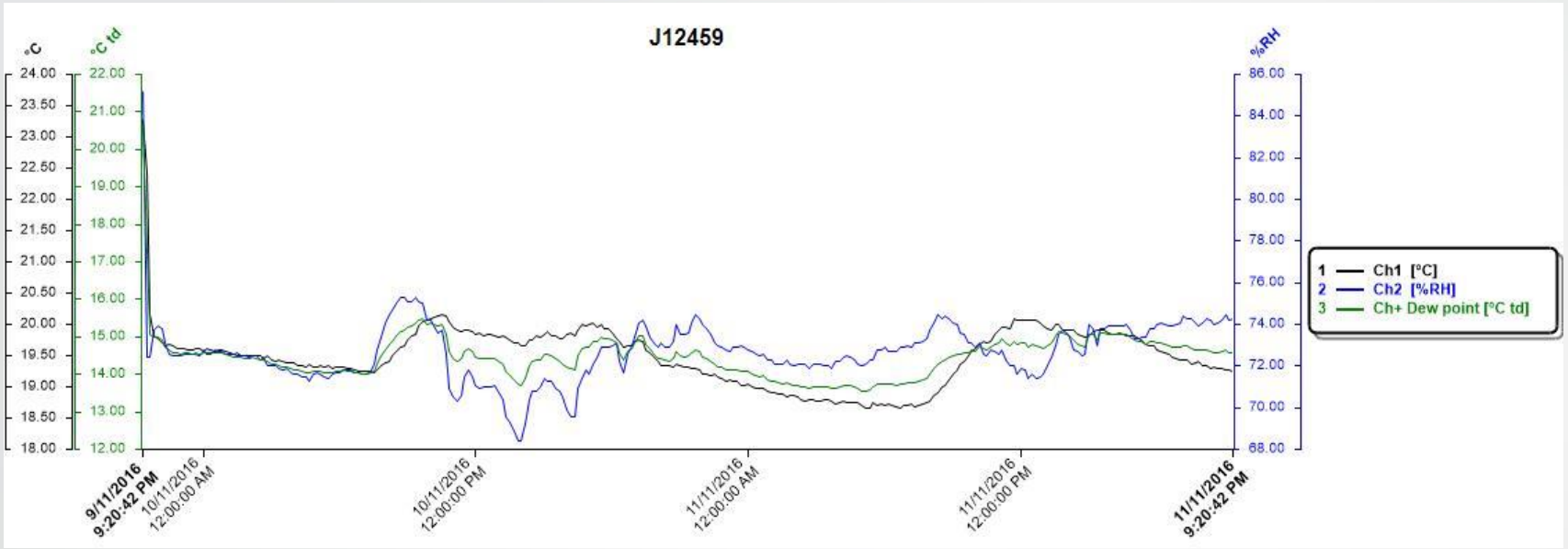



RETURN AIR POINT (2 DAYS LOGGING)

