

Humidity Control

Solving Building Performance Issues Worldwide

CIBSE - ASHRAE Group Webinar

February 13th, 2013



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Outline

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1. The Secret Guide to Worldwide Humidity Control

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- 2. Case History - Community clinic in SouthEast Asia**

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- 3. Case History - Military training building in Okinawa, Japan**
- 4. Summary**

Humidity Control Problems

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**Mold Growth
Health Clinic**

Humidity Control Problems



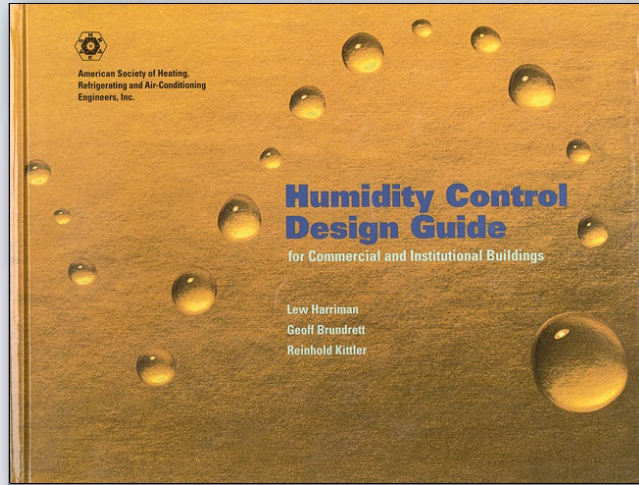
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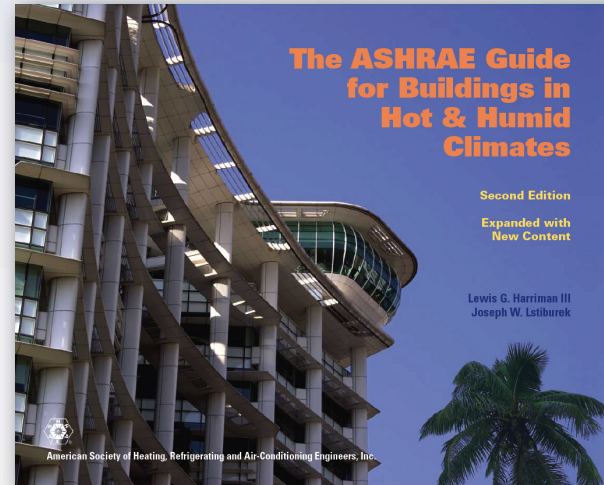
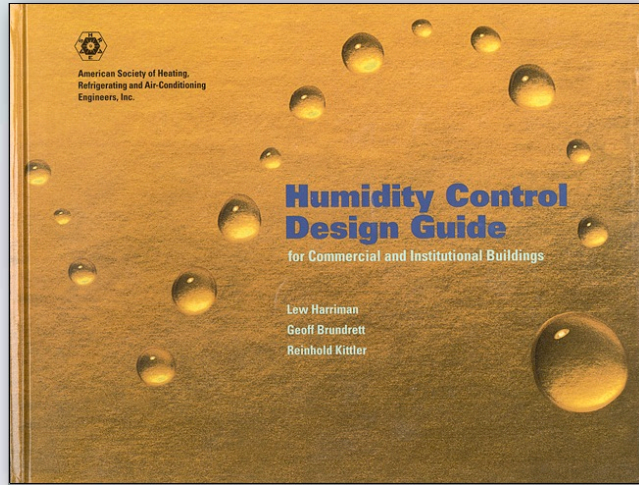
**Electronics Failures
Training Facility**

The Secret Guide To Humidity Control

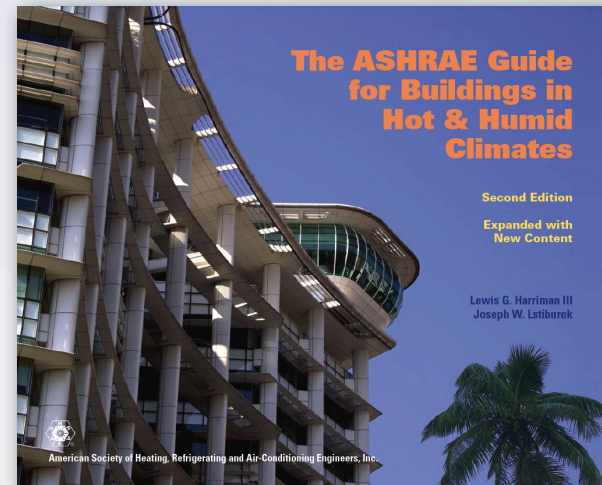
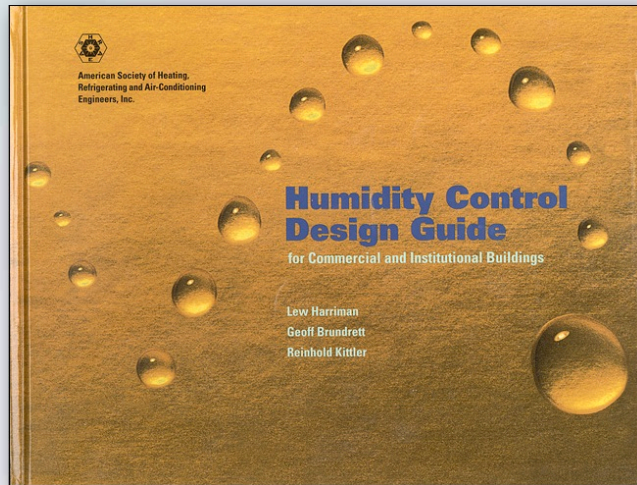
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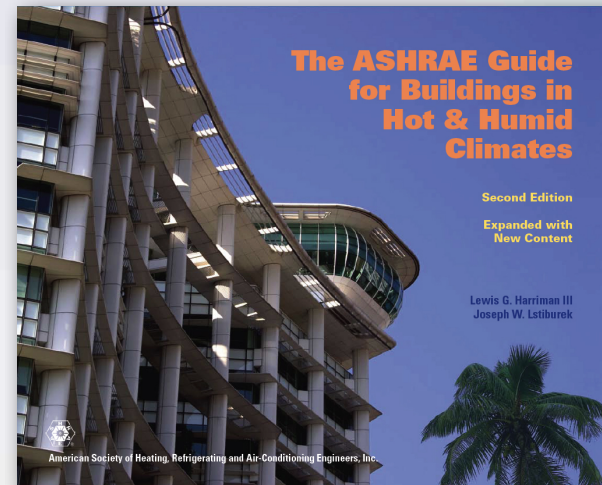
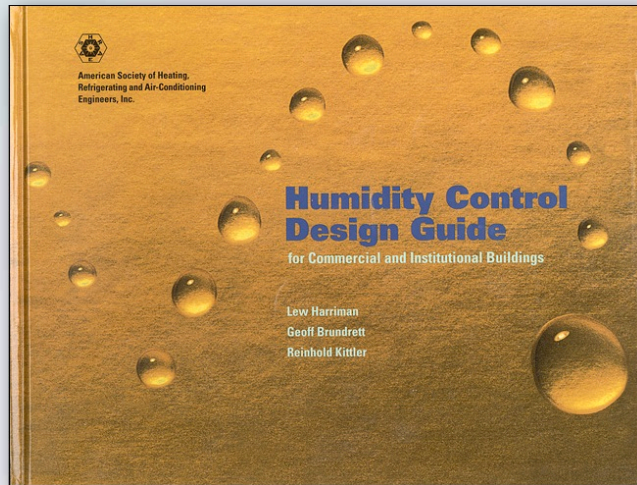


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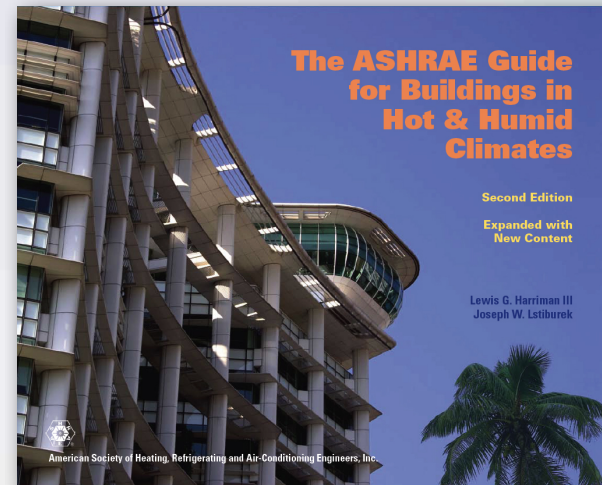
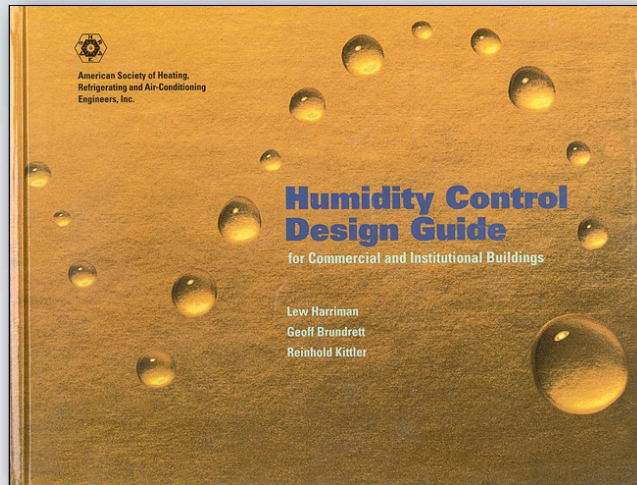
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The Secret Guide To Humidity Control



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- 2. Don't ever let it get too cold inside**

The Secret Guide To Humidity Control



1. Build an airtight building
2. Don't ever let it get too cold inside
3. Dry the ventilation and makeup air...
AT ALL TIMES

Case History - Community Health Clinic



Case History - Community Health Clinic



- Why we need tight buildings, and...

Case History - Community Health Clinic



- Why we need tight buildings, and...
- Why we must not oversize cooling systems

Great building, great HVAC system!...
So why did it grow mold 3 times in five years?

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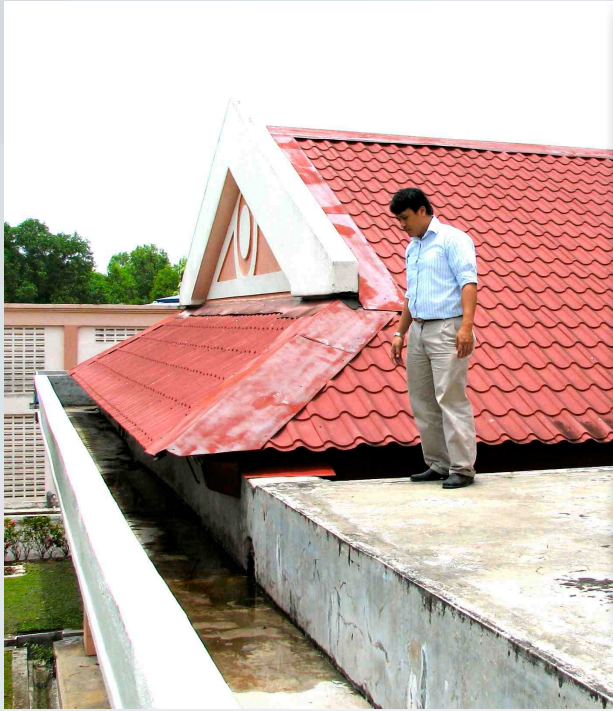
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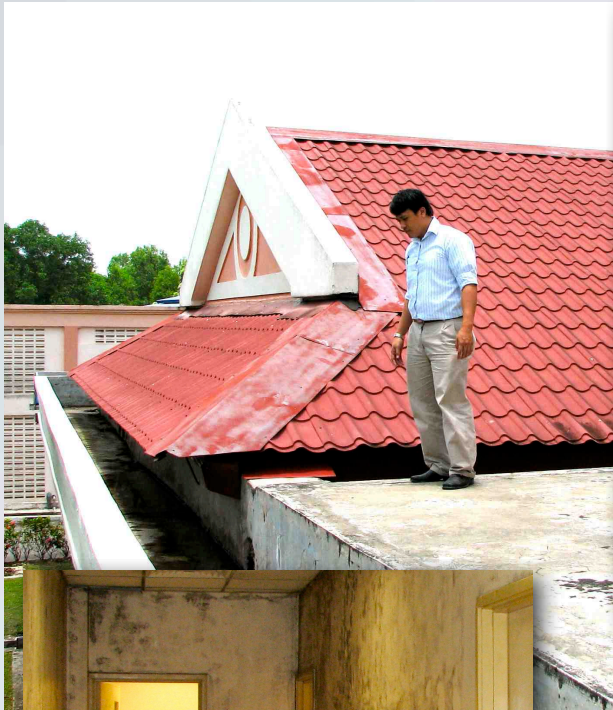
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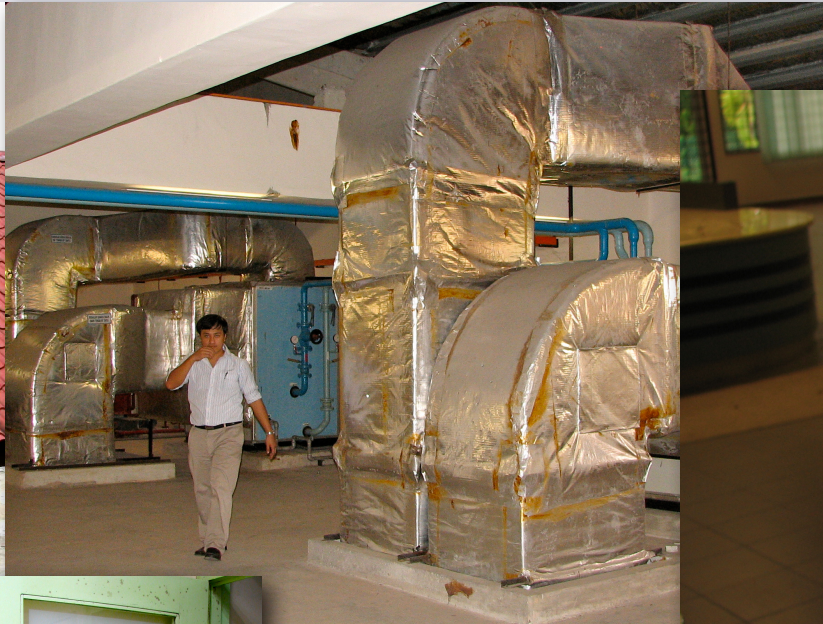
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- Bad publicity forced closure and mold remediation in 2008
- New engineering firm was contracted to remediate mold and re-adjust HVAC (yet again). The engineers wanted to get to the root of the ongoing problems and **solve** them... permanently.

