PENCEGAHAN KULAT DALAM BANGUNAN PERINGKAT REKABENTUK

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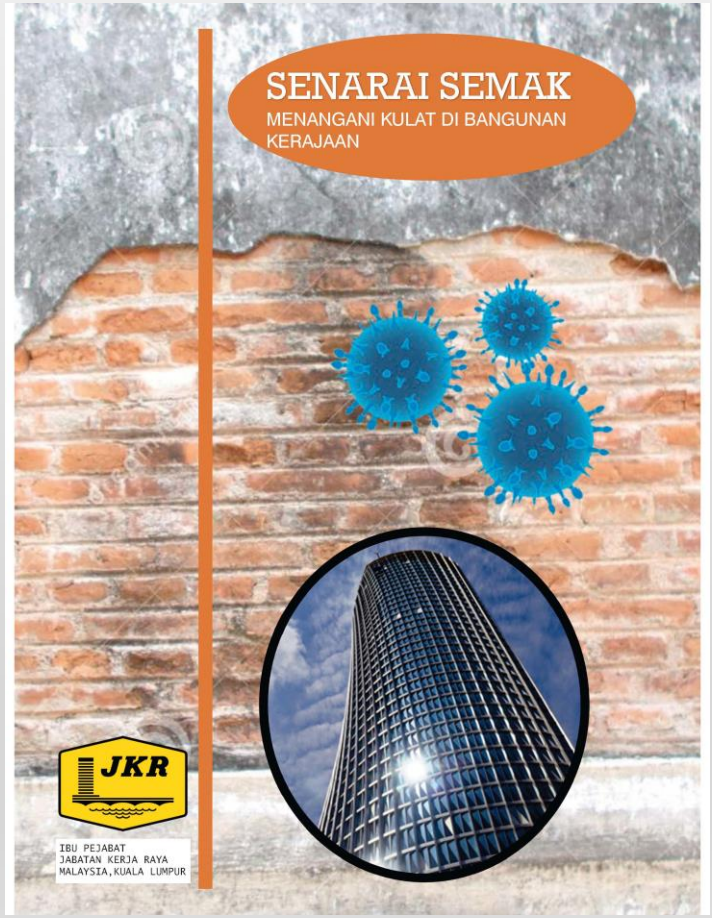
ISI KANDUNGAN

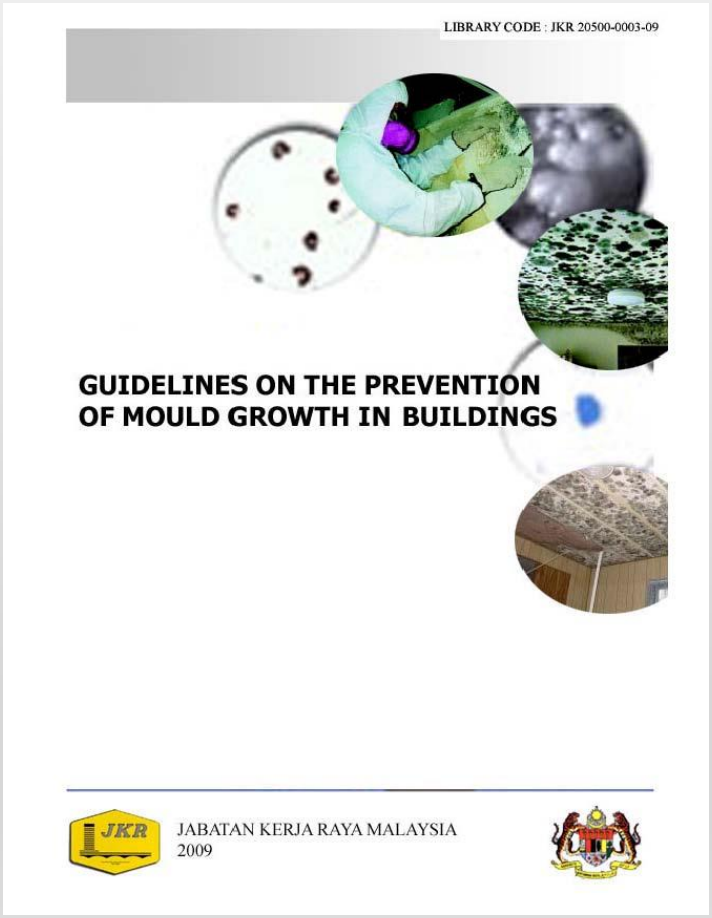
- PENGENALAN
- METHODOLGY
- CORAK-CORAK FUNGUS
- PENEMUAN & ANALISA
- CADANGAN TINDAKAN PEMBETULAN DAN PENCEGAHAN
- KESIMPULAN

PENGENALAN

- ISU FUNGUS MERUPAKAN MASALAH DI SERATA DUNIA TERMASUK DI NEGARA BARAT.
- MALAYSIA MEMPUNYAI CUACA PANAS DAN LEMBAP YANG MUDAH MENYEBABKAN MASALAH KETIDAKSELESAAN SERTA FUNGUS DALAM BANGUNAN.
- TERDAPAT SEDIKIT PERBEZAAN MASALAH FUNGUS DI MALAYSIA DIBANDINGKAN DENGAN NEGARA BARAT.