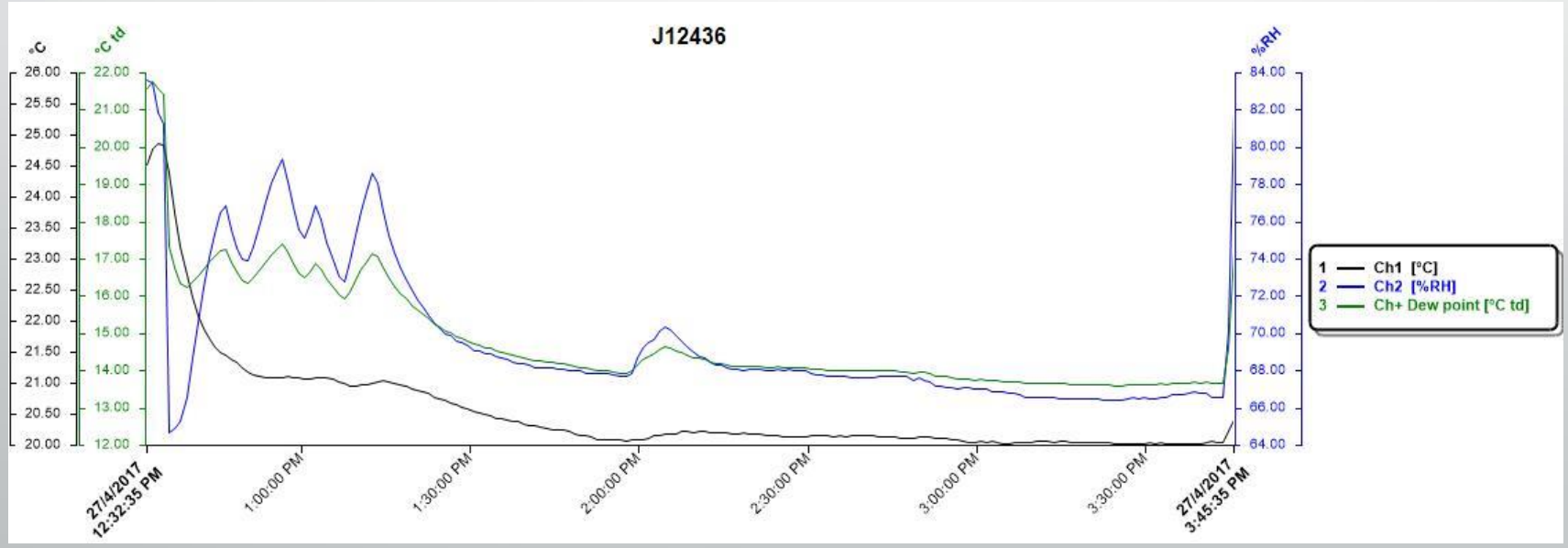
# ZONE PHARMACY-**( 50% BYPASS )**




RETURN AIR POINT (3 HRS LOGGING)