WAKTU OPERASI

ISNIN – KHAMIS

8.00 pg – 1.00 ptg

2.00 ptg – 5.00 ptg

JUMAAT

8.00 pg – 12.15 tgh

2.45 ptg – 5.00 ptg

TUTUP

SABTU

AHAD

KEPERASAN AM

PERHATIAN KECEMASAN PADA WAKTU REHAT

PERALIHAN KEHIMPUNAN
PROFESIONAL KEJERAKAN

APM/PPMS/REAP/1081/1/090515

TAN. SUTARNO MALAYSIA

POLIKLINIK KOMUNITI AYER KEROH



ARAS BAWAH

- | | | |
|--|---------------------------|--------------------|
| RUANG PULSA (MRF) | TRANGGI | RAWATAN & SEKURITI |
| KEMAS 300 MENCAMAM-Macam & BANGUNAN ALAM | PUSKES MANDAR KANAK-KANAK | TELEFON BAWAH |
| PUSKES TANGAN JIWA | BATERIA | TAMBAH AWAM |

ARAS SATU

- | | | |
|---------------------------|---------------|---------------|
| KAWASAN DOKUMEN KADU BUKU | PUSKES MANDAR | TAMBAH AWAM |
| UNIT PERUBATAN | TAMBAH AWAM | MATA TEL |
| RUANG PERUBATAN | BILIK SAMPUL | TELEFON BAWAH |

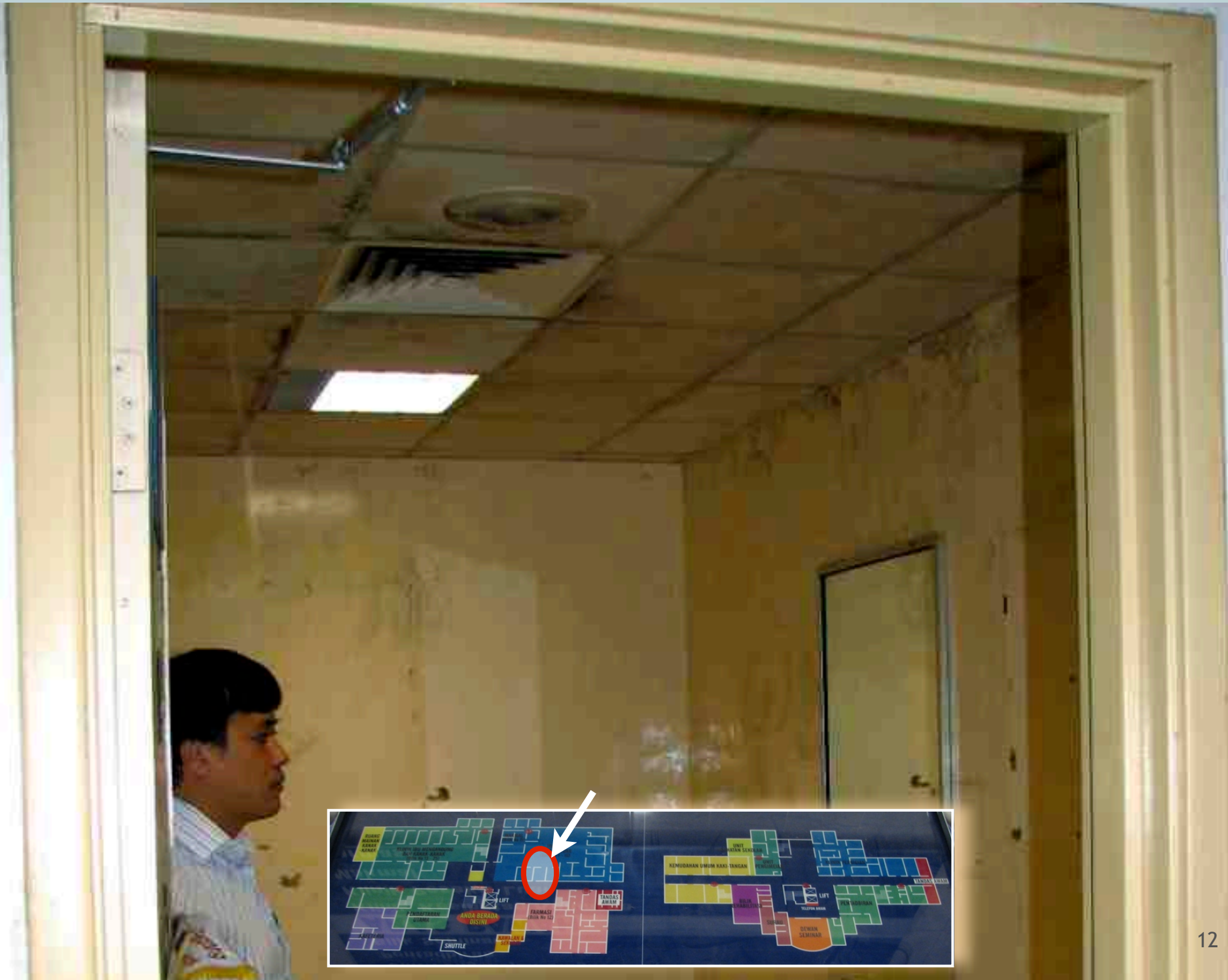
POLIKLINIK KOMUNITI



















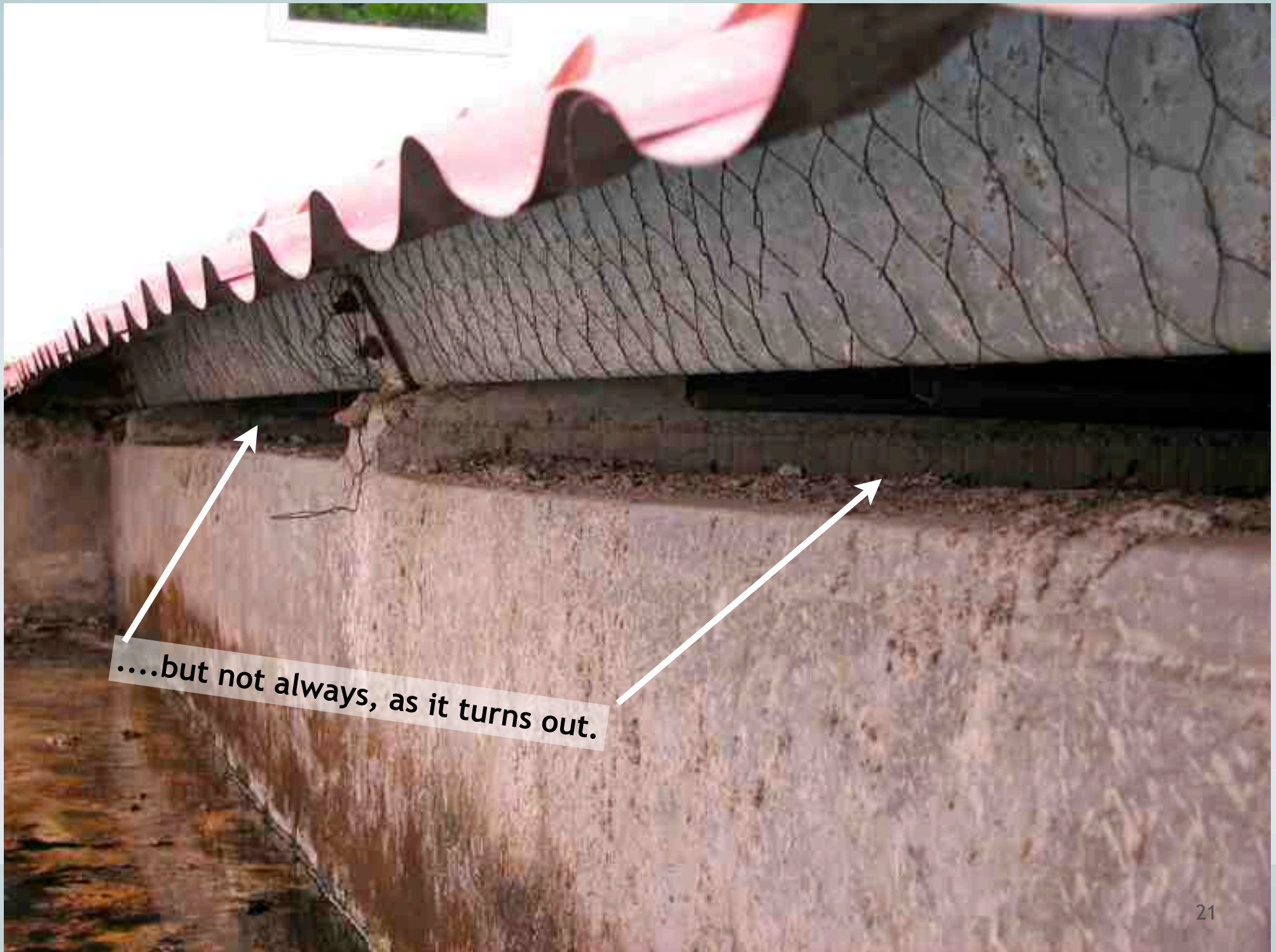








Sheet metal covers joint



....but not always, as it turns out.



This particular opening is 5 cm high, by.....

Roof-wall connection

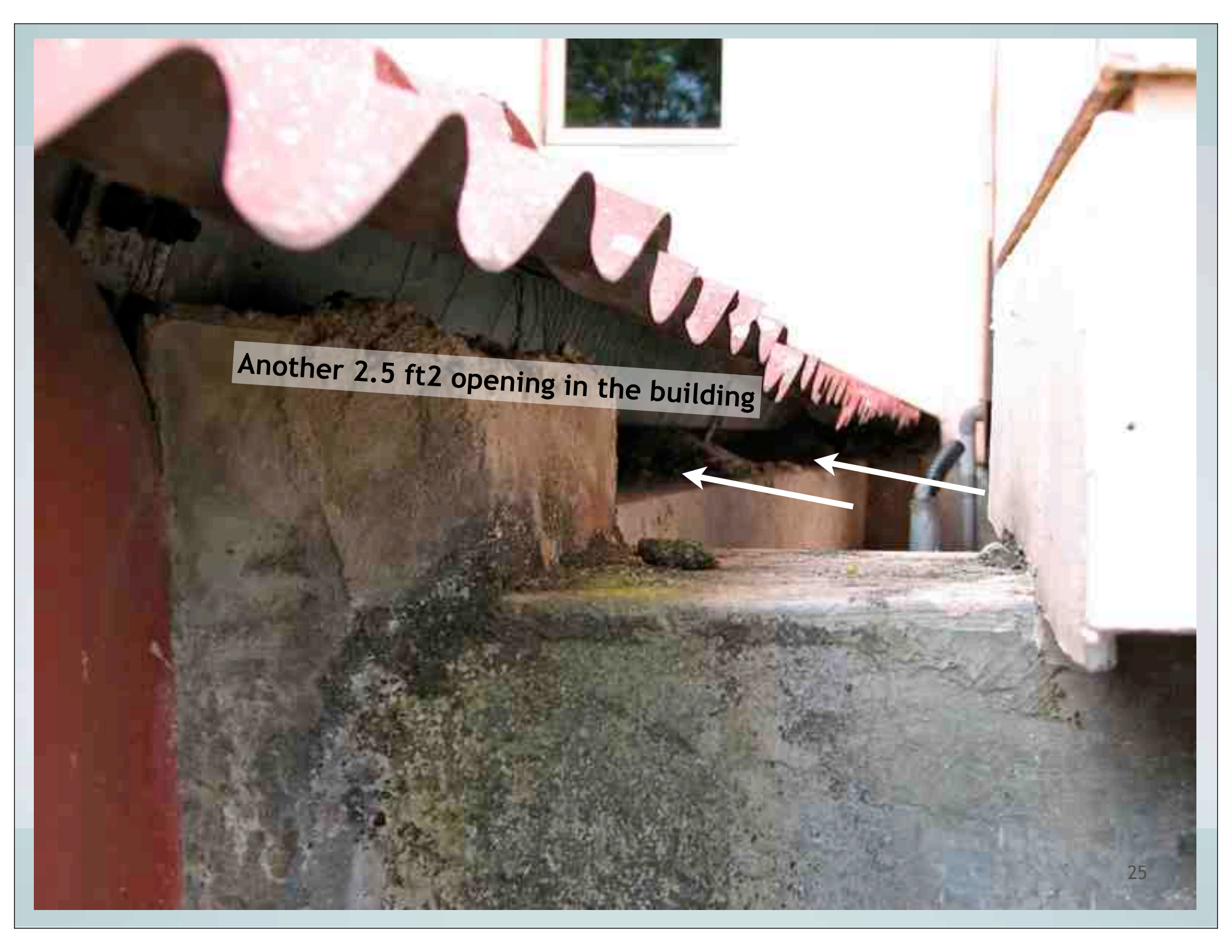


by... 7.5 meters long (15 ft.)

So this particular gap measures 2.5 ft² open area



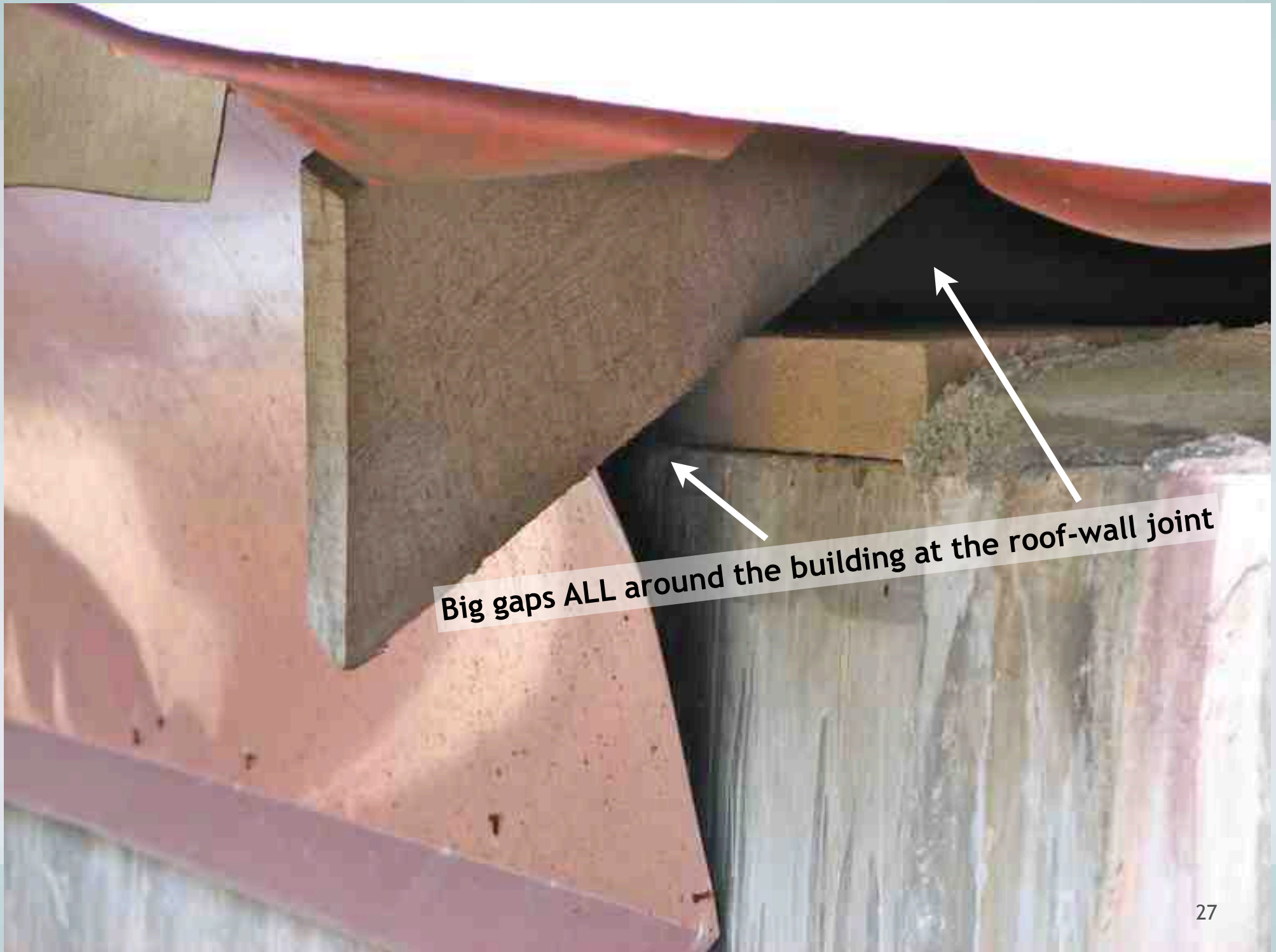
...but that's not the only gap. Here's another one, same size



Another 2.5 ft² opening in the building



Big gaps ALL around the building at the roof-wall joint



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12°C indoor dew point when systems are operating....



... rises to **18° C** dew point only **20 minutes** after systems turn off..



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... which means the rh AT THE SURFACE is over 95%



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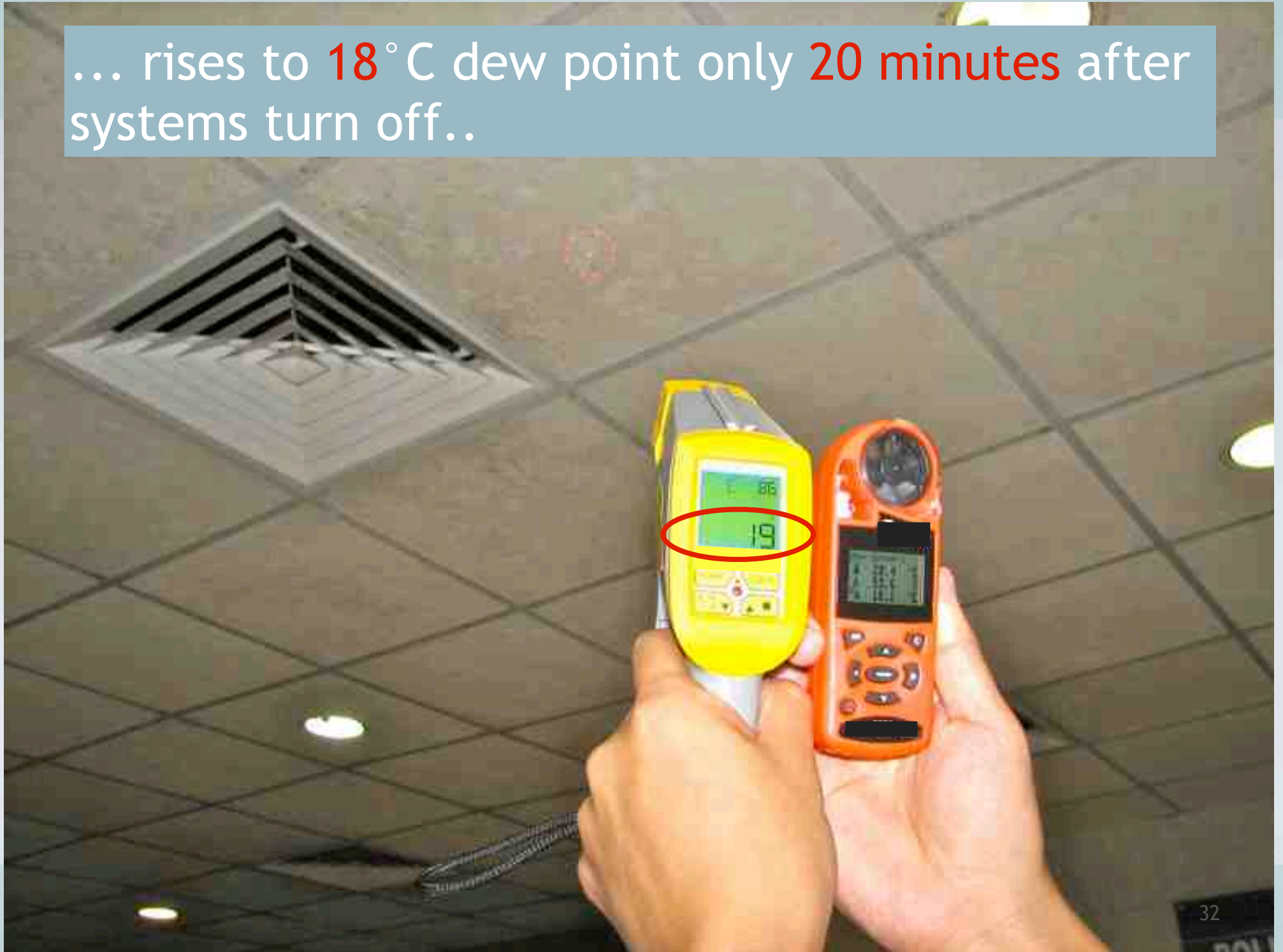
And that's why mold grows on the cool, damp surface..