DOKUMEN RUJUKAN JKR

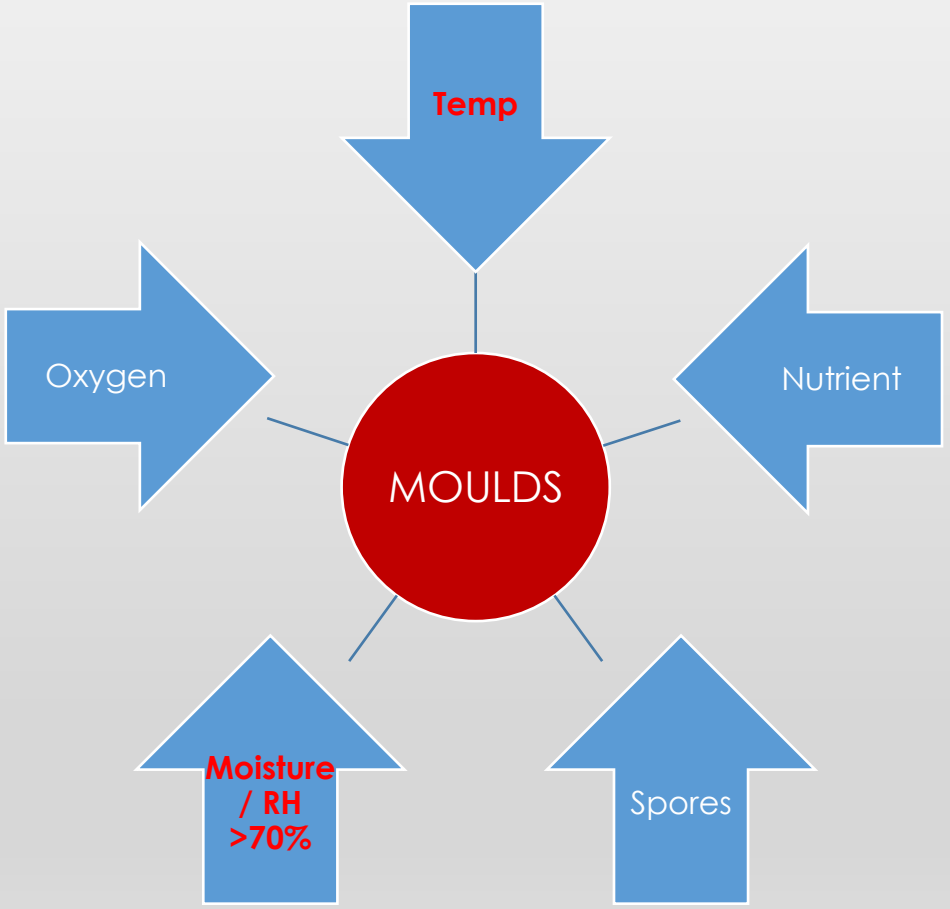




1.2 DEFINITION OF MOULD

There are thousands of known species of moulds, which include opportunistic pathogens, exclusive saprotrophs, aquatic species and thermophiles. Like all fungi, moulds derive energy not through photosynthesis but from the organic matter on which they live. Typically, moulds secrete hydrolytic enzymes from predominantly hyphal tips. These enzymes degrade complex biopolymers such as starch, cellulose and lignin into simpler substances which can enter the hyphae. In this way, moulds play a major role in causing decomposition of organic material, enabling the recycling of nutrients throughout ecosystems. Many moulds also secrete mycotoxins which, together with hydrolytic enzymes, inhibit the growth of competing micro-organisms.

Mould requires a nutrient source, proper temperature and moisture to grow. Mould does not require light to grow. It does not produce food, but instead absorbs nutrients by breaking down hydrocarbons. As such it will grow on any organic building material such as paper ,adhesives, resins, etc. It will even grow on the patina of dust that collects on surfaces. The dust in the office buildings consist primarily of paper dust and skin cells so that it provides an adequate nutrient source for mould growth. Nutrients to support mould growth are everywhere in the building environment. The temperatures required for mould growth are in the same range as indoor building environment. The pervasive nature of nutrients and a temperature range suitable for mould growth leaves control of moisture as the only practical way to control mould growth.