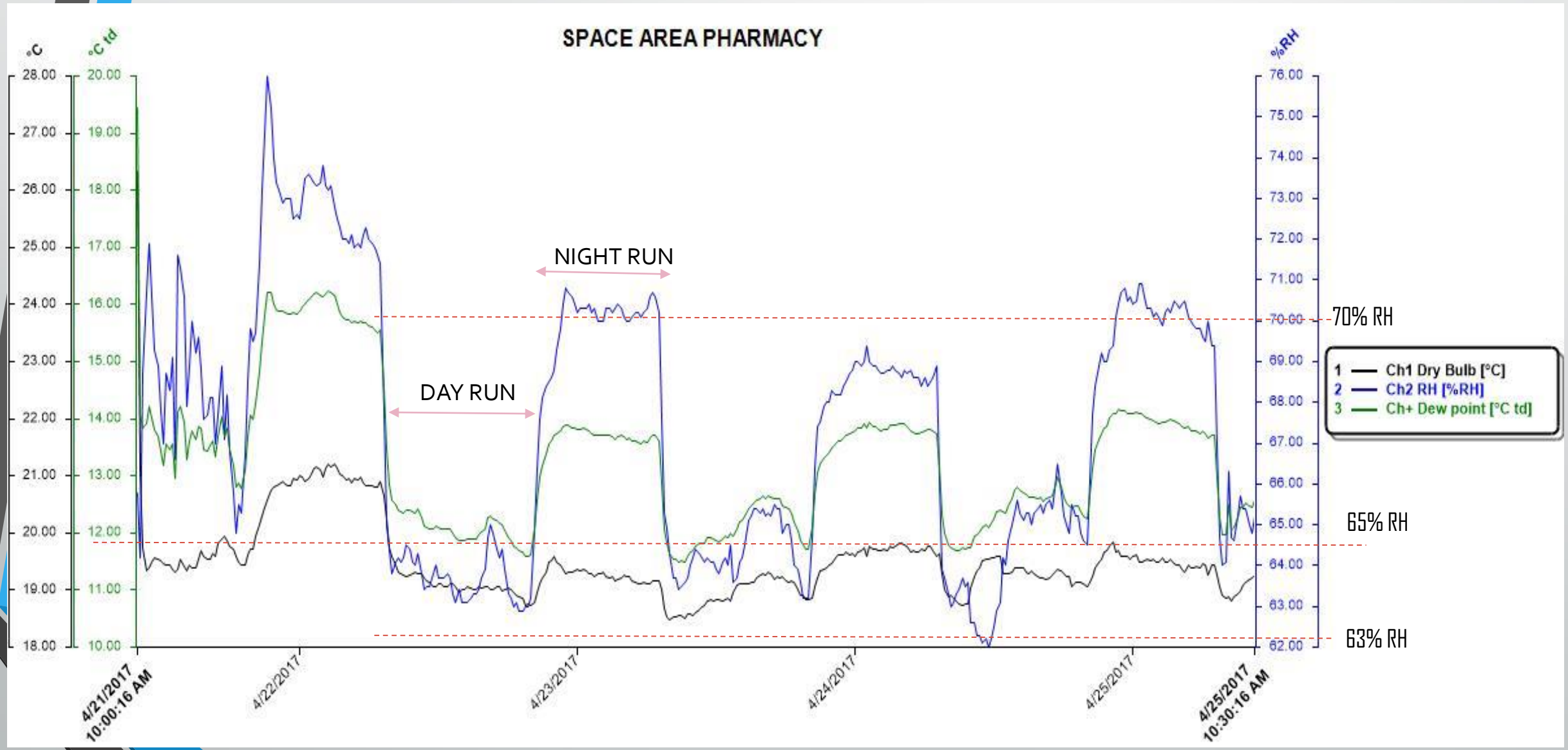



0 % BYPASS



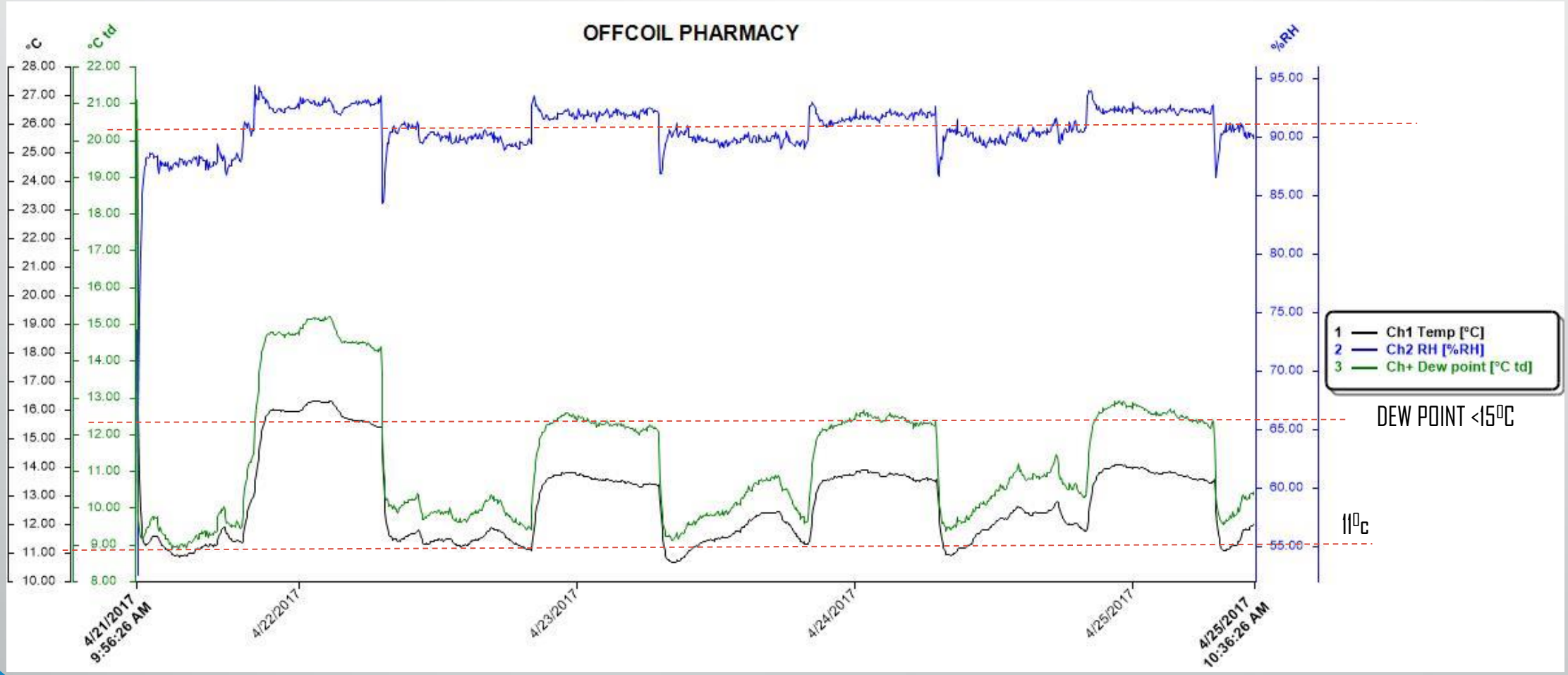

50 % BYPASS

# ZONE PHARMACY-**( 50% BYPASS )**