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...even though the rh IN THE AIR is only 54%



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95% RH at the surface



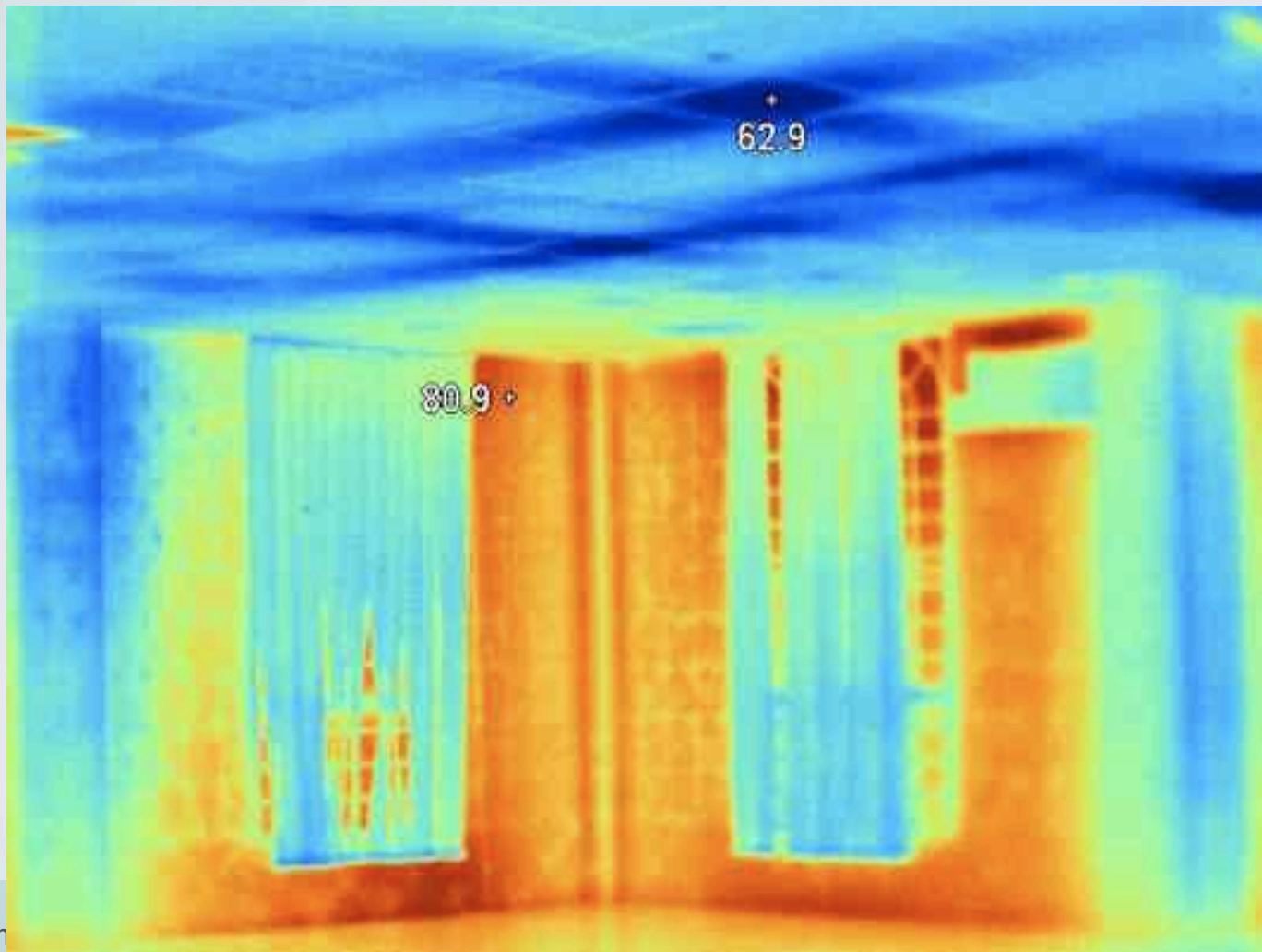
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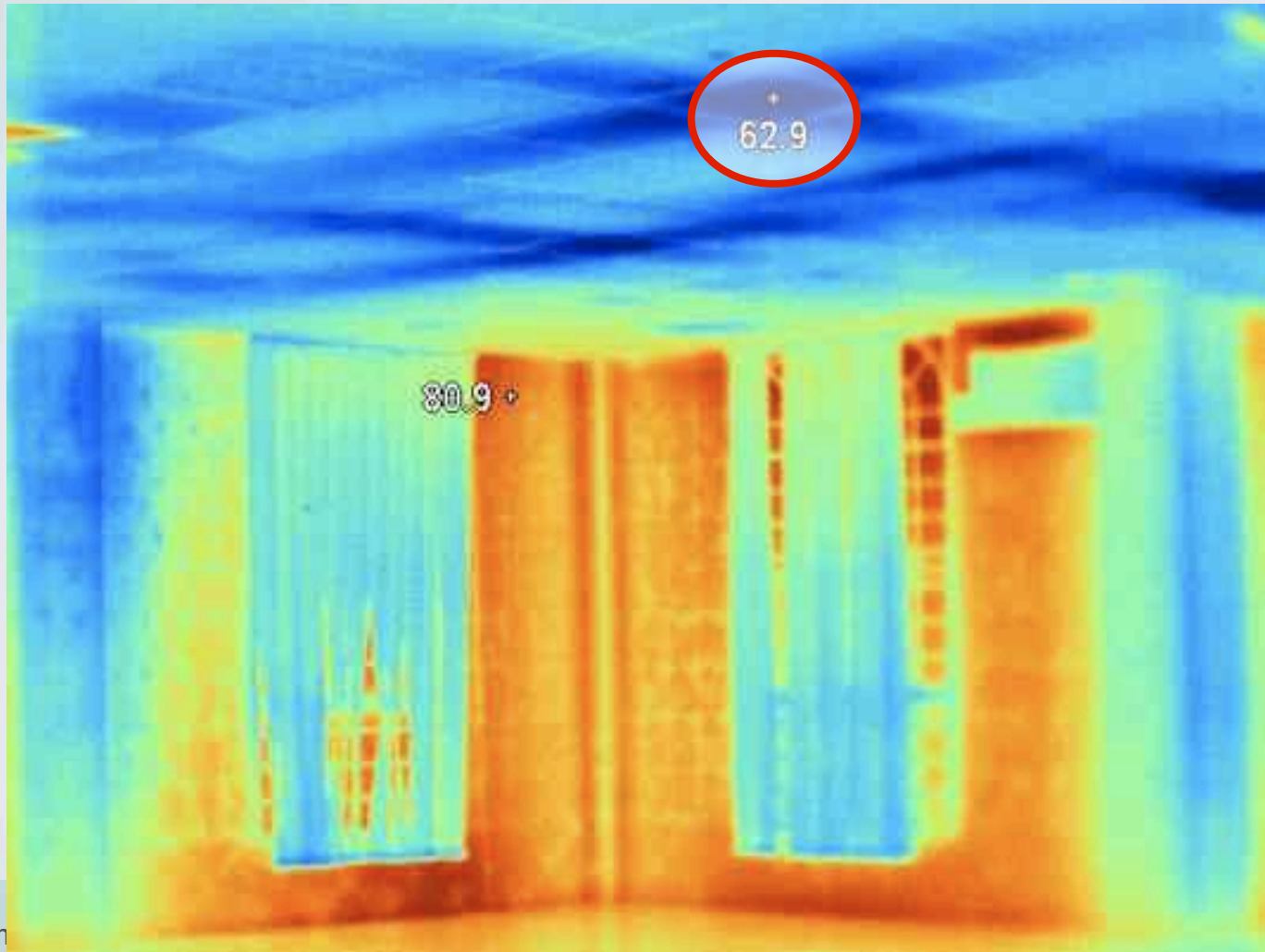


54% RH in the air

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Cold surfaces = moisture absorption = mold



Retrofit Solution

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- Installed desiccant DH unit which operates after AC units turn off at 5:00pm. DH keeps indoor air near or below 55° F dew point.
- No more comfort problems. Mold problems gone.. except for overcooled pharmacy storage.

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- Typical reaction of HVAC designers to high humidity loads... “Add MORE TONS of cooling” (Catastrophically the **wrong** reaction).

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- Probably nobody told the architectural designer air tightness is CRITICAL in an air conditioned building.
- A focus on **controlling dew point** would have provided quick clues to surface condensation and mold growth problems

Case History - Military Training Building



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- Why we need to dry ventilation and makeup air

Case History - Military Training Building



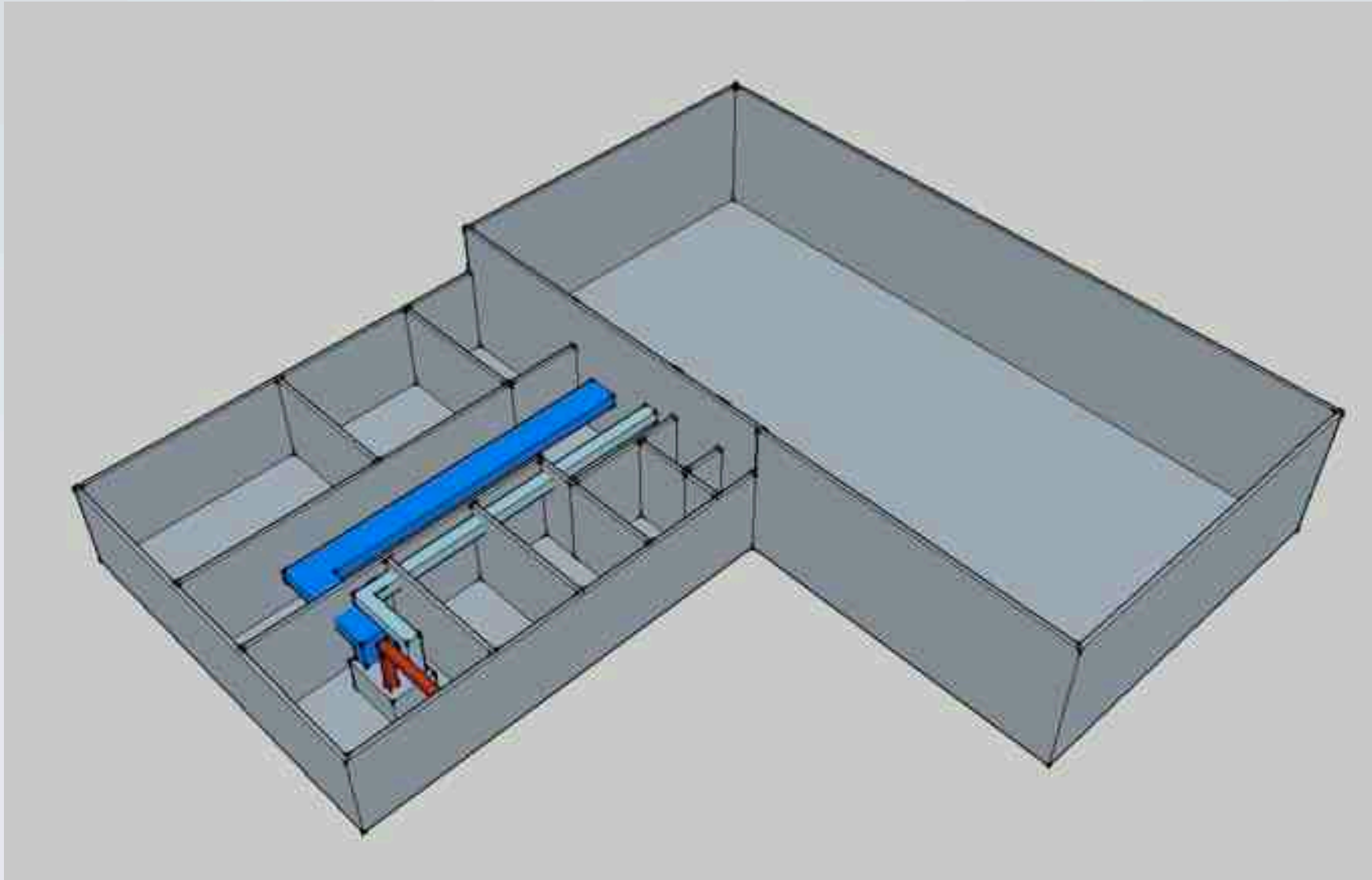
- Why we need to dry ventilation and makeup air
- Why we must not oversize cooling equipment

Humidity Control Problems

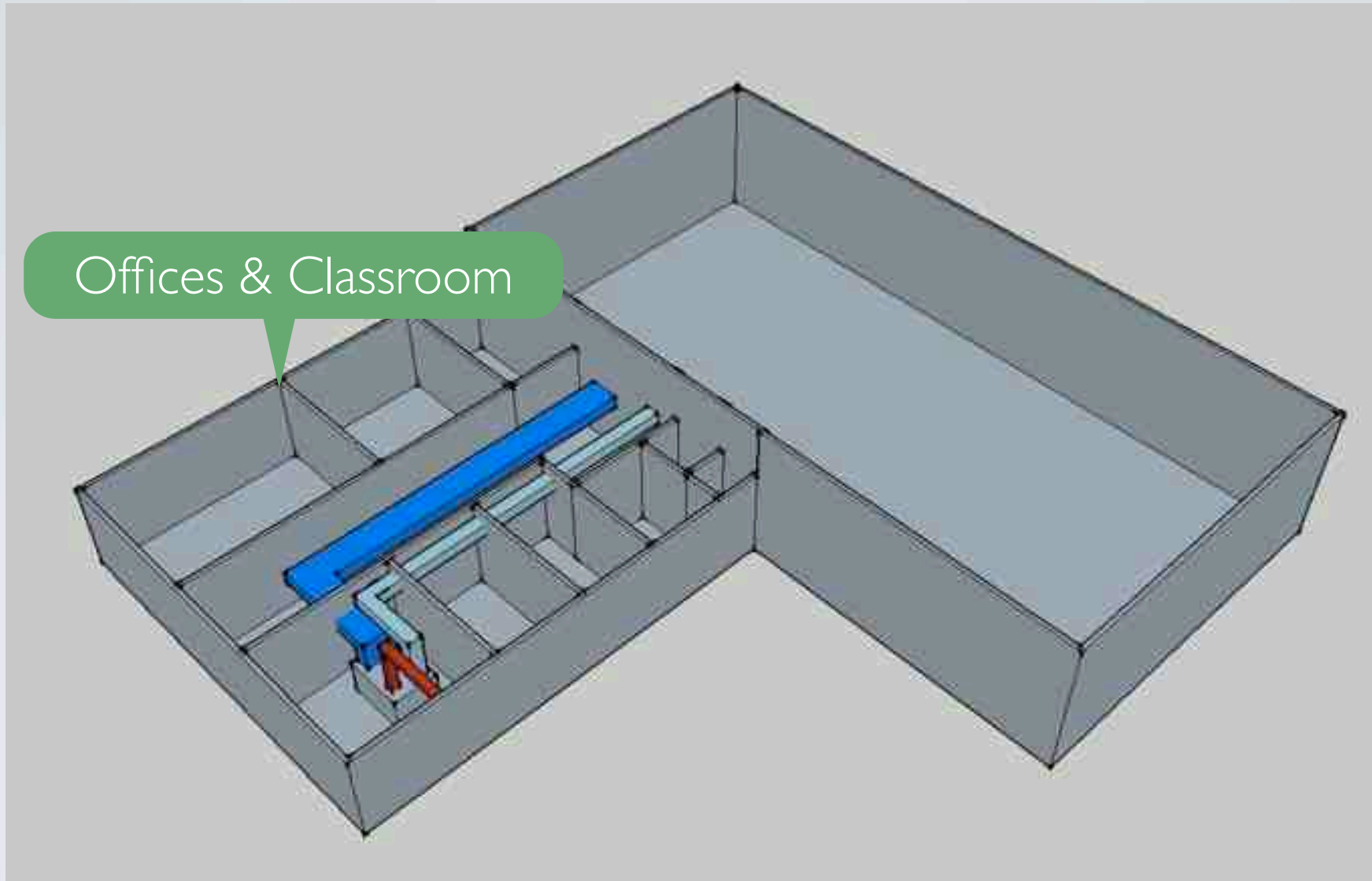


1/26/12	3rd MED were trained. All passed. 4 Marines from MHG + HQ Div were trained. All passed.	21.8°C / 38%
2/7/12	For the month of January a total of 47 Marines were trained with no academic failures. 3 Marines from 1/4 were trained. All passed.	22.0°C / 76%
2/9/12	3 Marines from CLR-37 + 12th MAR were trained. All passed.	21.7°C / 39%
2/14/12	3 Marines from 12th MAR + Div Comm (Div Schools) were	22.1°C / 77%