1.5 ROLES OF PARTIES INVOLVED

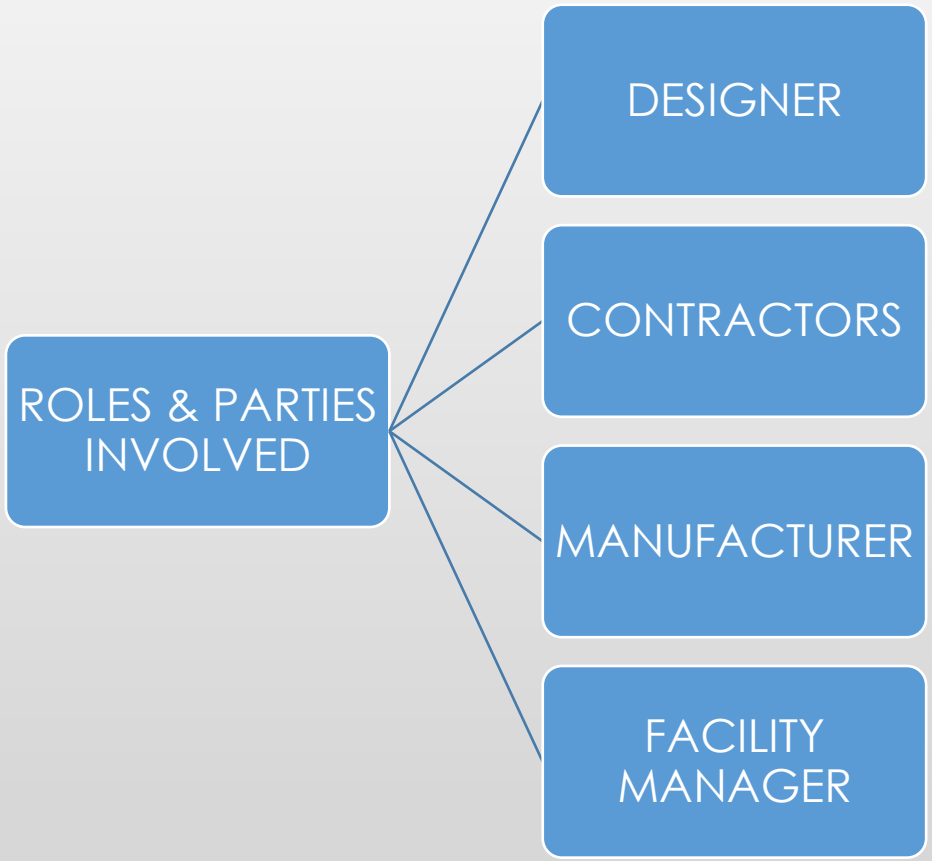
Mould growth control essentially needs a multidisciplinary approach. All relevant parties have to play their role to prevent mould growth in buildings. In this guideline, the roles of each party are outlined below:

a. ***Designers*** **–** Architects, Civil & Structural Engineers and Mechanical Engineers should design the building and its internal services in such a way that the risk of mould growth inside the building is reduced or if possible, eliminated.

b. ***Contractors*** – Construction Contractors should play a role in eliminating the risk of mould growth in a building by providing skilled and experienced labour to handle materials and they should adhere to specified procedures during building erection.

c. ***Manufacturers*** – Suppliers and Manufacturers should ensure all supplied building materials and equipment are of good quality that does not promote mould growth (i.e. materials with low moisture absorption rate).

d. ***Facility Managers*** – The facility managers should plan, execute and supervise maintenance works, as well as schedule inspection with the overall task of preventing mould growth in buildings during operation



STRATEGI PENCEGAHAN KULAT

1. Mengelakkan kemasukan udara lembab dari persekitaran dan zon tanpa penyaman udara.
2. Mengalakkan prestasi penyahlembapan yang tinggi bagi sistem penyaman udara.
3. Mengelakkan kondensasi pada dinding, siling dan sesalur udara.
4. Mengelakkan kelembapan dan takungan air pada struktur bangunan.
5. Mengelakkan suhu dinding, lantai dan siling yang rendah dan seterusnya memastikan kelembapan bandingan permukaan di bawah RH 80%.
6. Penggunaan bahan dan kemasan anti kulat atau tahankelembapan.
7. Mengurangkan /mengelakkan sumber air dalam bangunan
8. Meminimumkan peredaran spora di dalam udara.
9. Memastikan kadar pengudaraan optimum bagi mengelakkan udara mati.

REKABENTUK PASIF

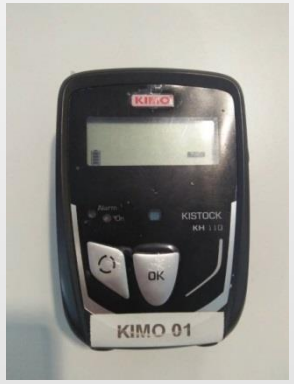
- Zoning
- Airlock room (high traffic)
- Themal conductivity
- Bahan binaan kering
- Bahan/kemasan tahan lembap bagi kawasan lembap
- Elakkan sumber air dalam bangunan
- Pintu
- Tingkap
- Lantai (lapisan lembap) & dinding
- Kedudukan/pembinaan bilik air
- Koridor/courtyard dalaman

REKABENTUK AKTIF

- Duct insulation
- Prestasi sistem penyaman udara
- Mengadakan pengedaran mekanikal bagi koridor yang terlalu panjang
- Pemilihan bahan dan laluan paip di kawasan sensitif