THREE (3) DAYS LOGGING DATA-ZONE PHARMACY-24 HRS OPERATION

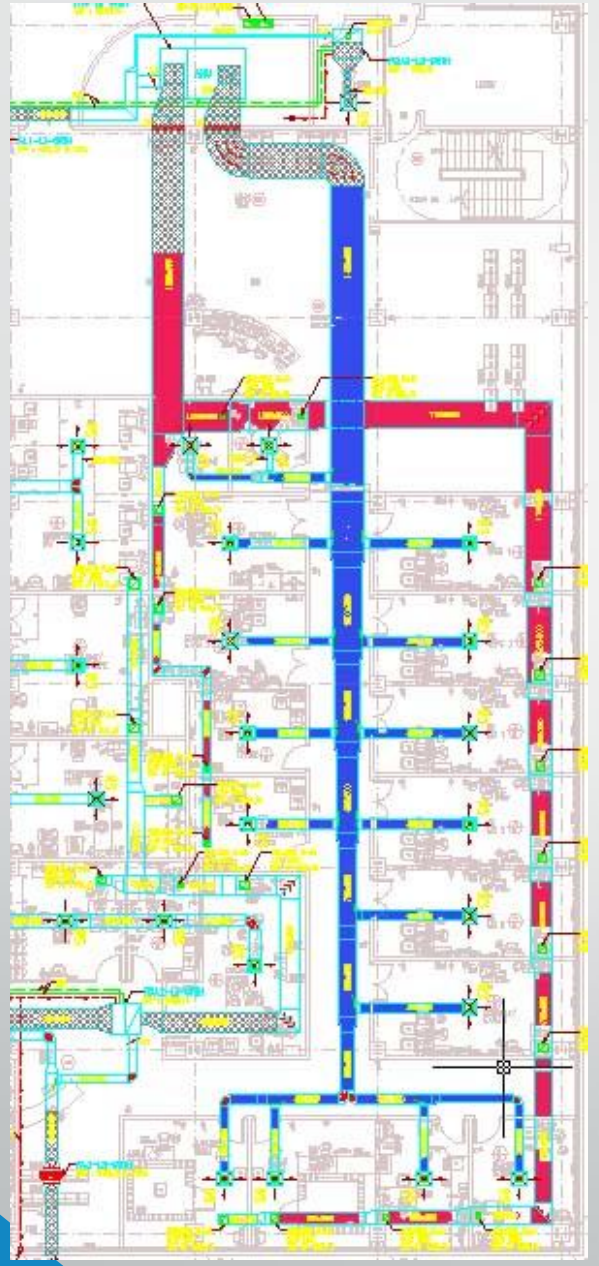
# OFFCOIL ZONE PHARMACY **(50% BYPASS)**