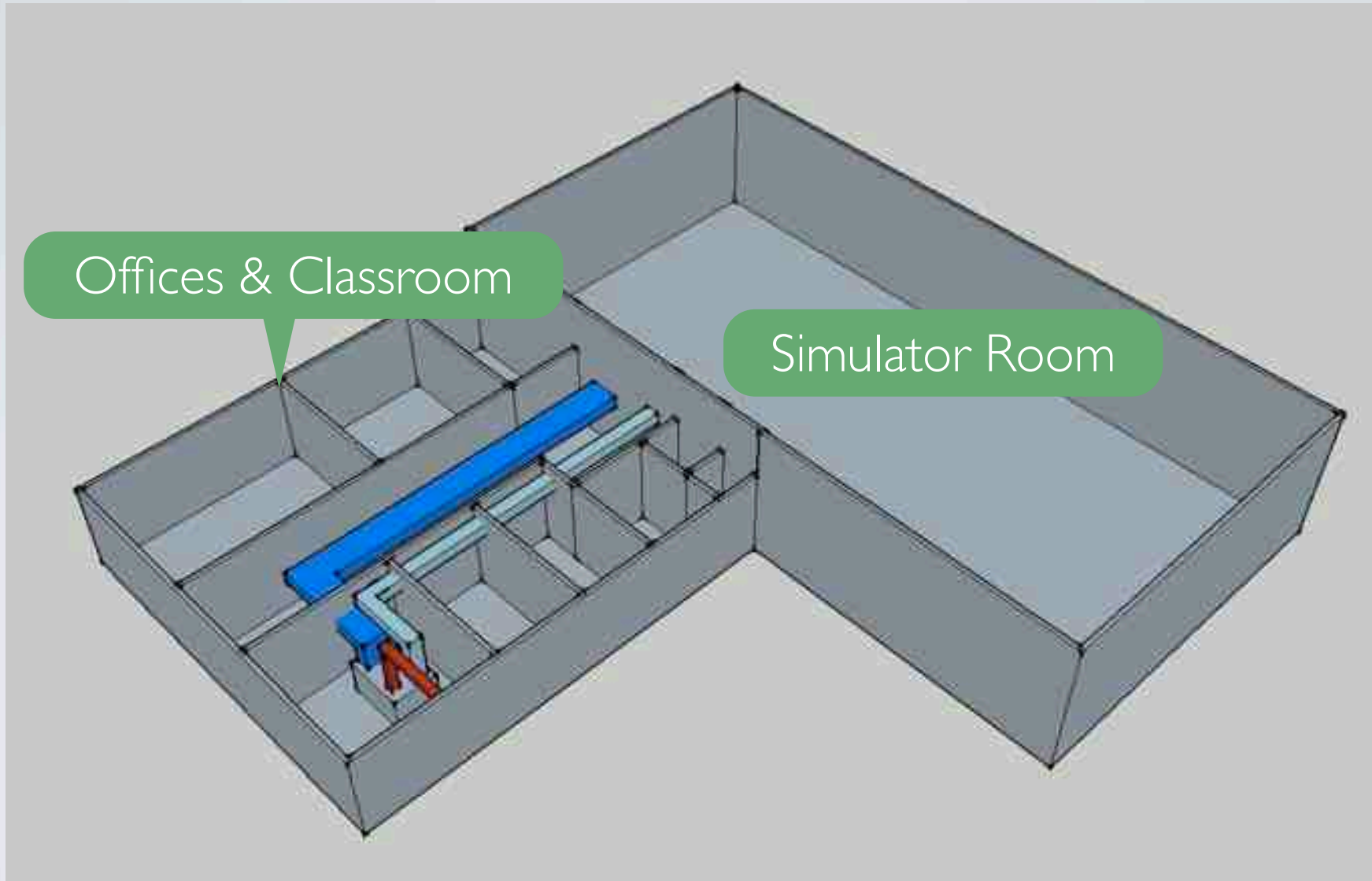
Building layout



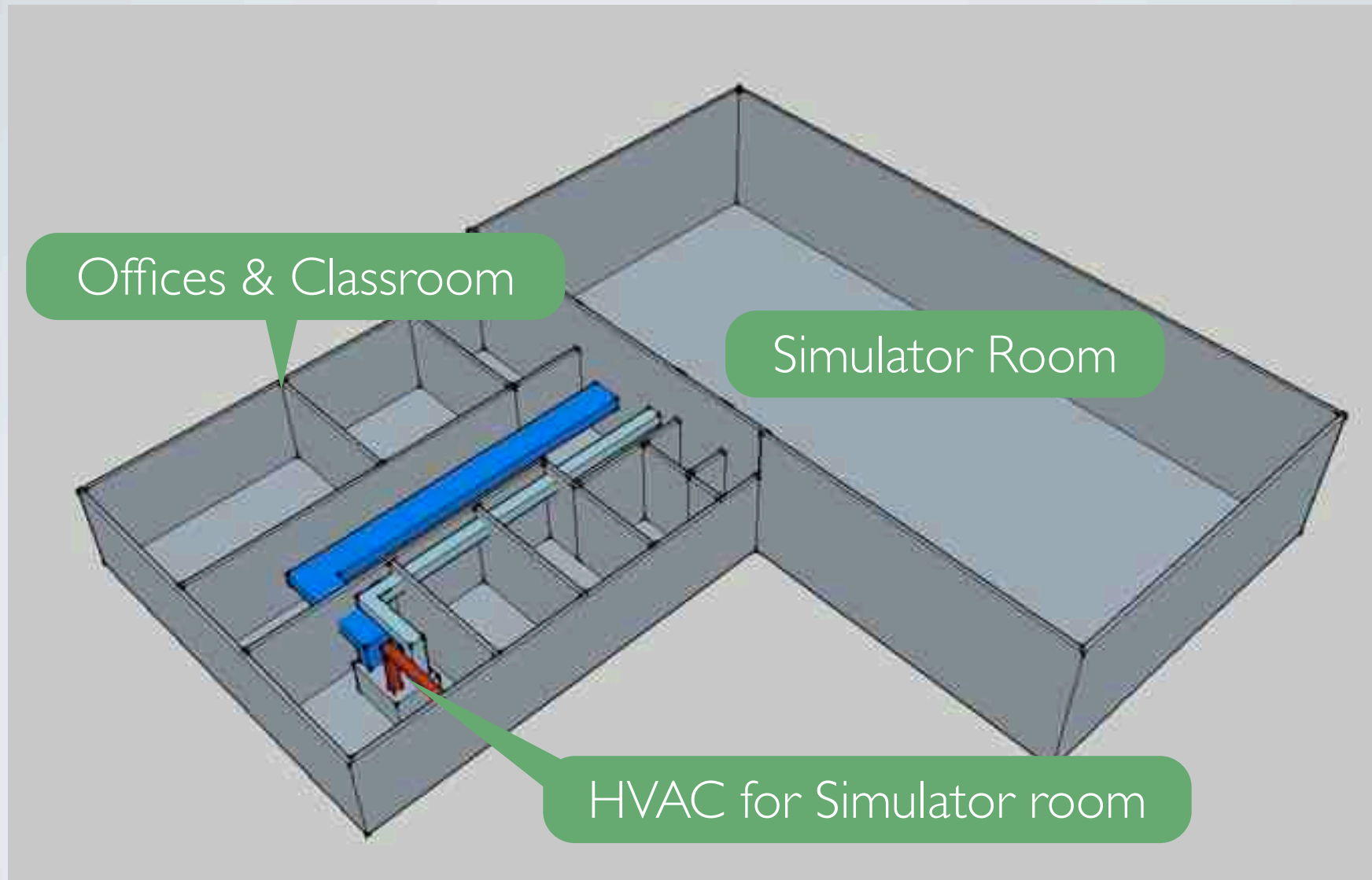
Building layout



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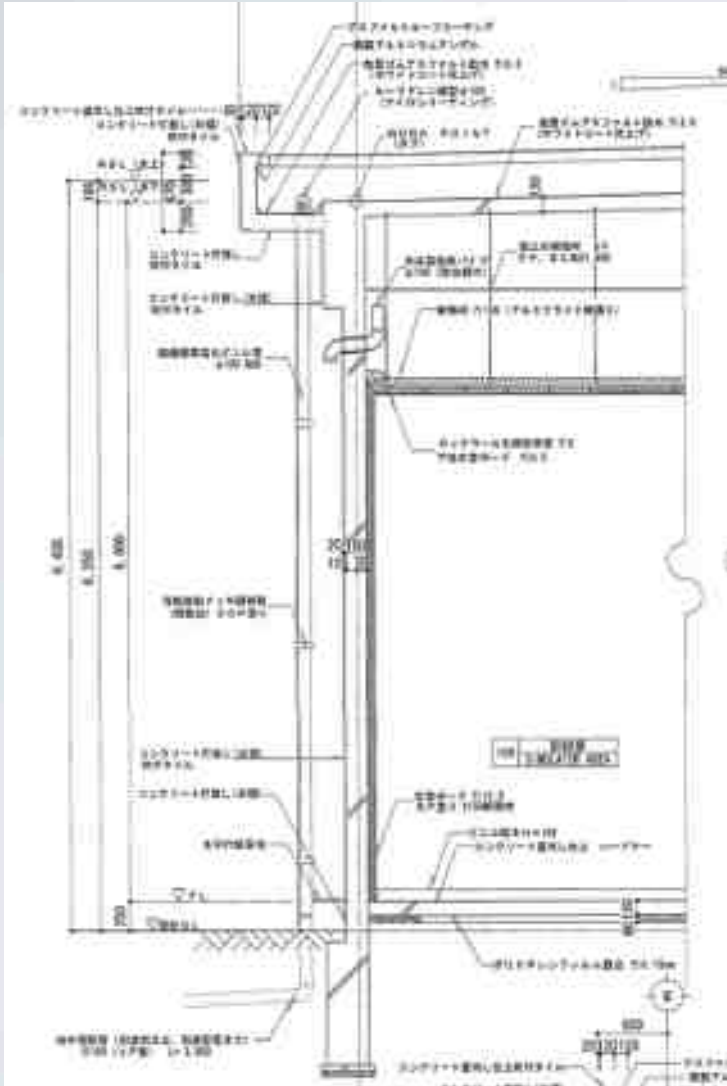


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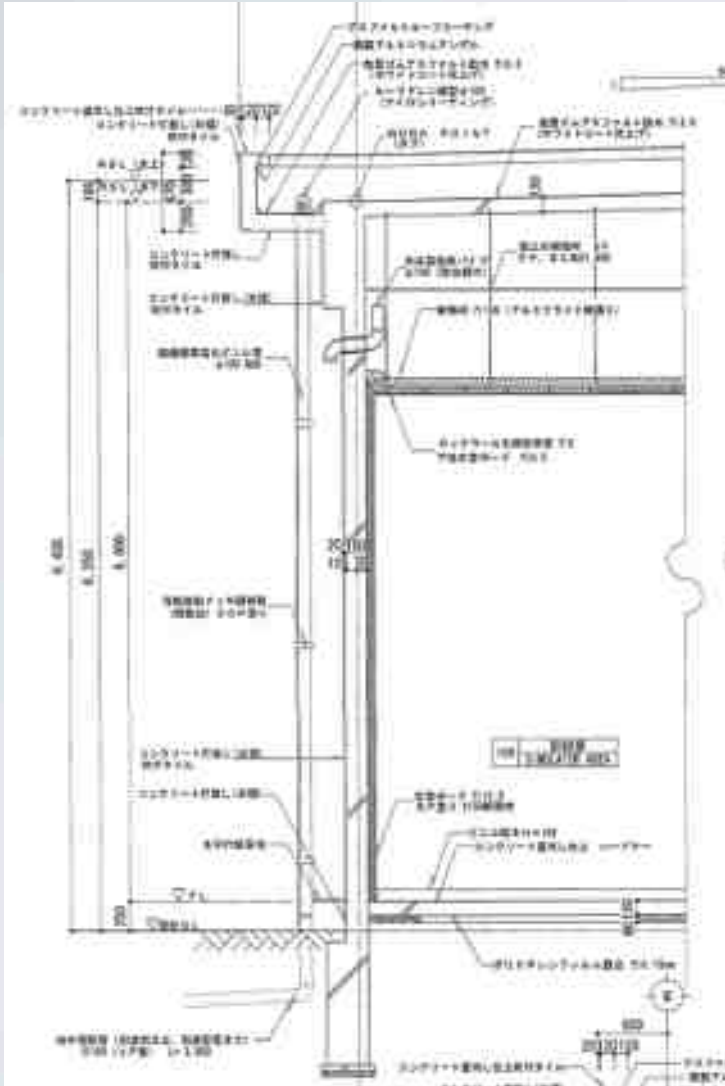


Leaky building?... Definitely NOT!