PEMERIKSAAN DI TAPAK

Methodologi Pemeriksaan



Temperature and RH % Data Logger

Anemometer

Moisture Meter

Flowhood

Sling Psychrometer

CORAK /JENIS FUNGUS

1. Fungus due to Condensation (wall & ceiling)
2. Fungus due to High Relative Humidity (Furniture, cloth,phone, lens etc)
3. Fungus due to Cold Spot (ceiling &wall)
4. Fungus due to Leakage (ceiling & wall)

*IN-ORDER TO EASE DIAGNOSE , THE PATTERN IS DETERMINED BY THE CAUSE

PEMERIKSAAN KHUSUS

- IAQ LOGGING DALAM RUANG PEJABAT
- MOISTURE CONTAIN DALAM SILING DAN DINDING


Fungus Due To Condensation
9 12:24


Fungus due to High Relative Humidity
PEJABAT KETUA
PERKHIDMATAN LOGISTIK


Fungus due to High Relative Humidity


Fungus due to High Relative
Humidity


Fungus due to Cold Spot


Fungus due to Leakage


Fungus due to Leakage

DATA ASAS :

- REKABENTUK BILIK:-

  75°F , RH 50 @ Specific moisture contain **70 grains** of moisture per pound of dry air

- OFFCOIL :-

  54°F , RH 90 @ Specific moisture contain **56 grains** of moisture per pound of dry air

- MAKSIMUM BILIK (COP IAQ 2010):

  78.8°F , RH 70 @ Specific moisture contain **110 grains** of moisture per pound of dry air

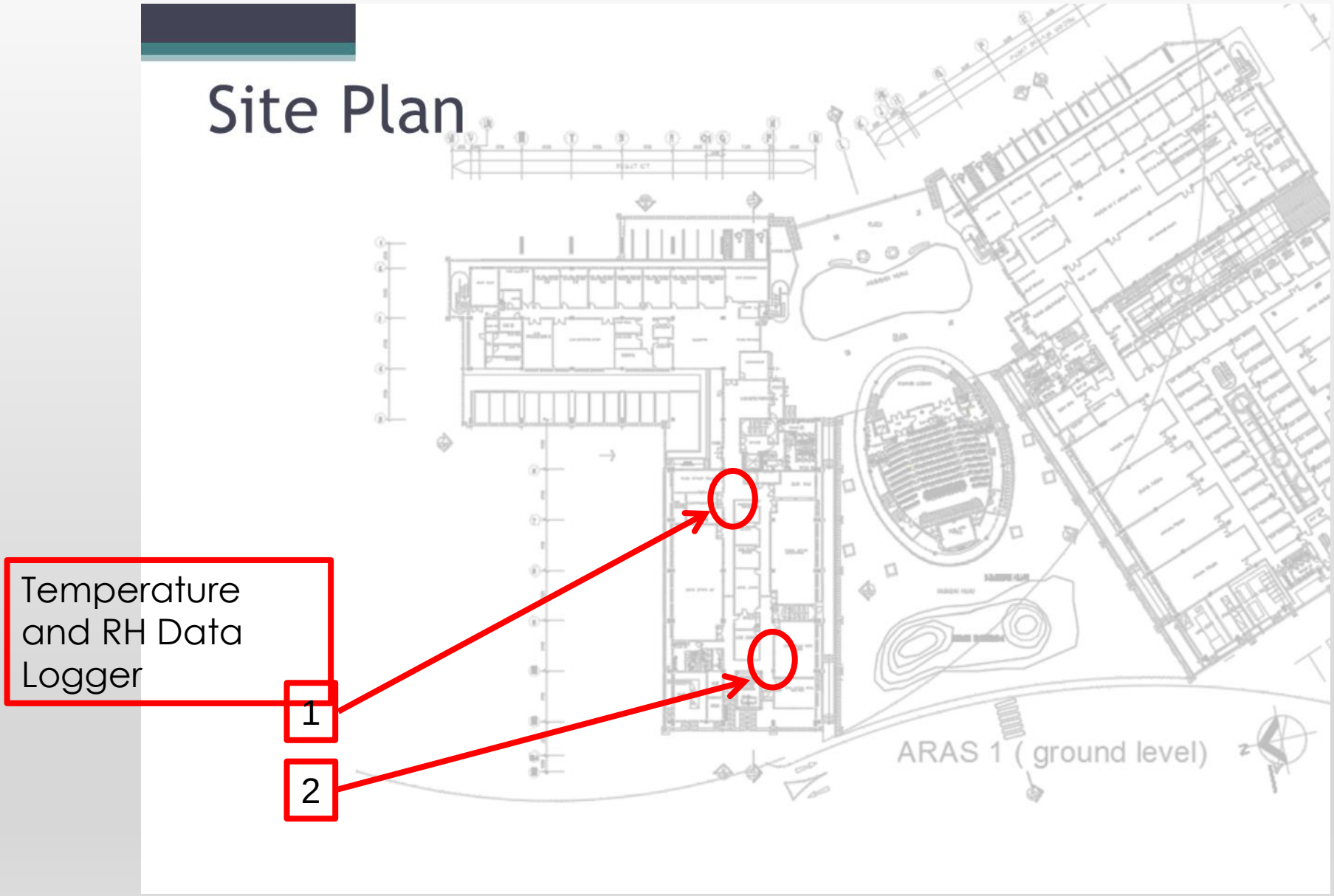
- UDARA LUAR (SAMPEL LOKASI PEKAN PAHANG)