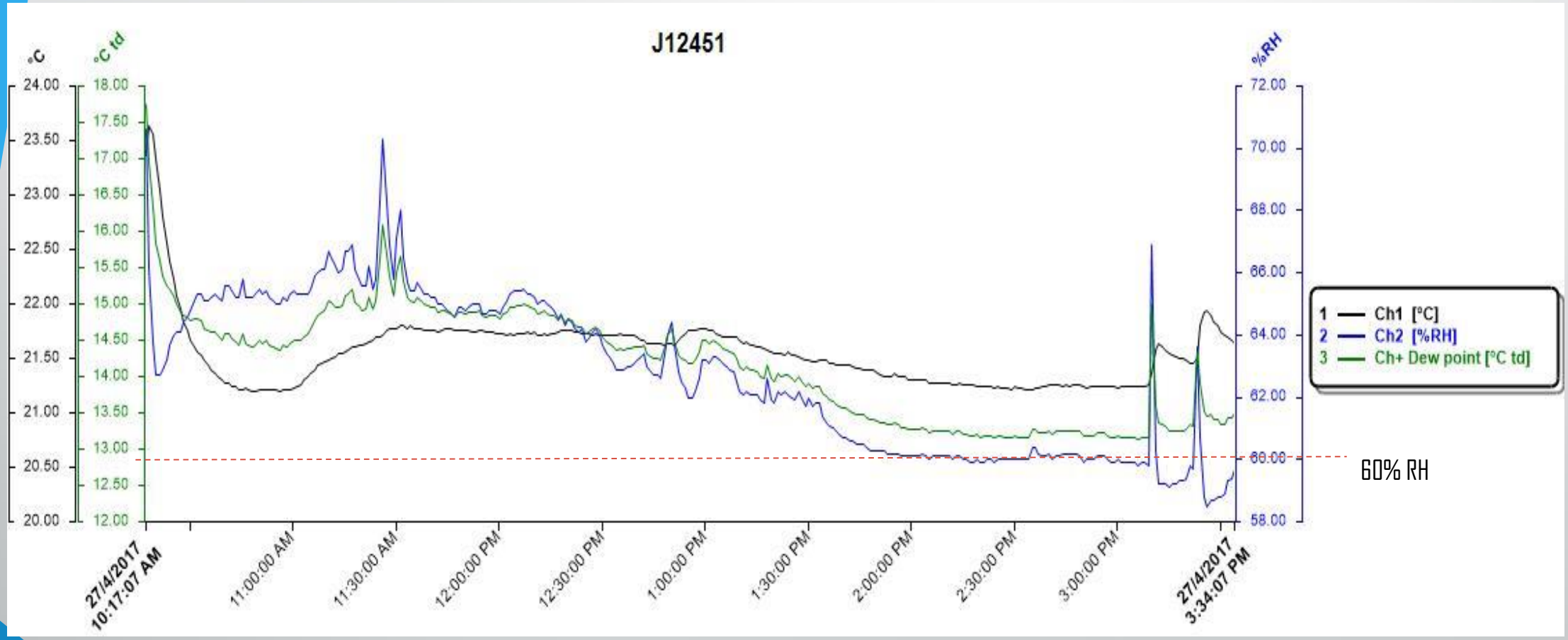

DEW POINT OFFCOIL WILL DETERMINE HUMID OR DRY IN SPACE

# ZONE ENT

# ENT FLOOR PLAN – 3RD FLOOR

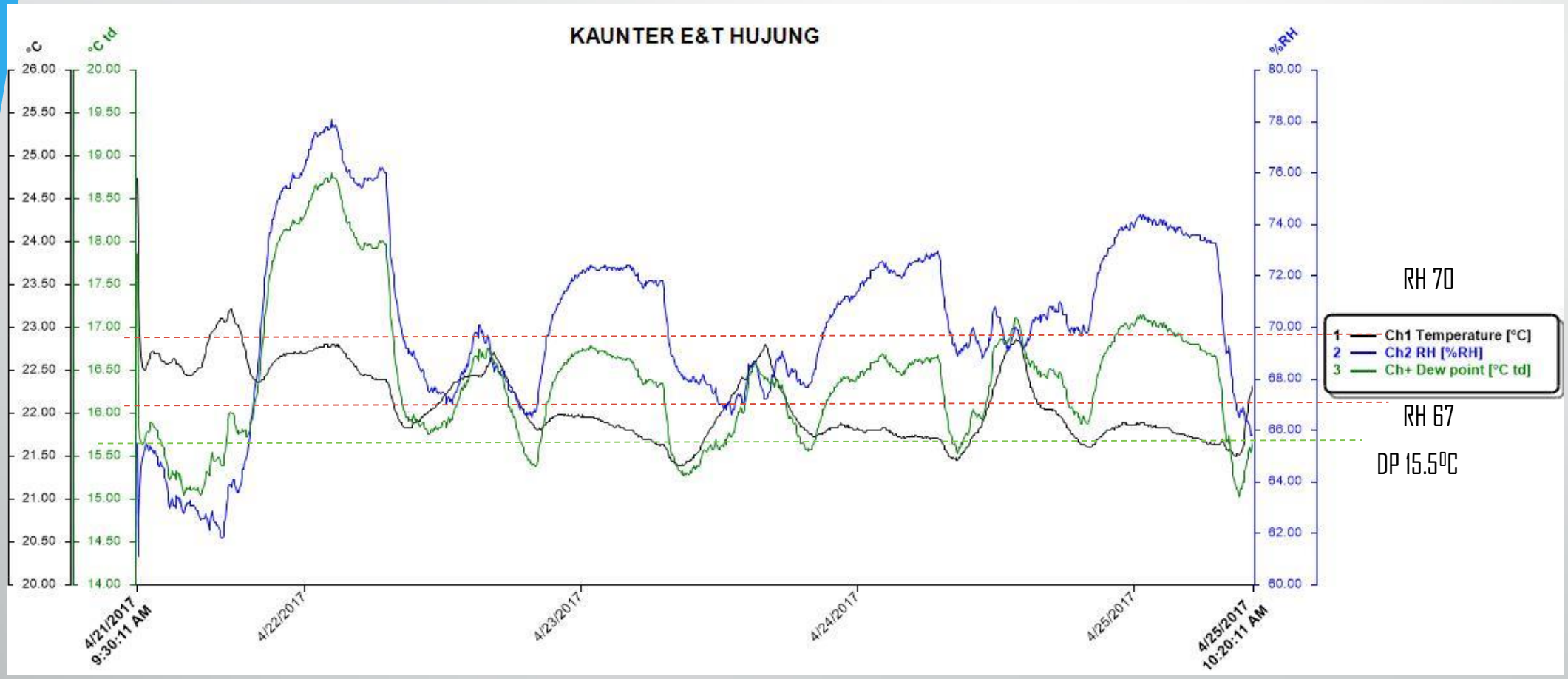


# ZONE ENT – (50% Bypass)

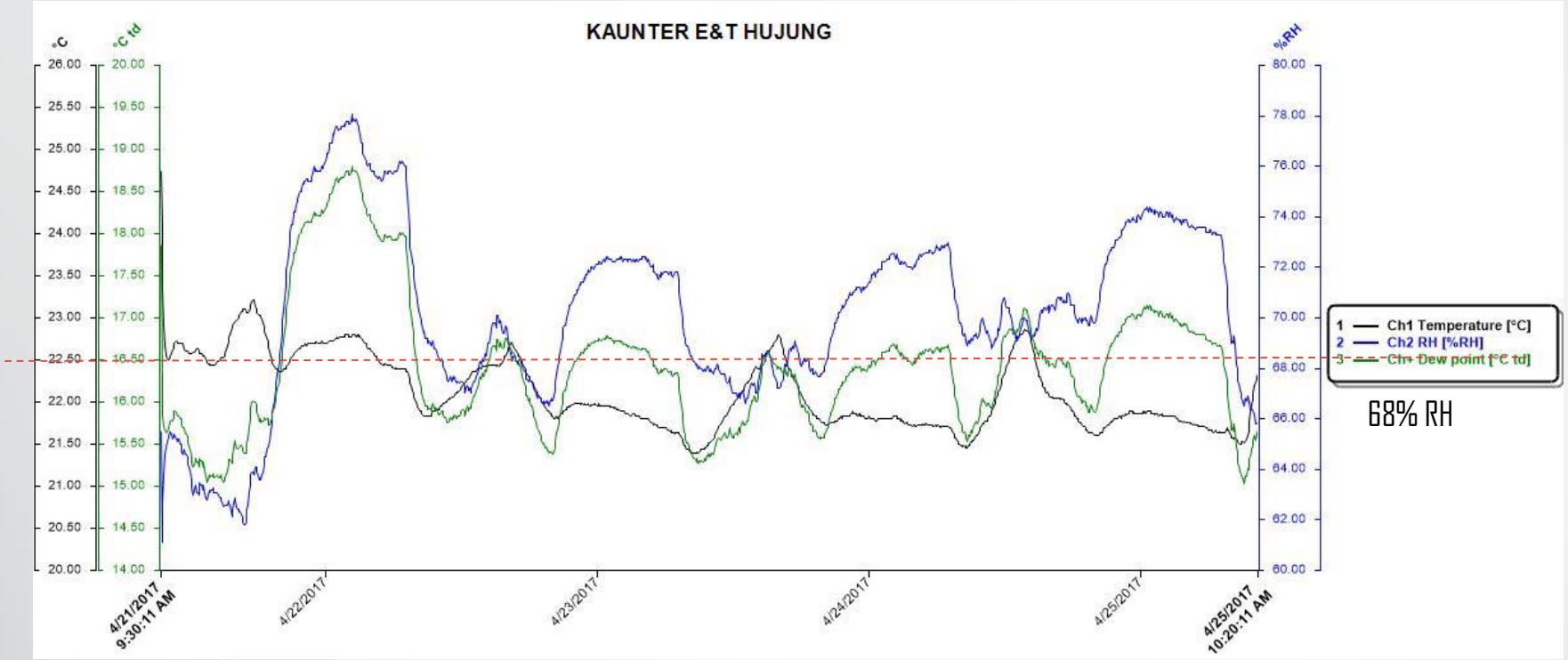



RETURN AIR POINT

# ZONE ENT (0% Bypass)

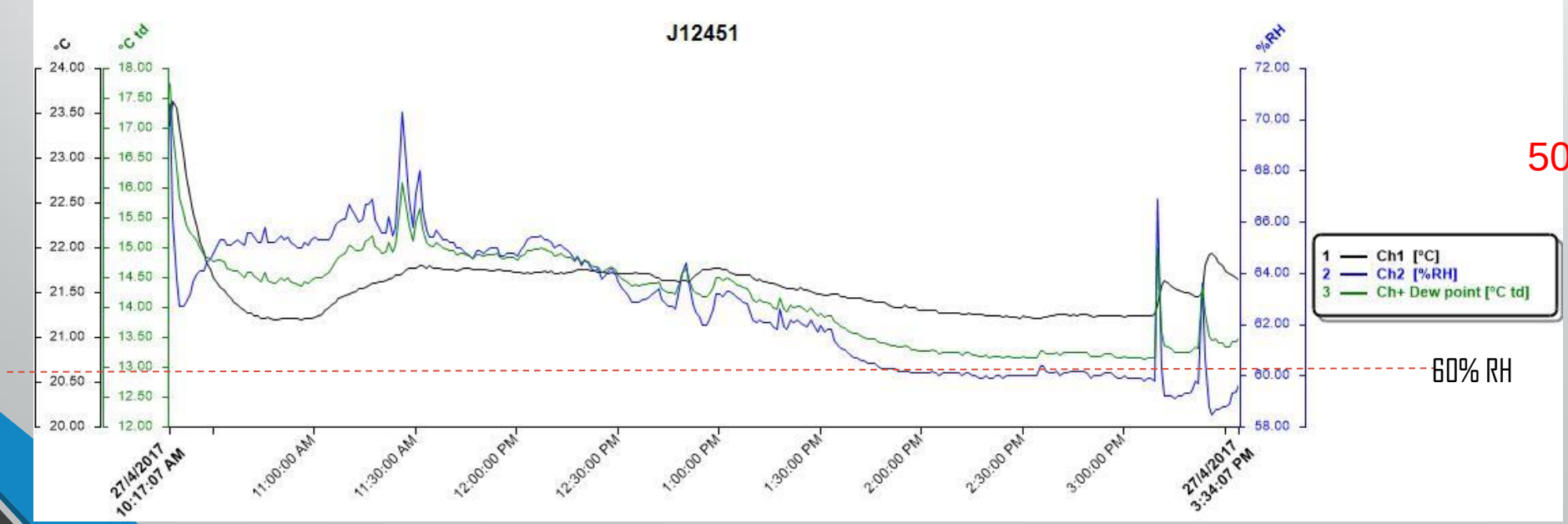



SPACE POINT




0 % BYPASS

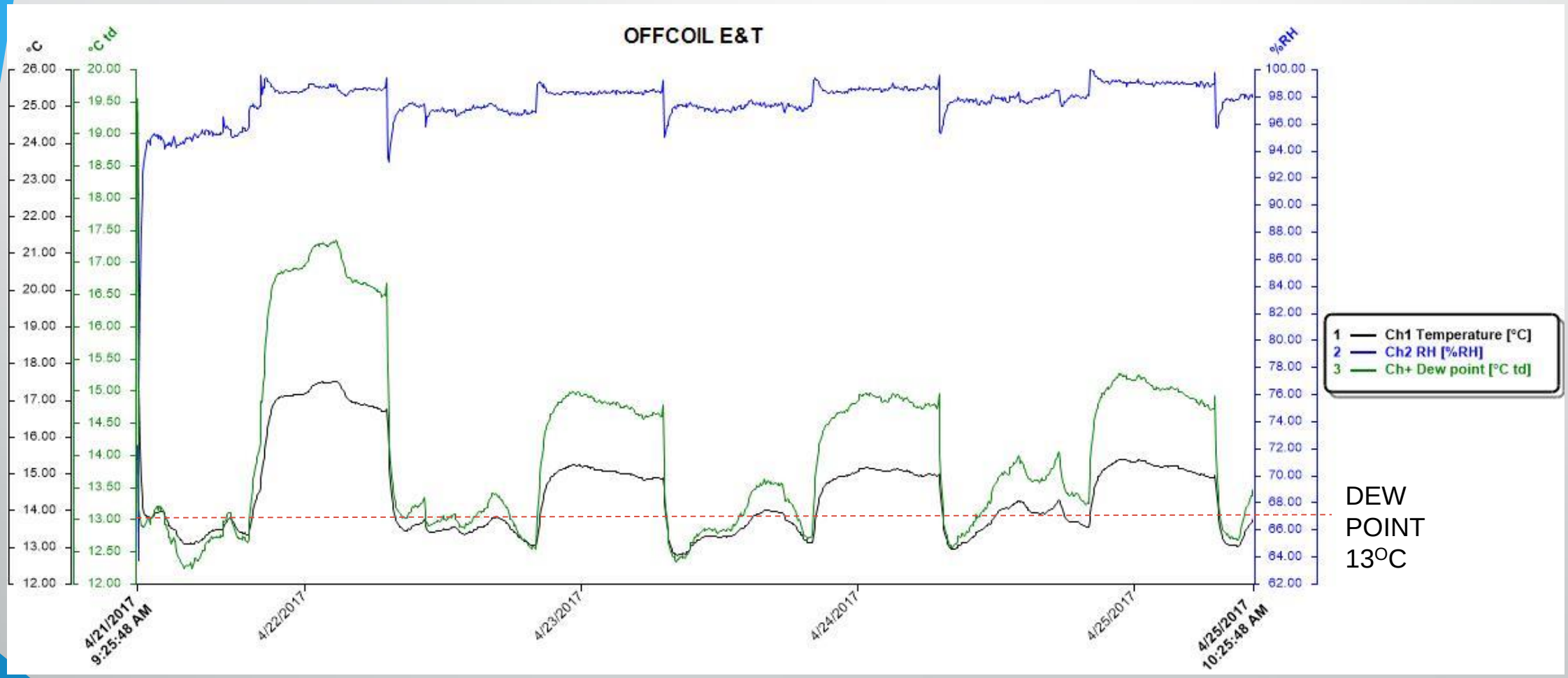
68% RH




50 % BYPASS

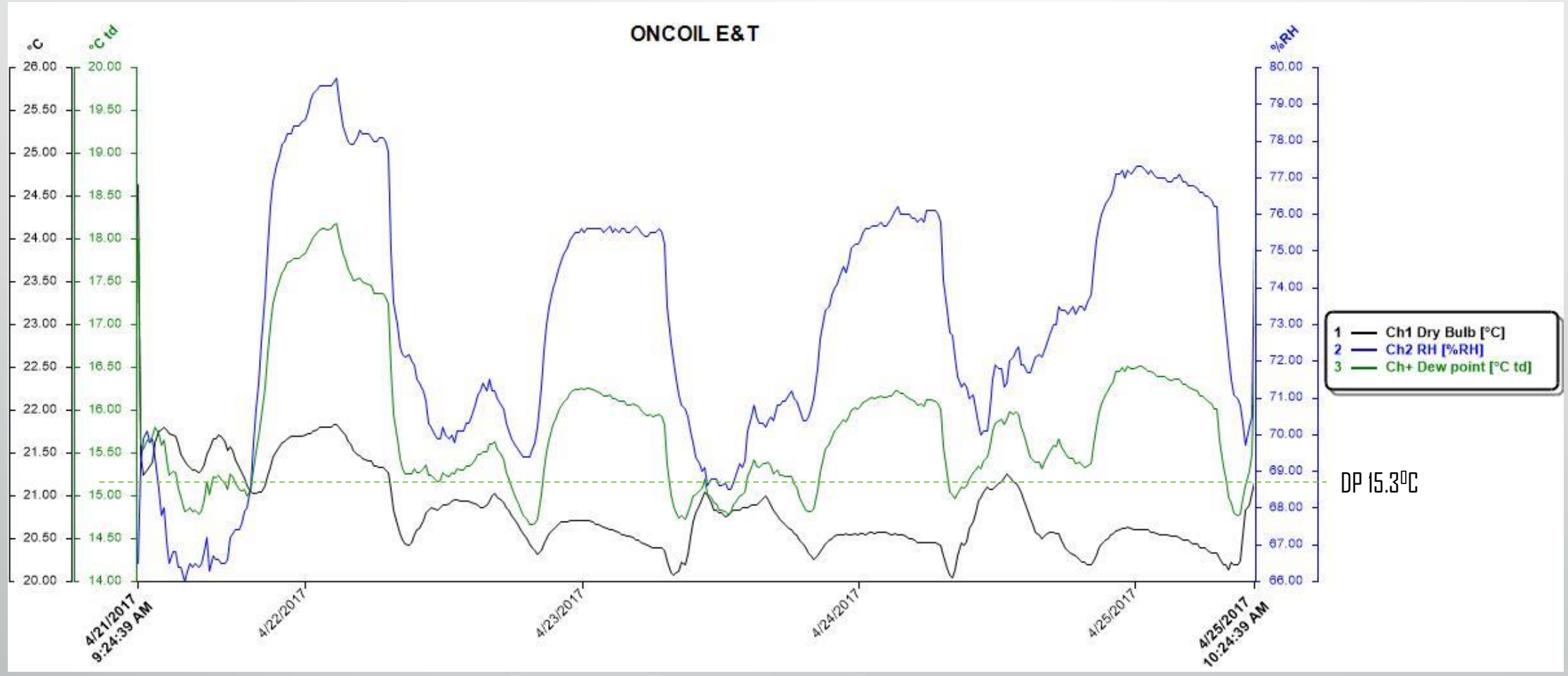
60% RH

# OFFCOIL ZONE ENT-12 HRS ( BYPASS 0 % )




DEW POINT $13^{O}C$