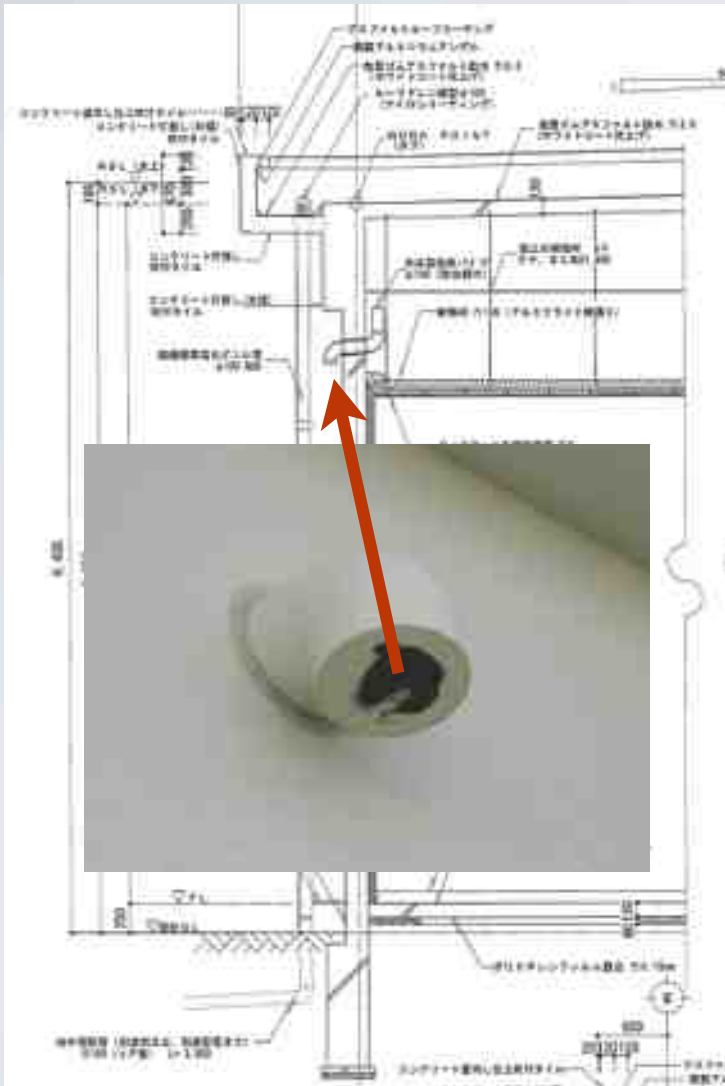
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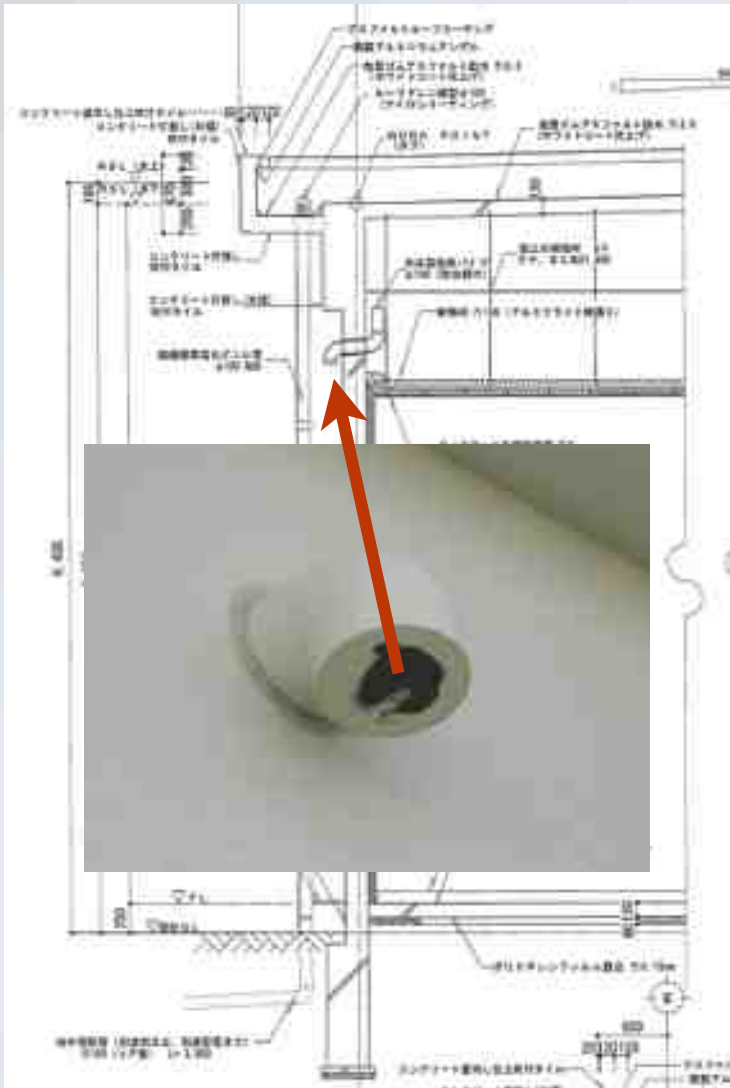
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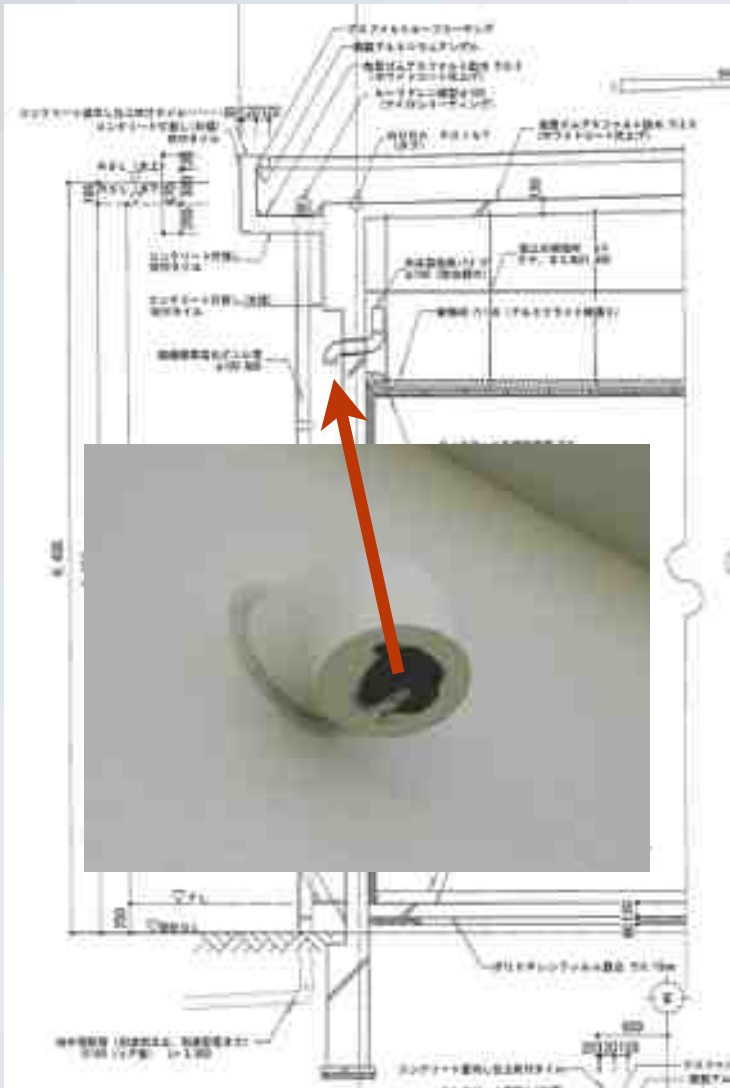
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Blower door test for whole-building air leakage

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**Negative
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Blower door test for whole-building air leakage



**Negative
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**Air
Infiltration
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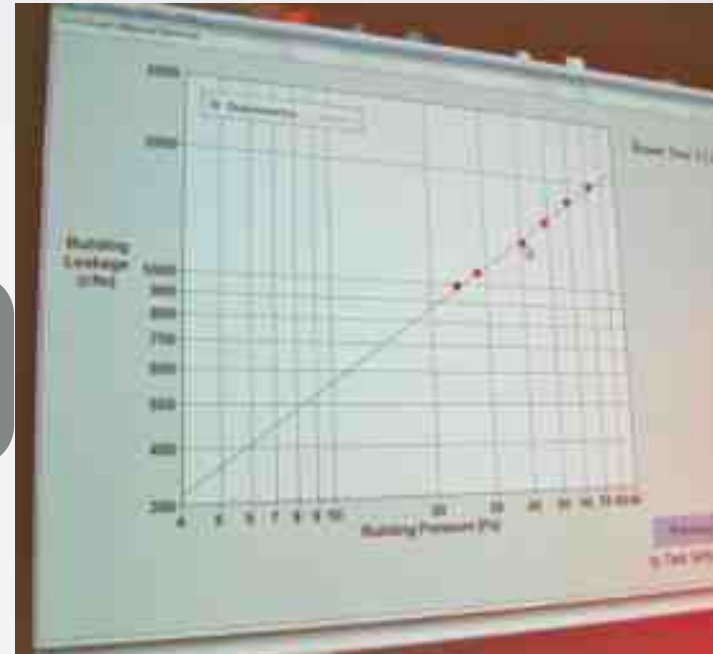
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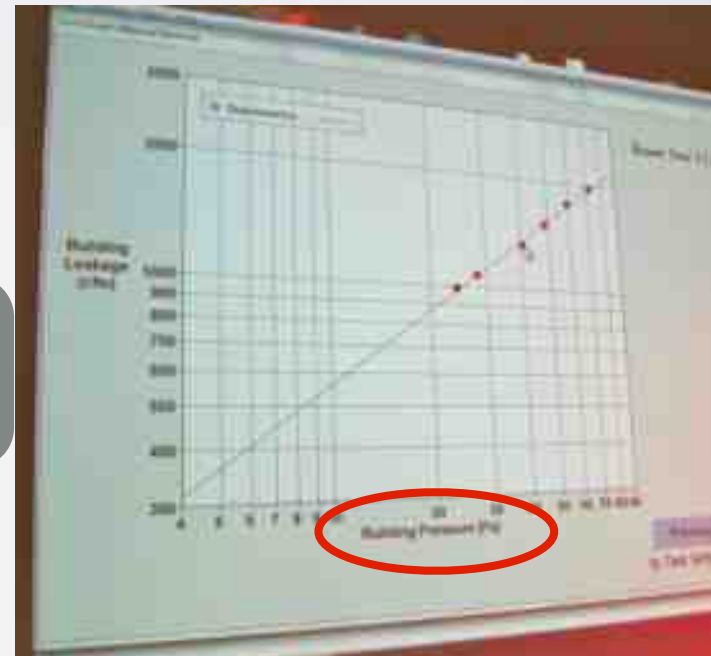
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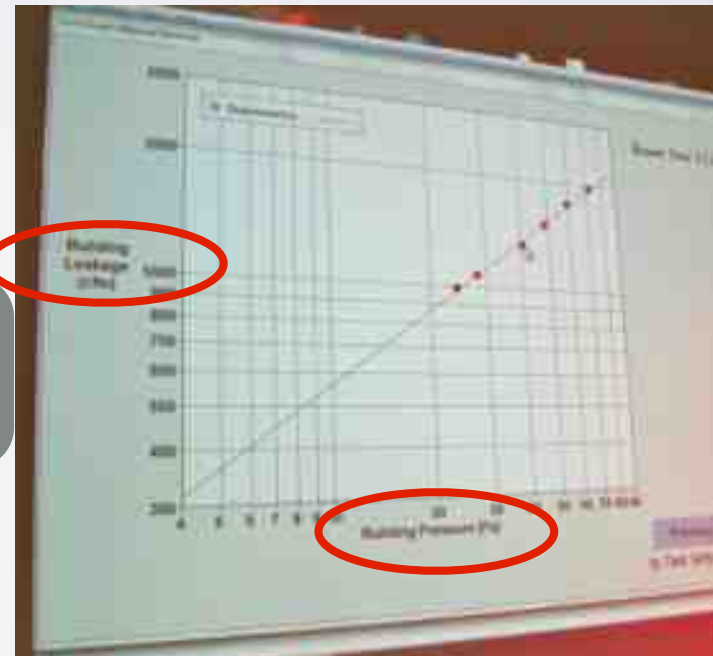
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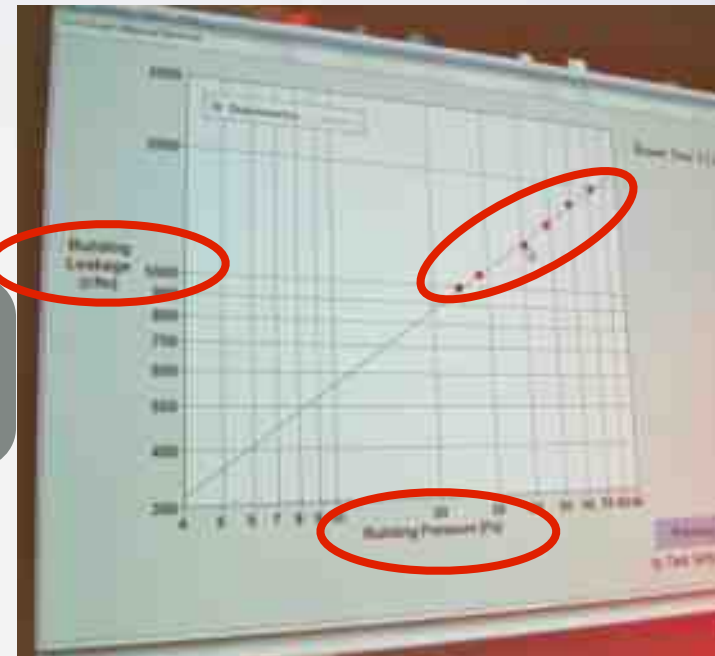
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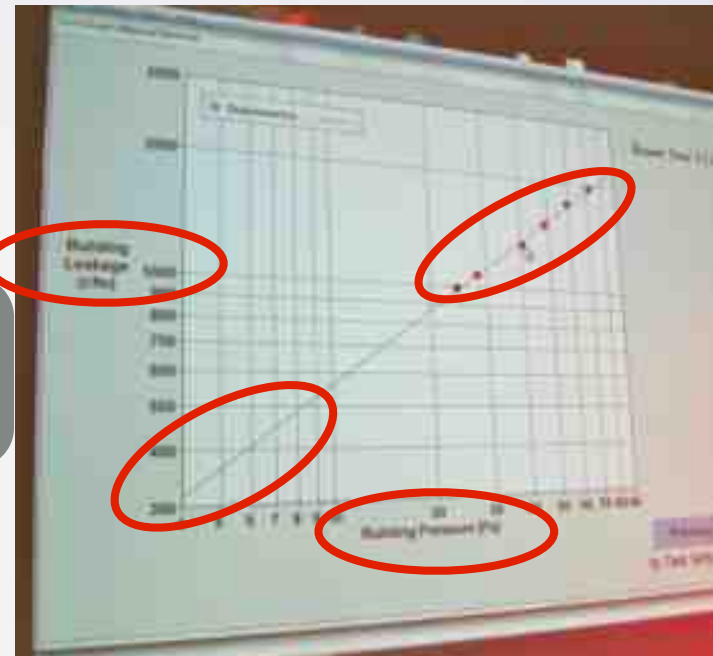
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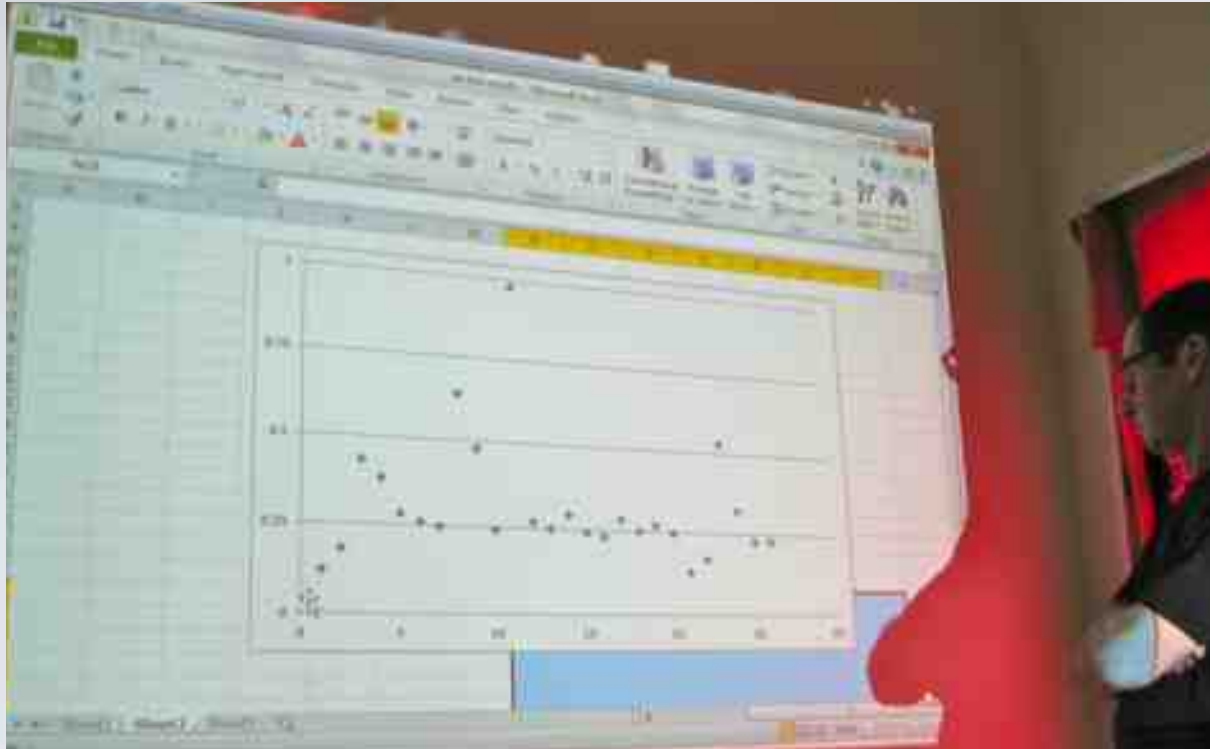
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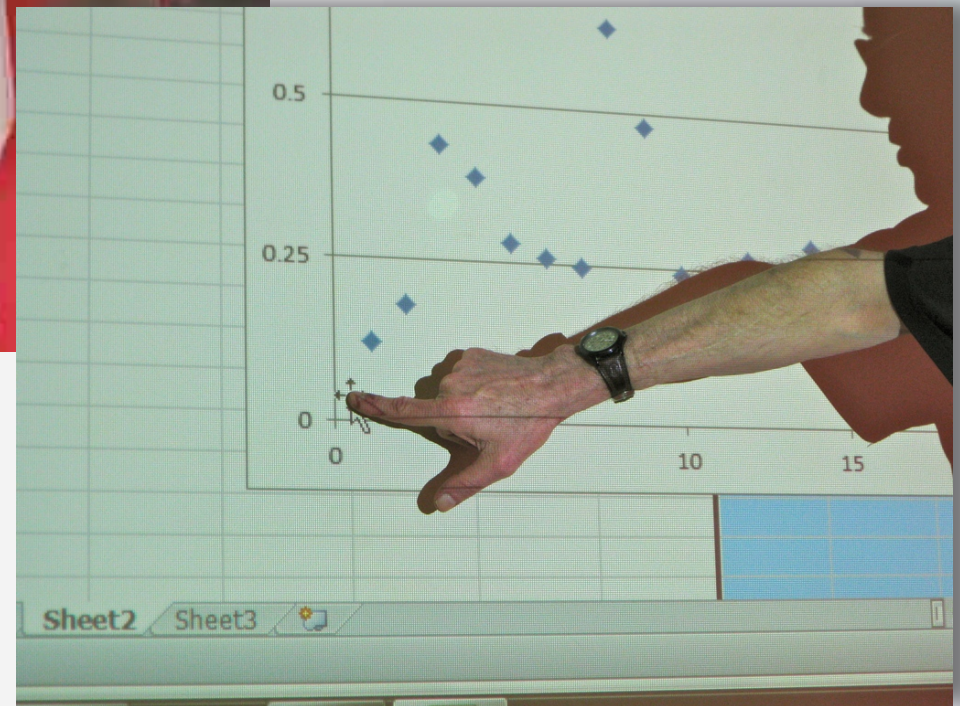
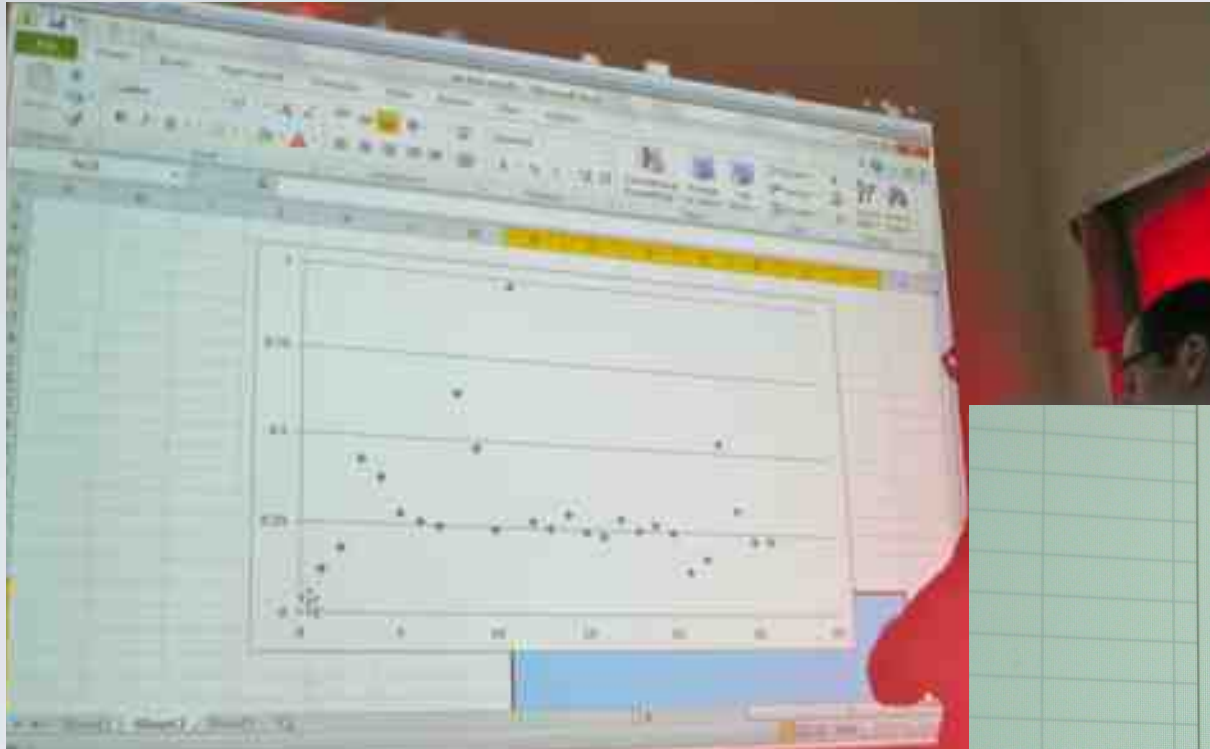
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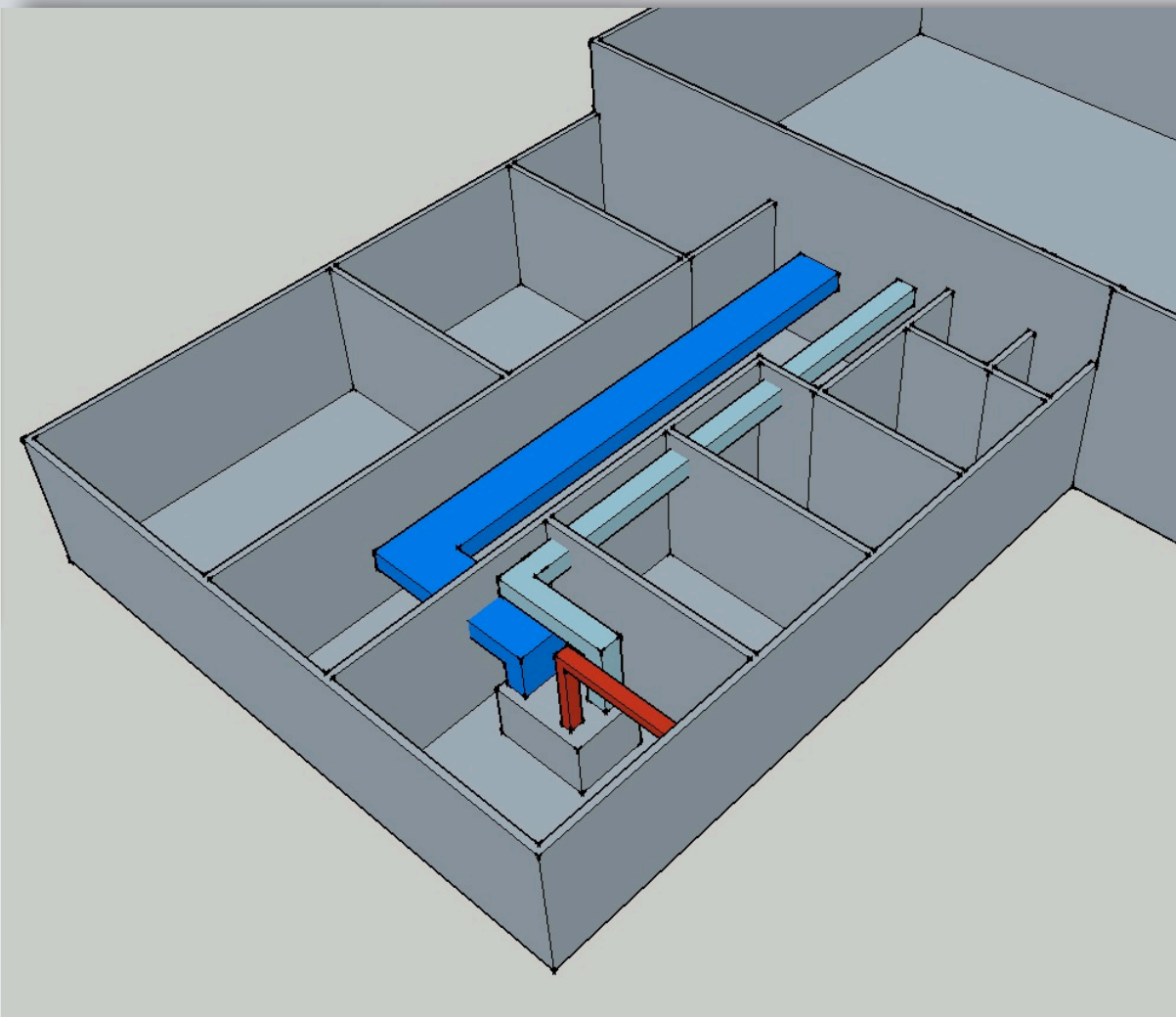