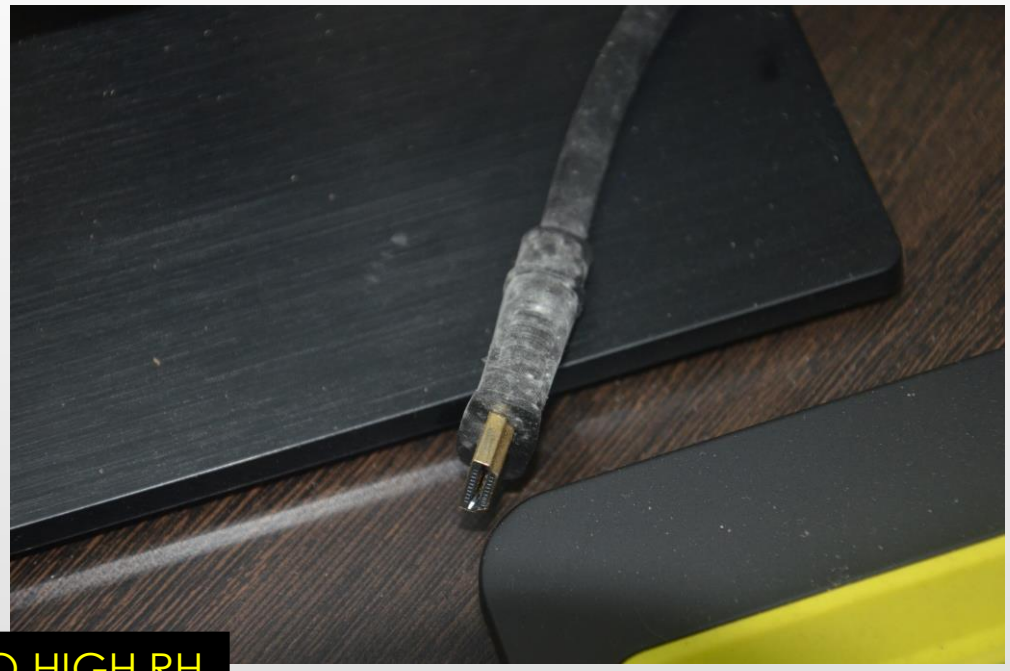
  80°F , RH 80 @ Specific moisture contain **124 grains** of moisture per pound of dry air