THREE (3) DAYS LOGGING DATA-ZONE ENT - 12 HRS OPERATION




ONCOIL POINT (RETURN+FRESH AIR)

# EQUIPMENT DATA

| DATA FOR ZONE PHARMACY : | | | | DATA FOR ZONE ENT : | | |
|---|---|---|---|---|---|---|
| AHU COOLING CAPACITY : | 378,000 | BTU/HR | | AHU COOLING CAPACITY : | 404,322 | BTU/HR |
| CHILLED WATER FLOW | 75.6 | USGPM | | CHILLED WATER FLOW | 59.6 | USGPM |
| AIR FLOW (CFM) : | 9,684 | CFM | | AIR FLOW (CFM) : | 10,320 | CFM |
| EXTERNAL STATIC FAN : | 2.5 | In. Wg | | EXTERNAL STATIC FAN : | 2.5 | In. Wg |
| FLOOR AREA : | 5561 | $ft^2$ | | FLOOR AREA : | 3602 | $ft^2$ |
| $Btu/ft^2$ | 68 | | | $Btu/ft^2$ | 112 | |
| $CFM/ft^2$ | 1.7 | | | $CFM/ft^2$ | 2.8 | |

# SUMMARY

| EFFECT BYPASS DAMPER | | | | |
|---|---|---|---|---|
| | *ZONE PHARMACY (24hrs)* | | *ZONE ENT (12hrs)* | |
| *BYPASS DAMPER OPENING* | *DB* | *RH* | *DB* | *RH* |
| *0 % BYPASS DAMPER :* | 20$^{O}$c (D)<br>19$^{O}$c (N) | 72% (D)<br>74 % (N) | 22$^{O}$c | 68% (D) |
| *50 % BYPASS DAMPER* | 19$^{O}$c | 65% (D)<br>Max 70% (N) | 21$^{O}$c | 60 %(D) |

# CONCLUSION

1. AHU WITH FACE BYPASS DAMPER WILL ALLOW TO FINE TUNE AHU CAPASITY TO SUIT WITH ACTUAL LOAD IN ORDER TO COMPLY CODE OF PRACTICE INDOOR AIR QUALITY.
2. THIS KIND OF APPROACH DESIGN WILL MINIMISE CONDENSATION AND FUNGUS ISSUES IN BUILDINGS
3. DEWPOINT AT OFFCOIL WILL DETERMINE THE HUMIDITY (<15°C)
4. INSTALLATION UNIT WITH 68 BTU/FT$^2$ AND 112 BTU/FT$^2$ REQUIRED 50% BYPASS AIR TO BETTER DEHUMIDIFICATION.
5. THIS METHOD CAN BE APPLIED NOT ONLY TO CHILLED WATER AHU BUT TO DX SYSTEM AS WELL

# THANK YOU