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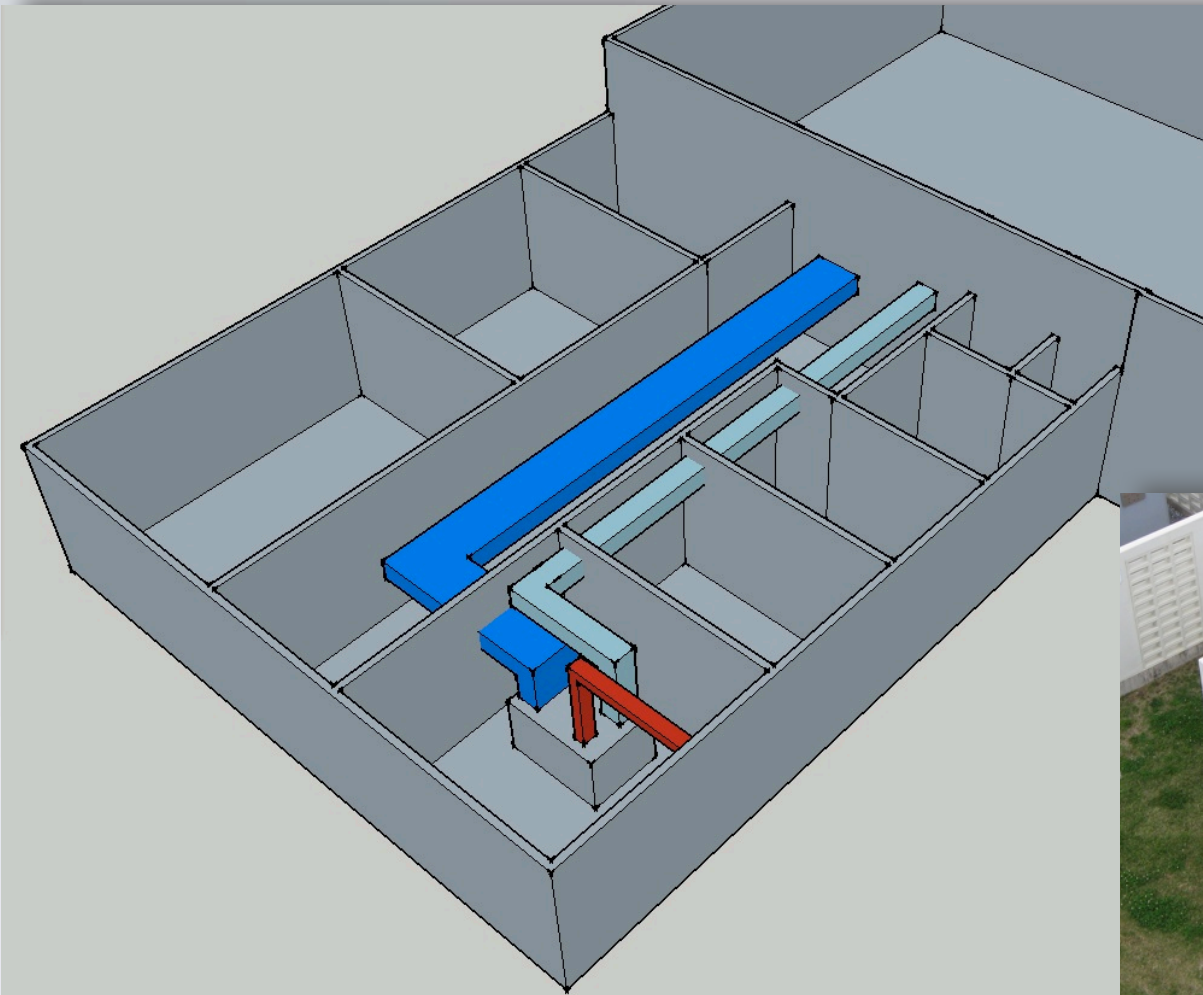