NOTE :
COP IAQ 2010- INDUSTRIAL CODE OF PRACTICE INDOOR AIR QUALITY 2010 BY DOSH

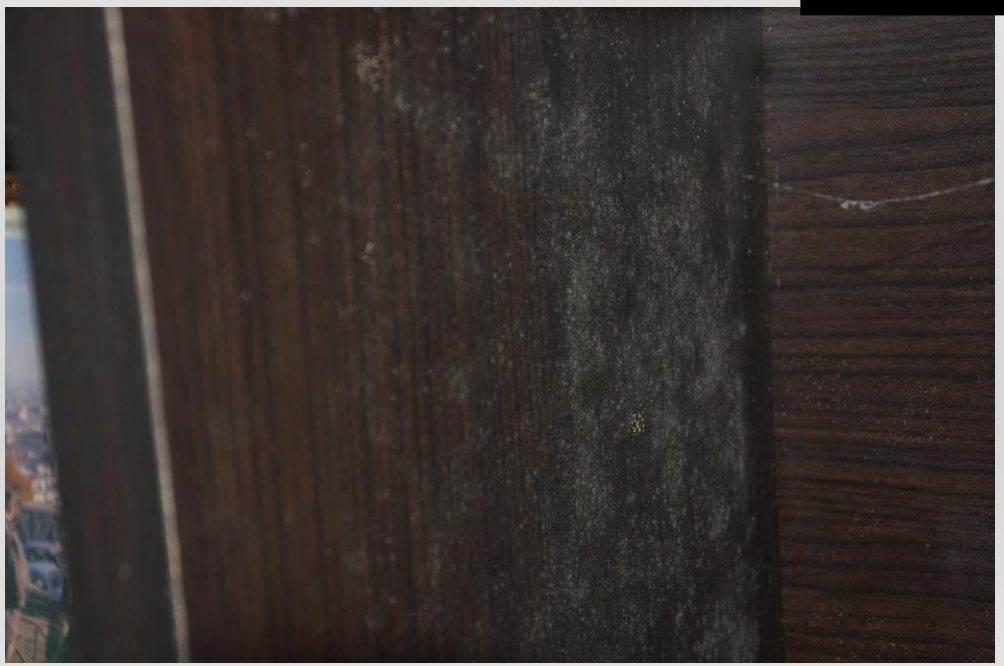
KES 1 :
DATA FUNGUS DUE TO HIGH RH

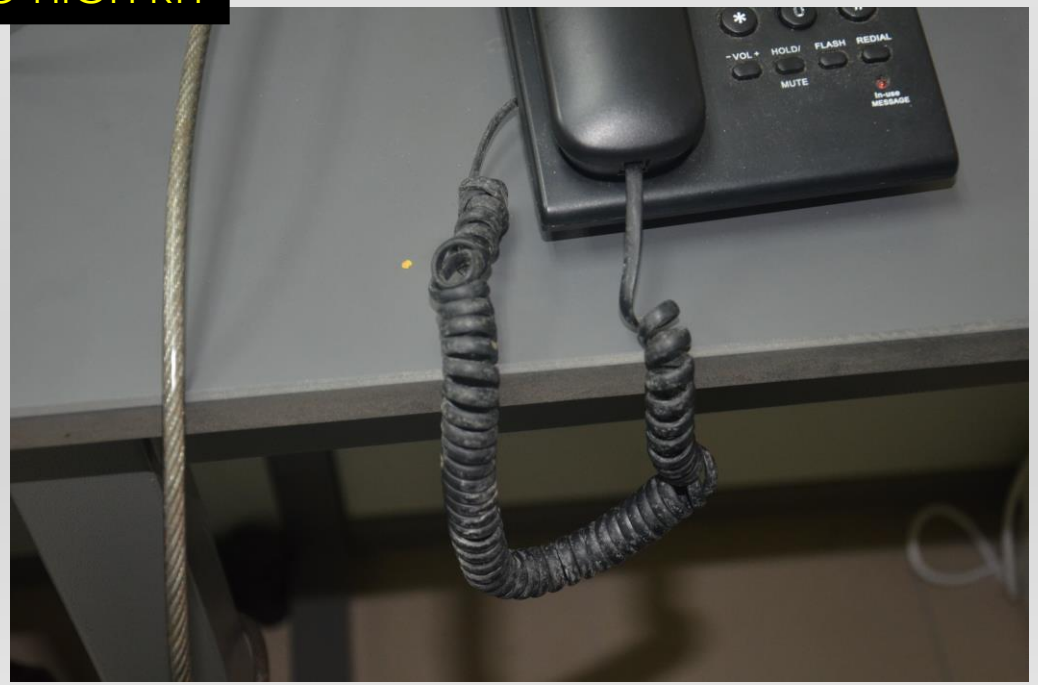
Site Plan



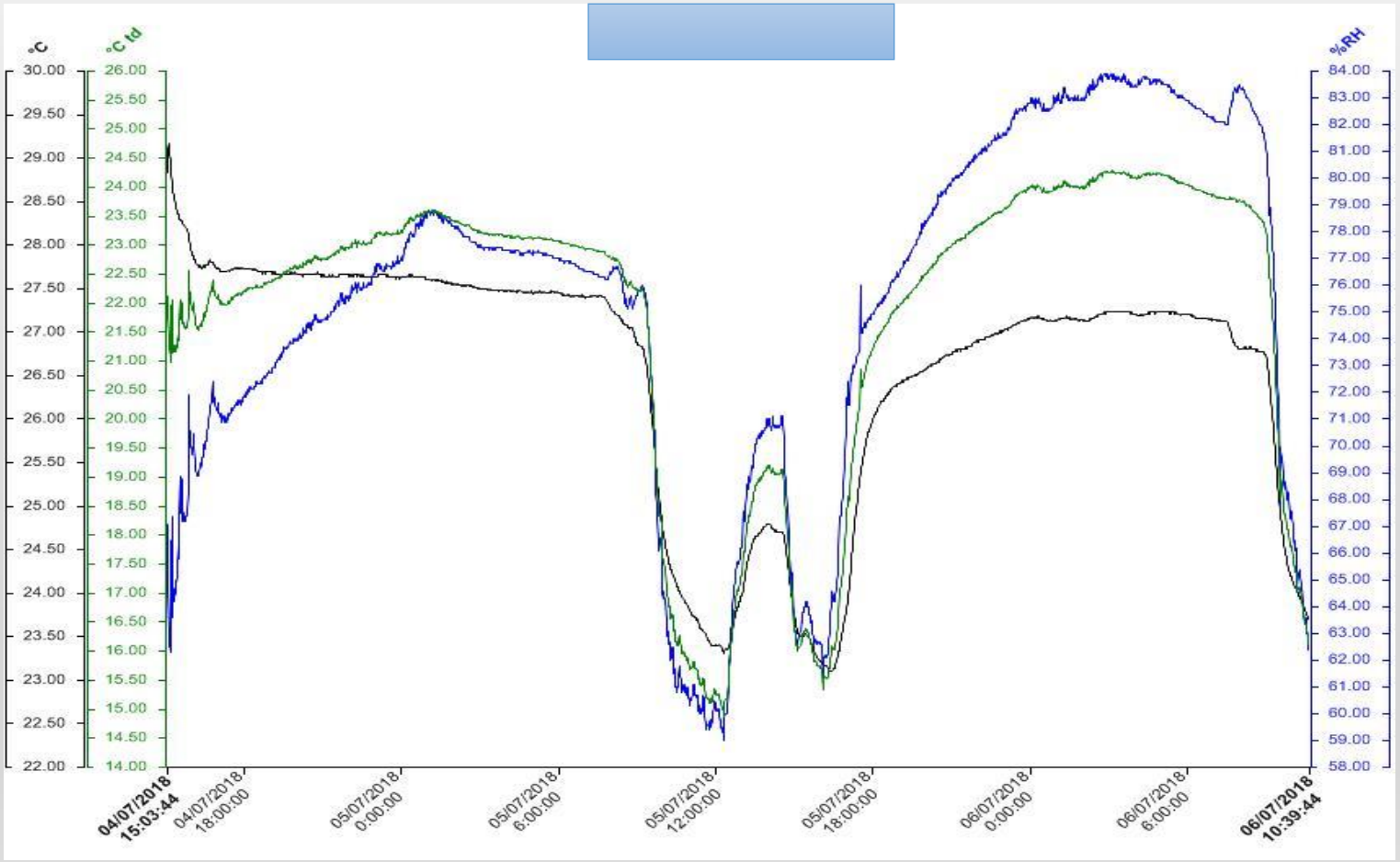


FUNGUS DUE TO HIGH RH