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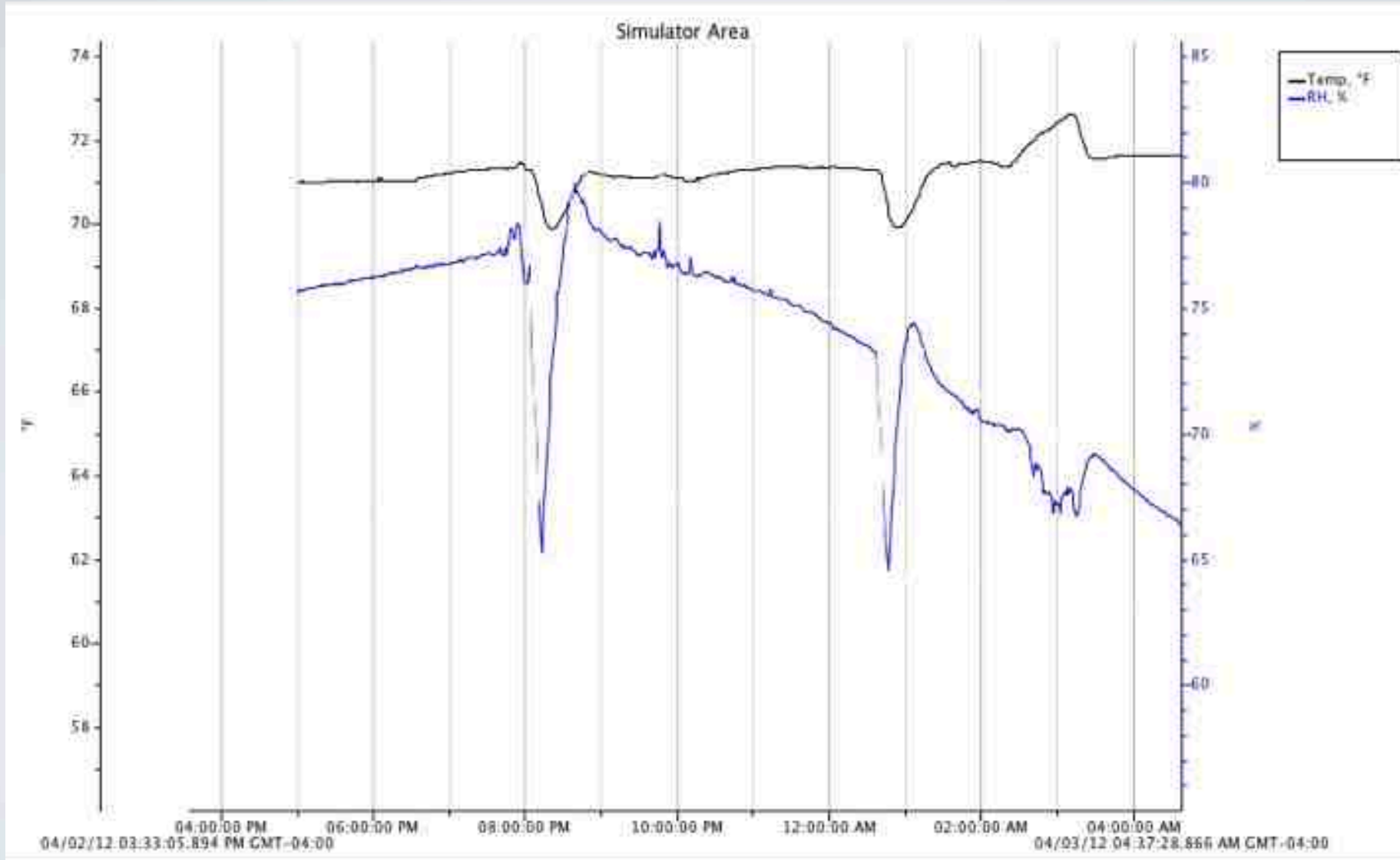
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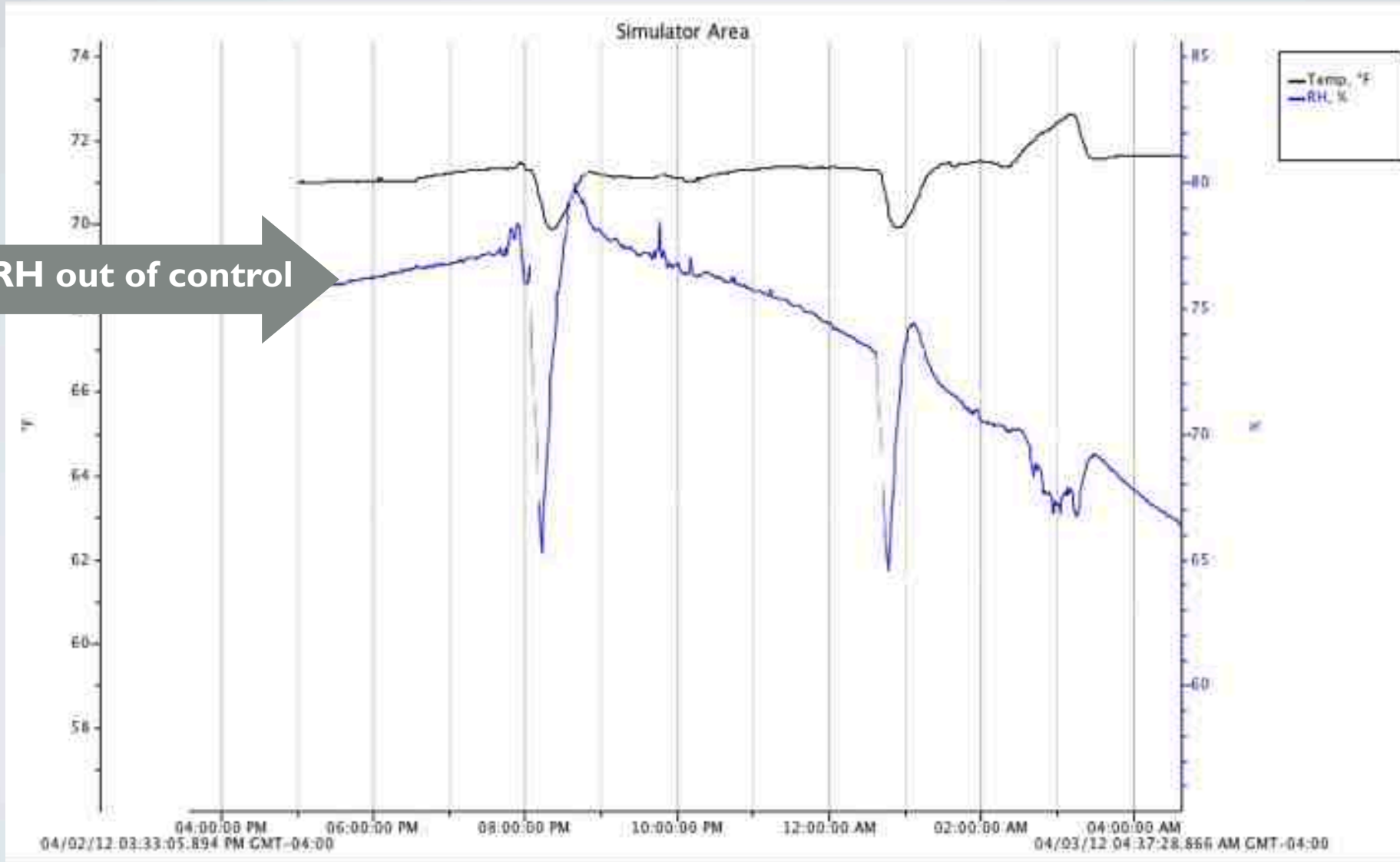
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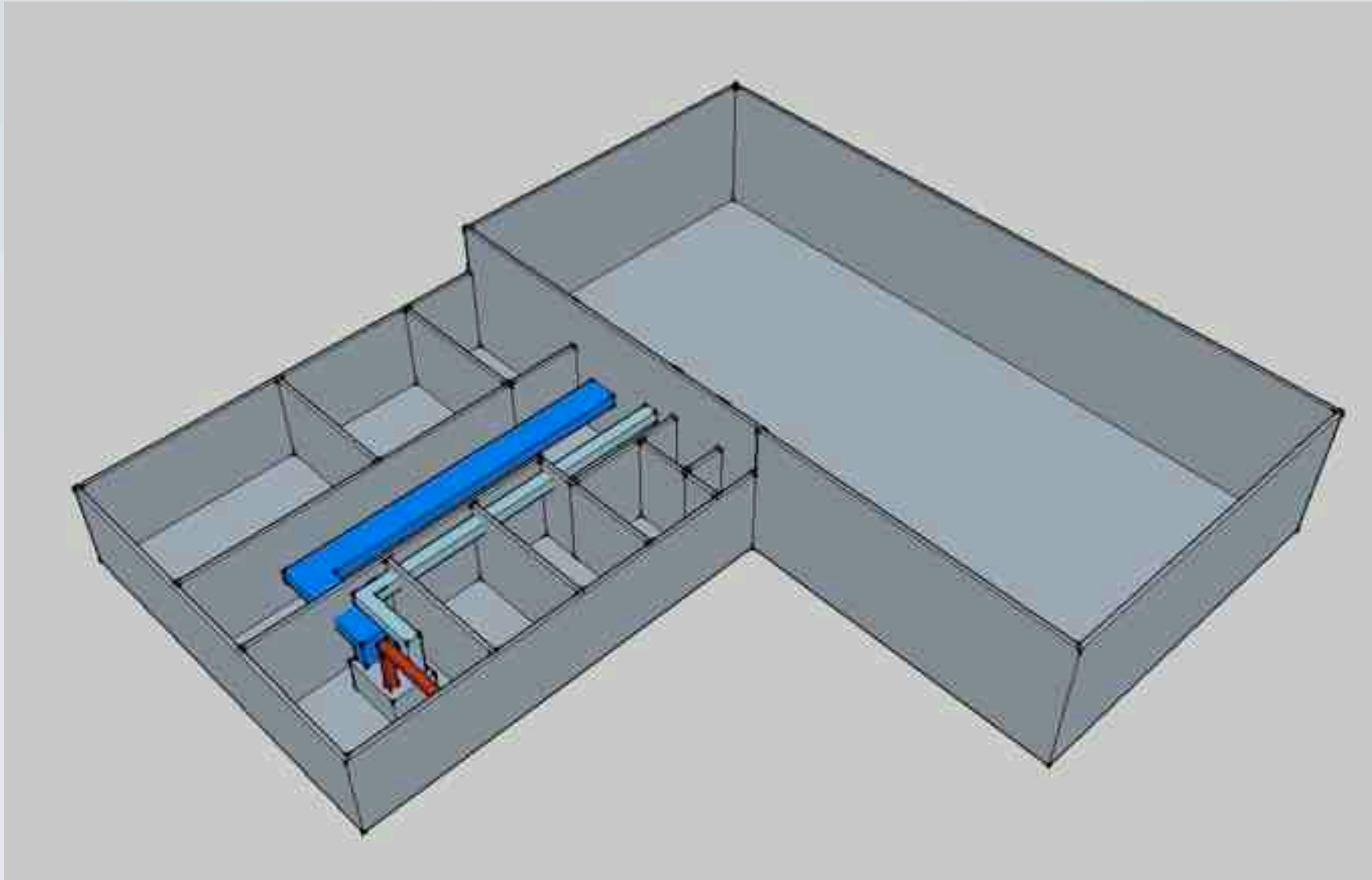
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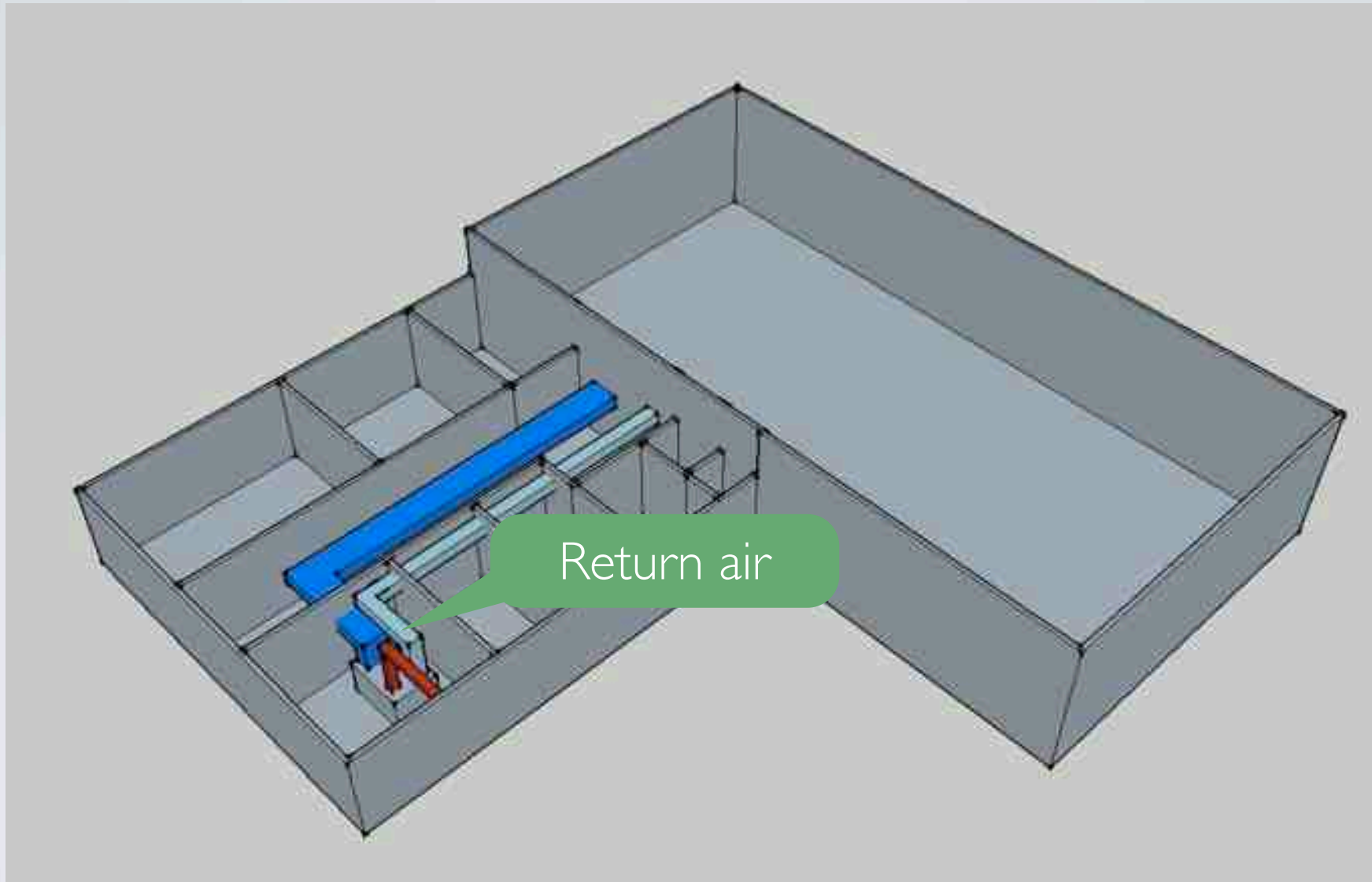
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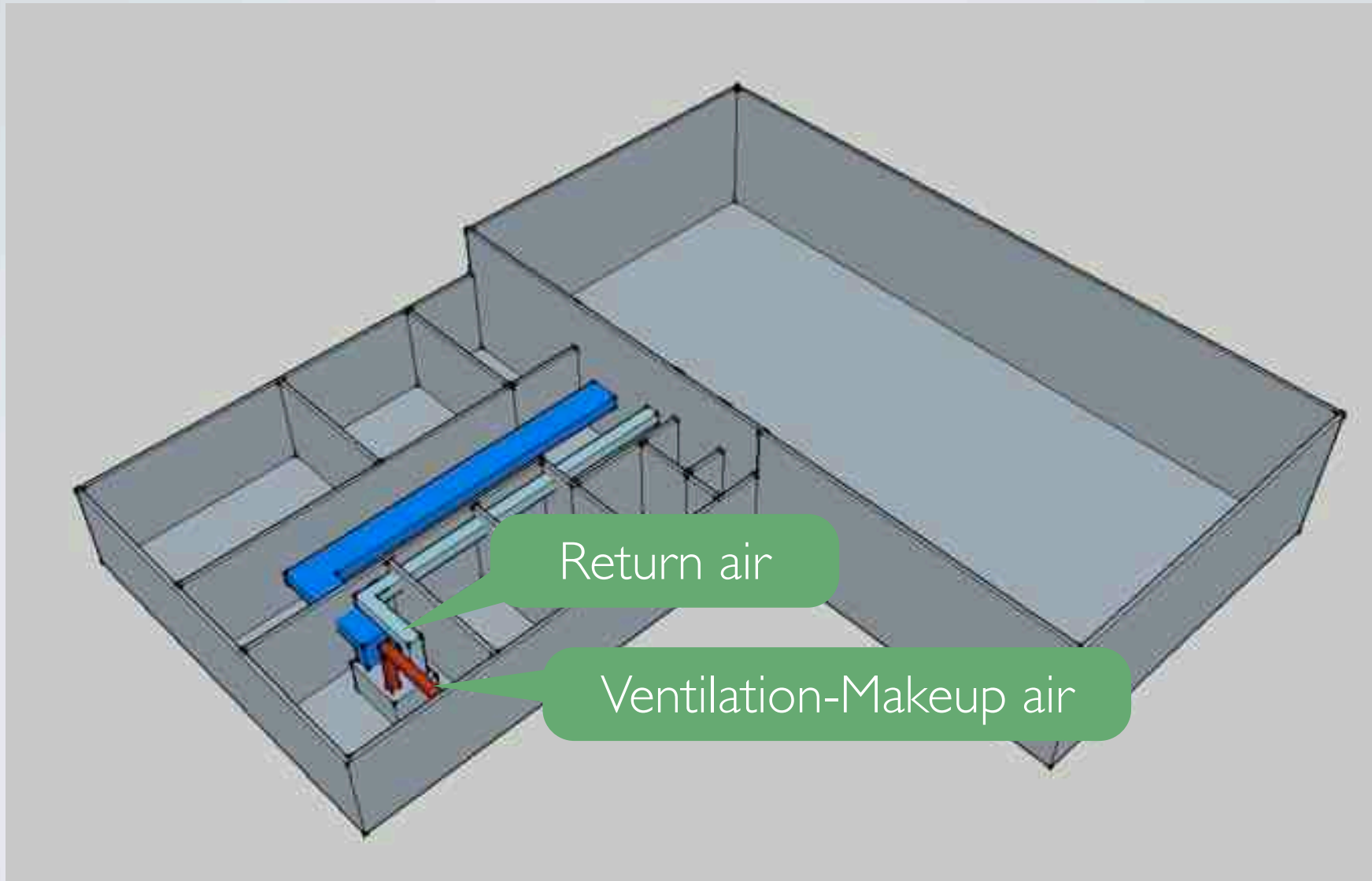
Cooling system layout



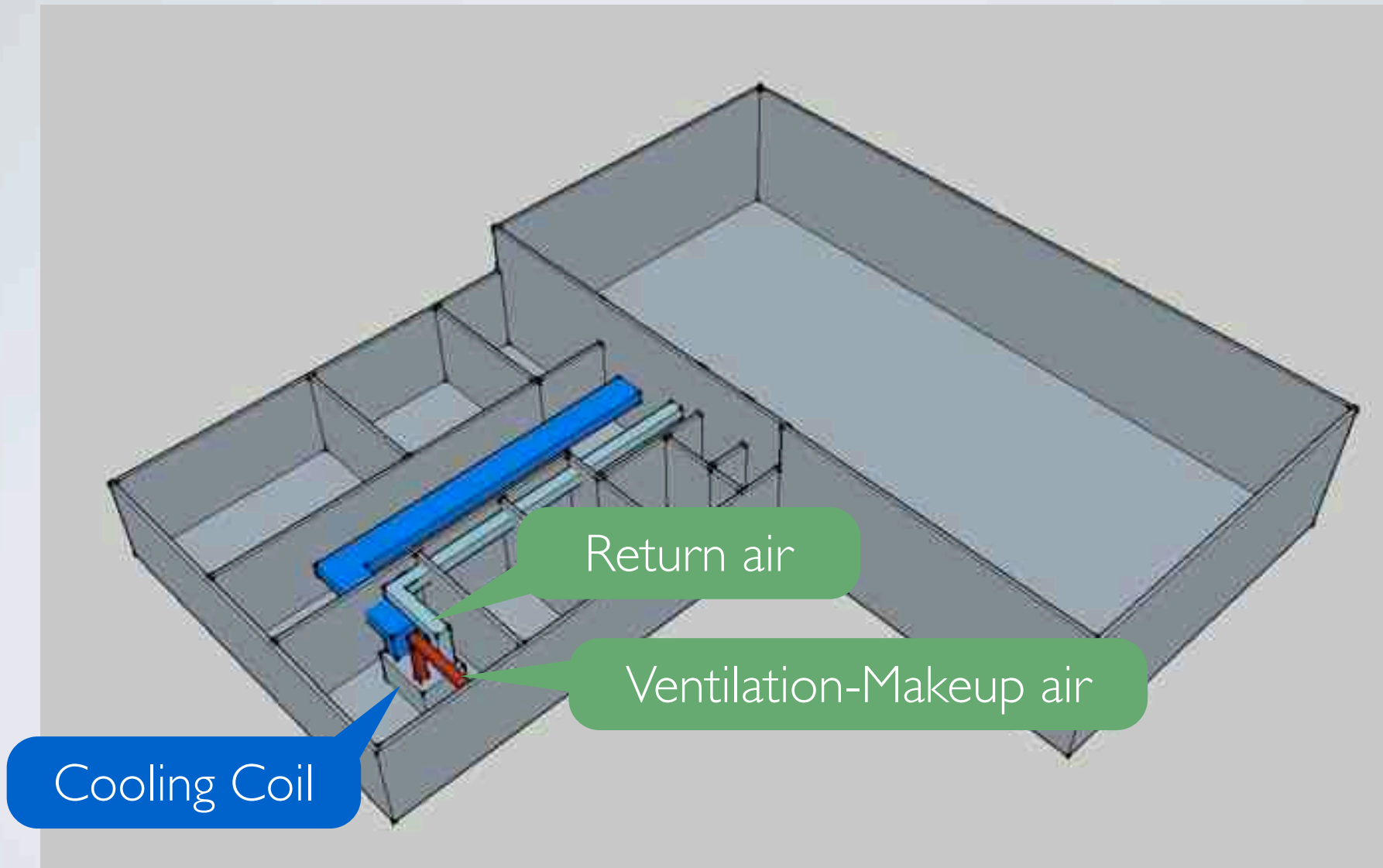
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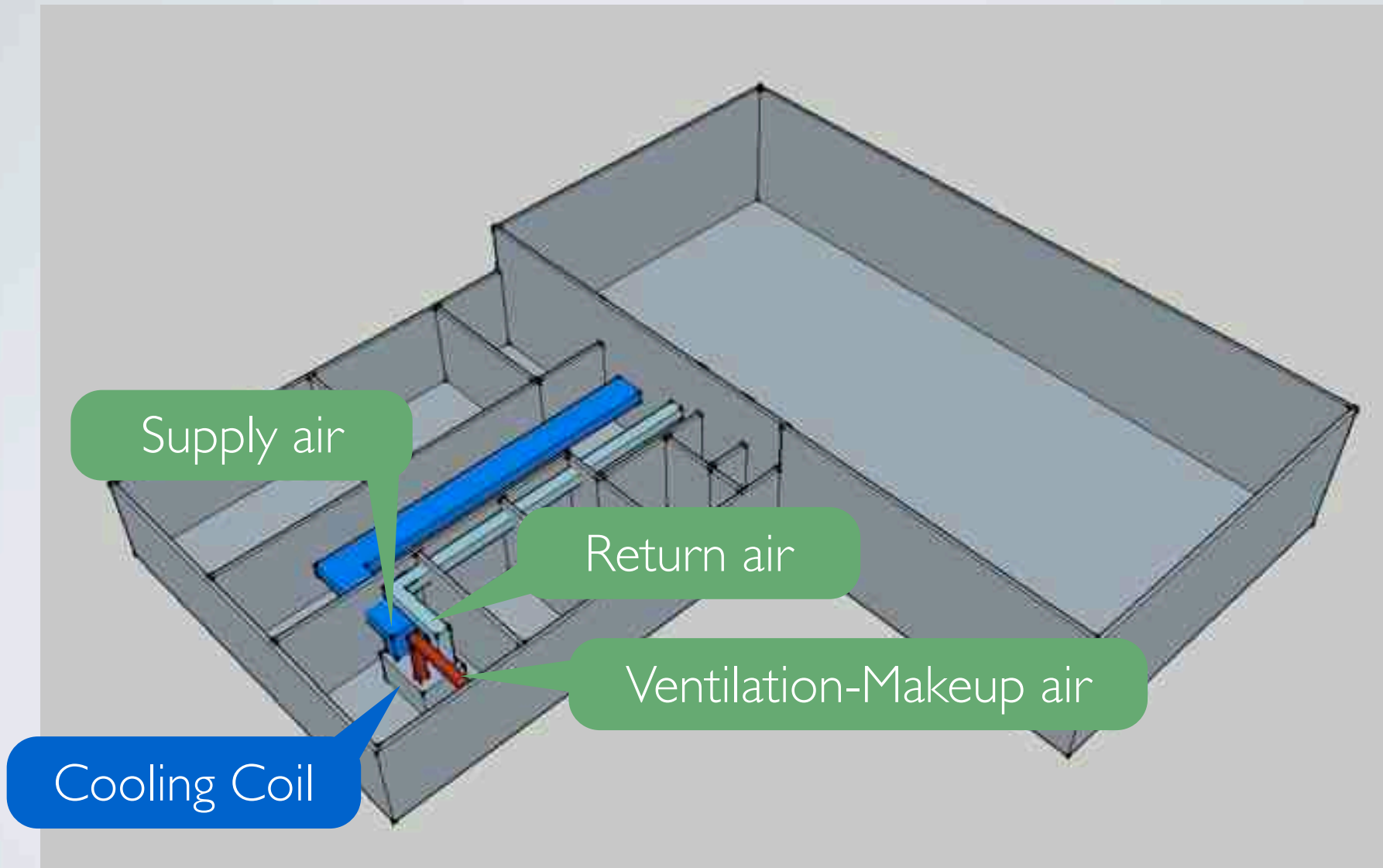
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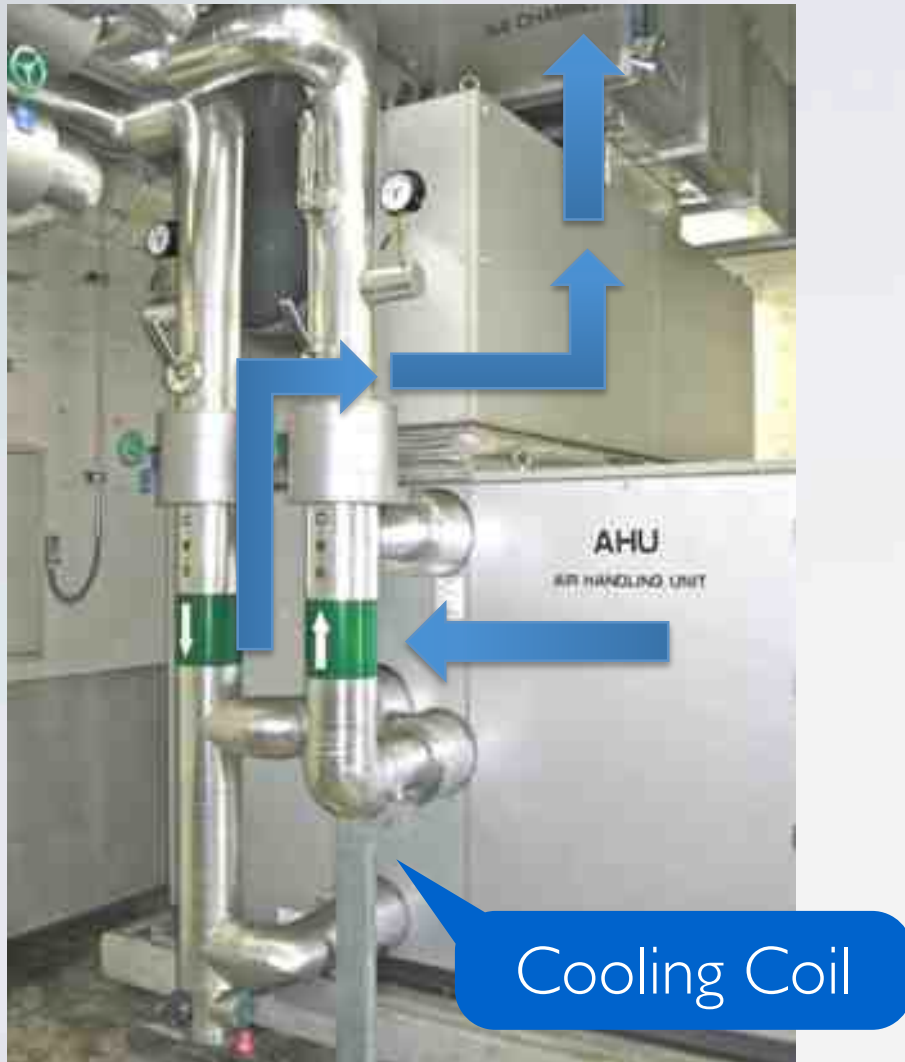
Cooling system layout



Huge cooling... near-zero dehumidification



Huge cooling... near-zero dehumidification



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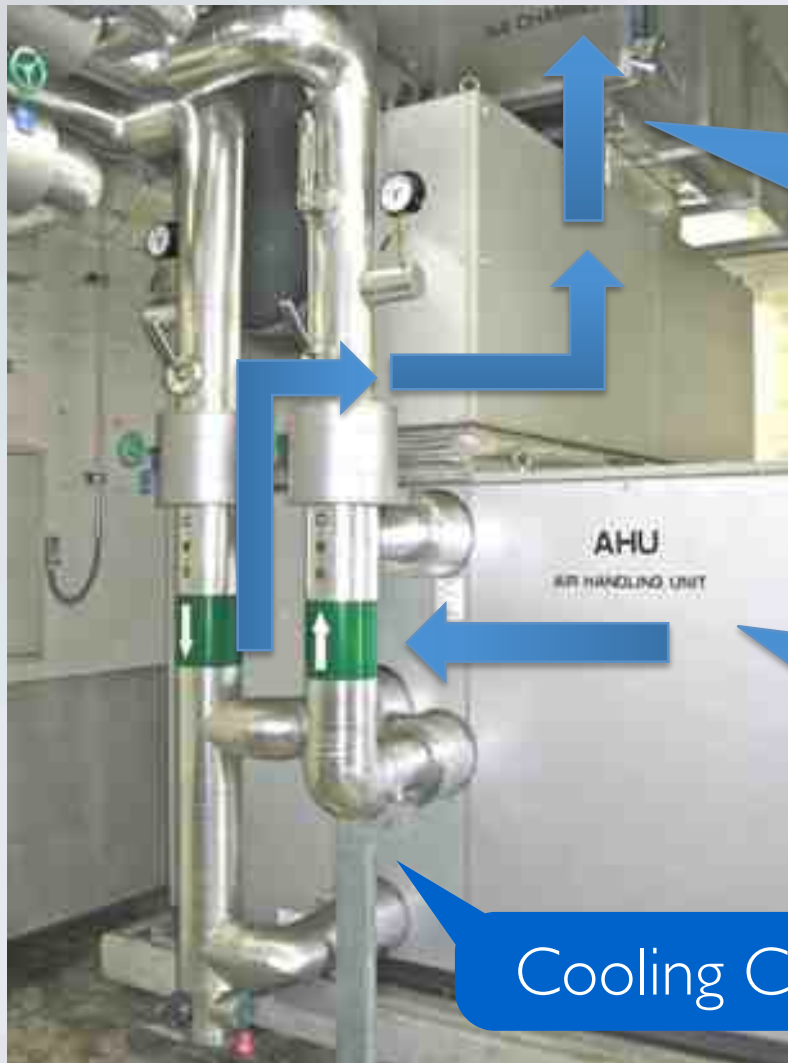
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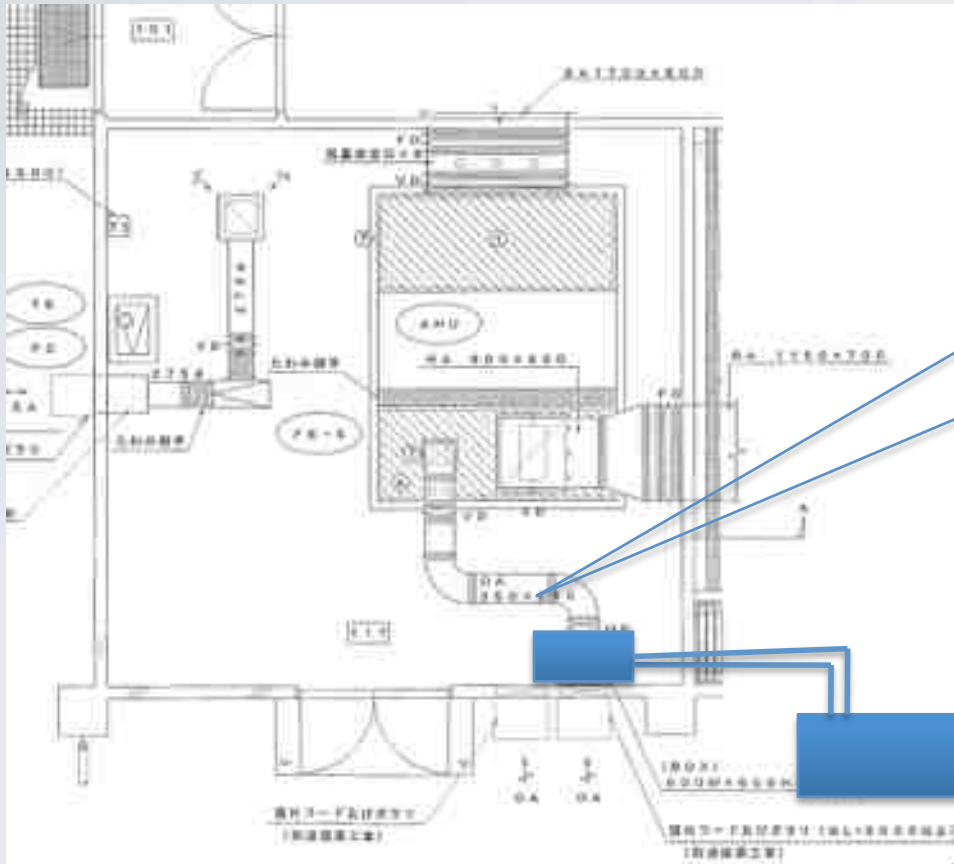
Huge cooling... near-zero dehumidification



Huge cooling... near-zero dehumidification



Solution: Dry the ventilation and makeup air



Outdoor air dried to a 10°C dew point, whenever the AC system is operating

Summary - The Secret Guide to Humidity Control

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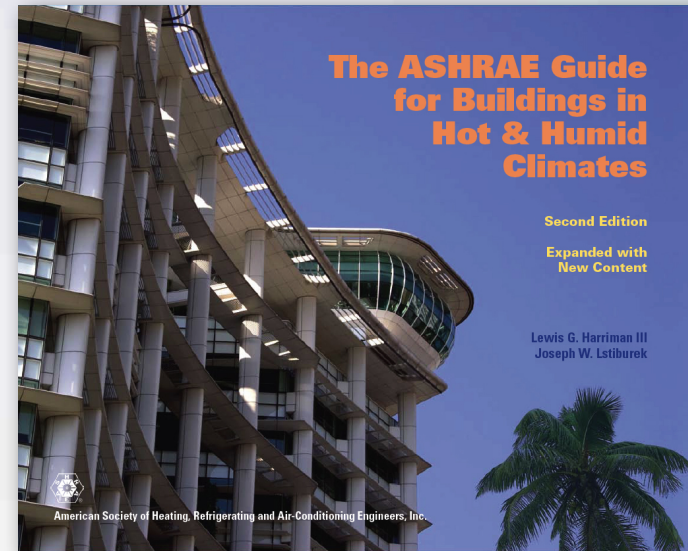
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Much more detail available from ASHRAE



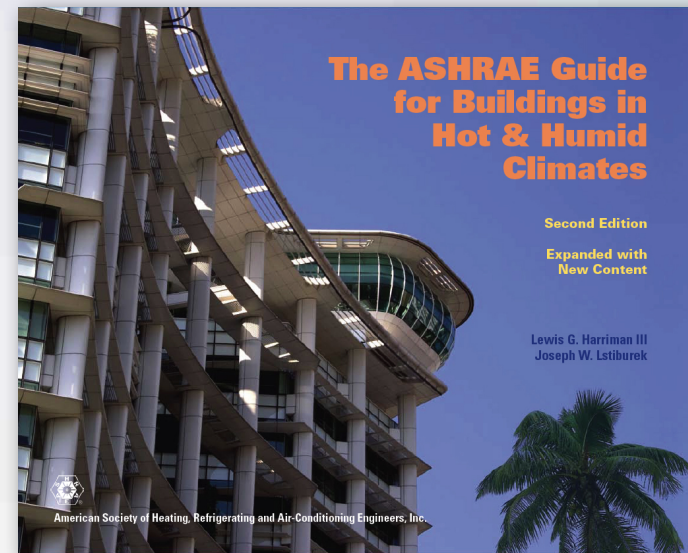
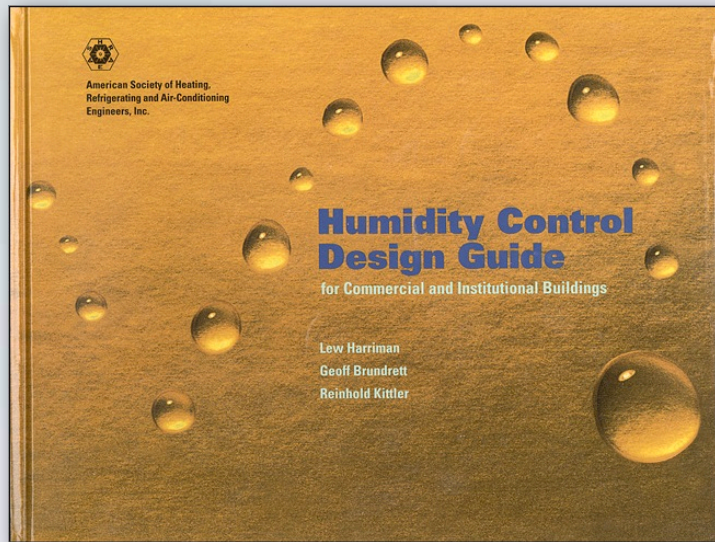
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Much more detail available from ASHRAE



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