Penemuan data logging

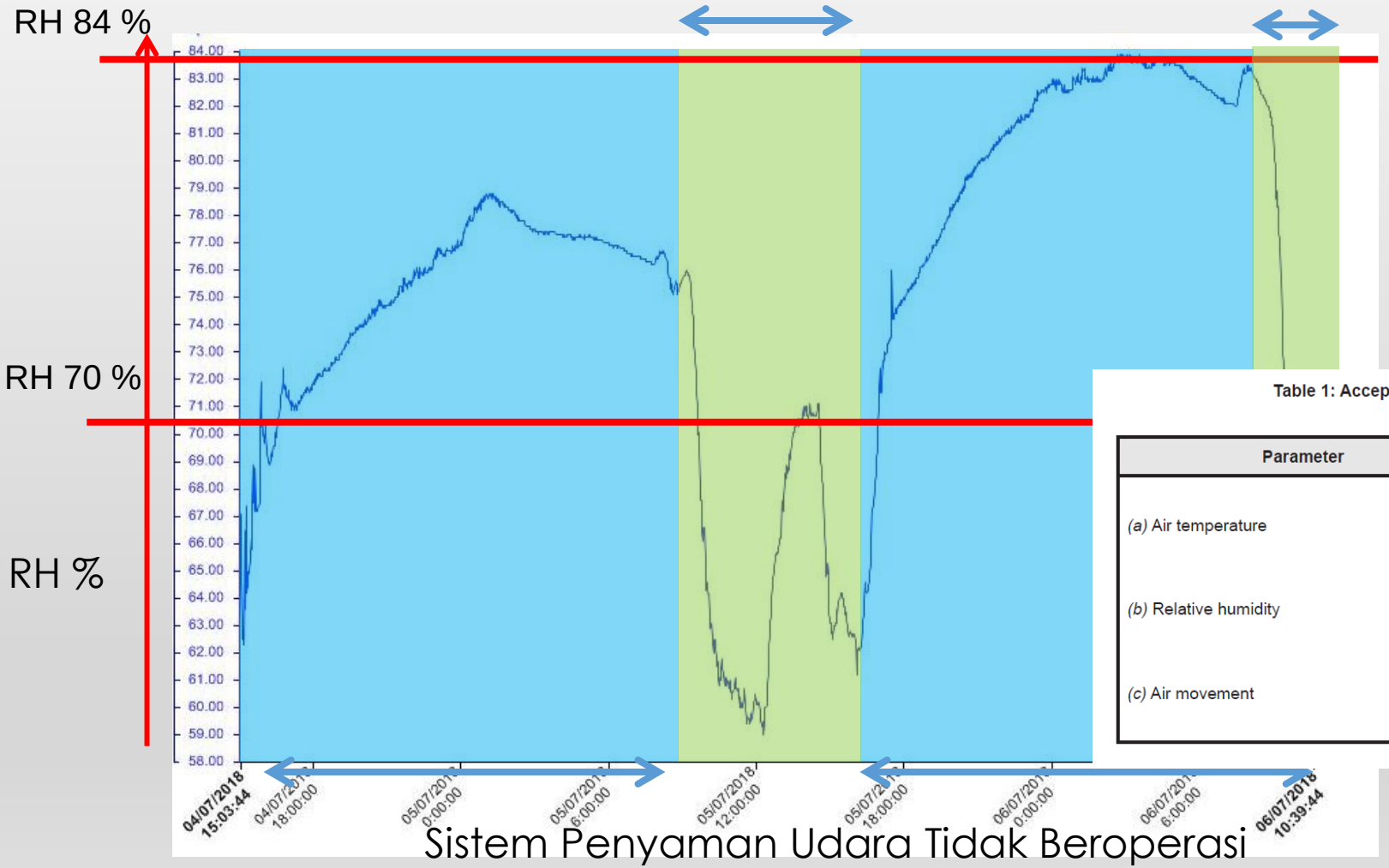


RH %
Dew Point
Dry Bulb Temp

Data Logger di Koridor berhawa dingin

PENEMUAN

Sistem Penyaman Udara Sedang Beroperasi



INDUSTRY CODE OF PRACTICE INDOOR AIR QUALITY 2010 BY DOSH :

RH hendaklah kurang dari 70%

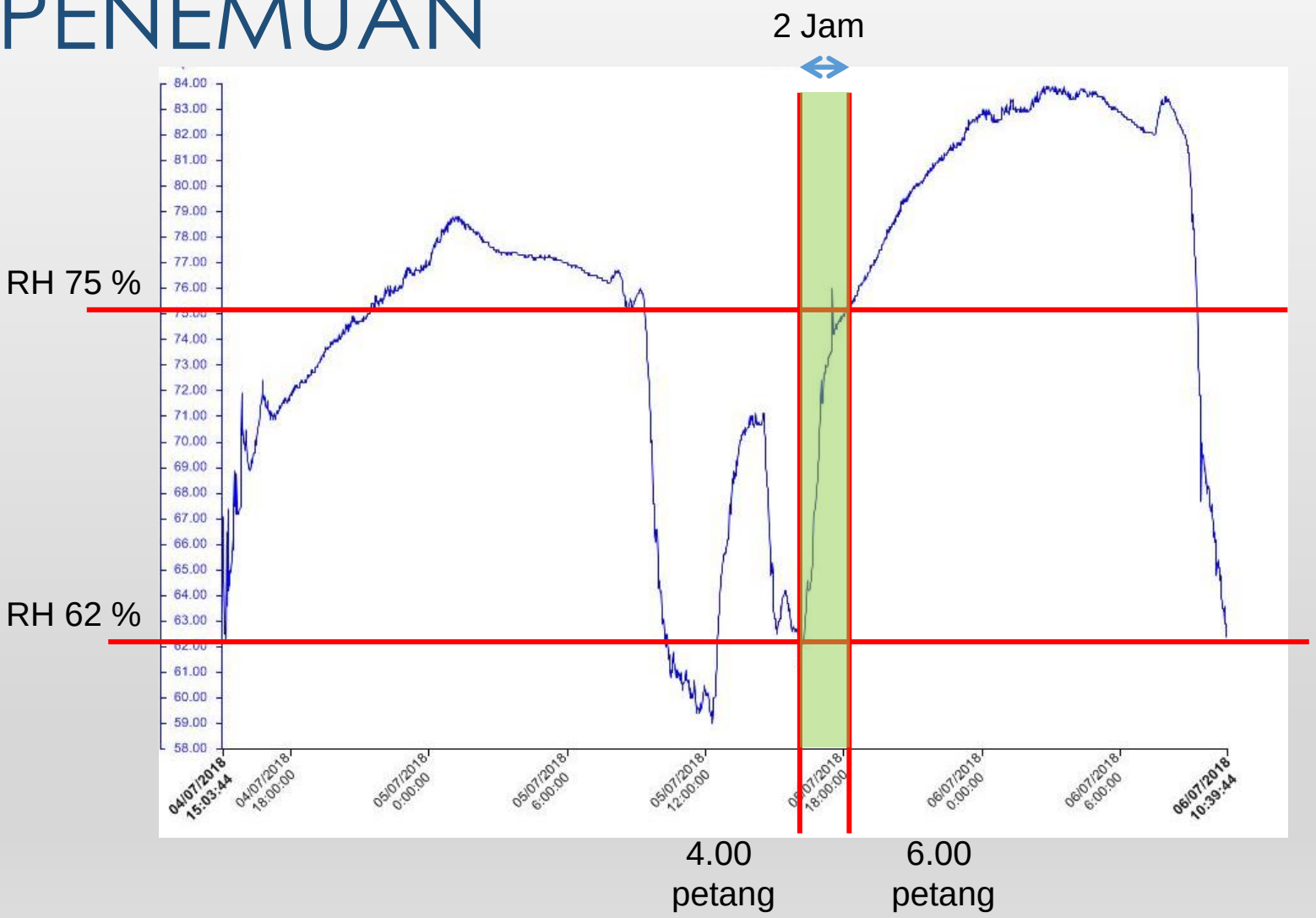
Table 1: Acceptable range for specific physical parameters

Parameter	Acceptable range
(a) Air temperature	23 – 26 °C
(b) Relative humidity	40-70%
(c) Air movement	0.15 – 0.50 m/s

Sistem Penyaman Udara Tidak Beroperasi

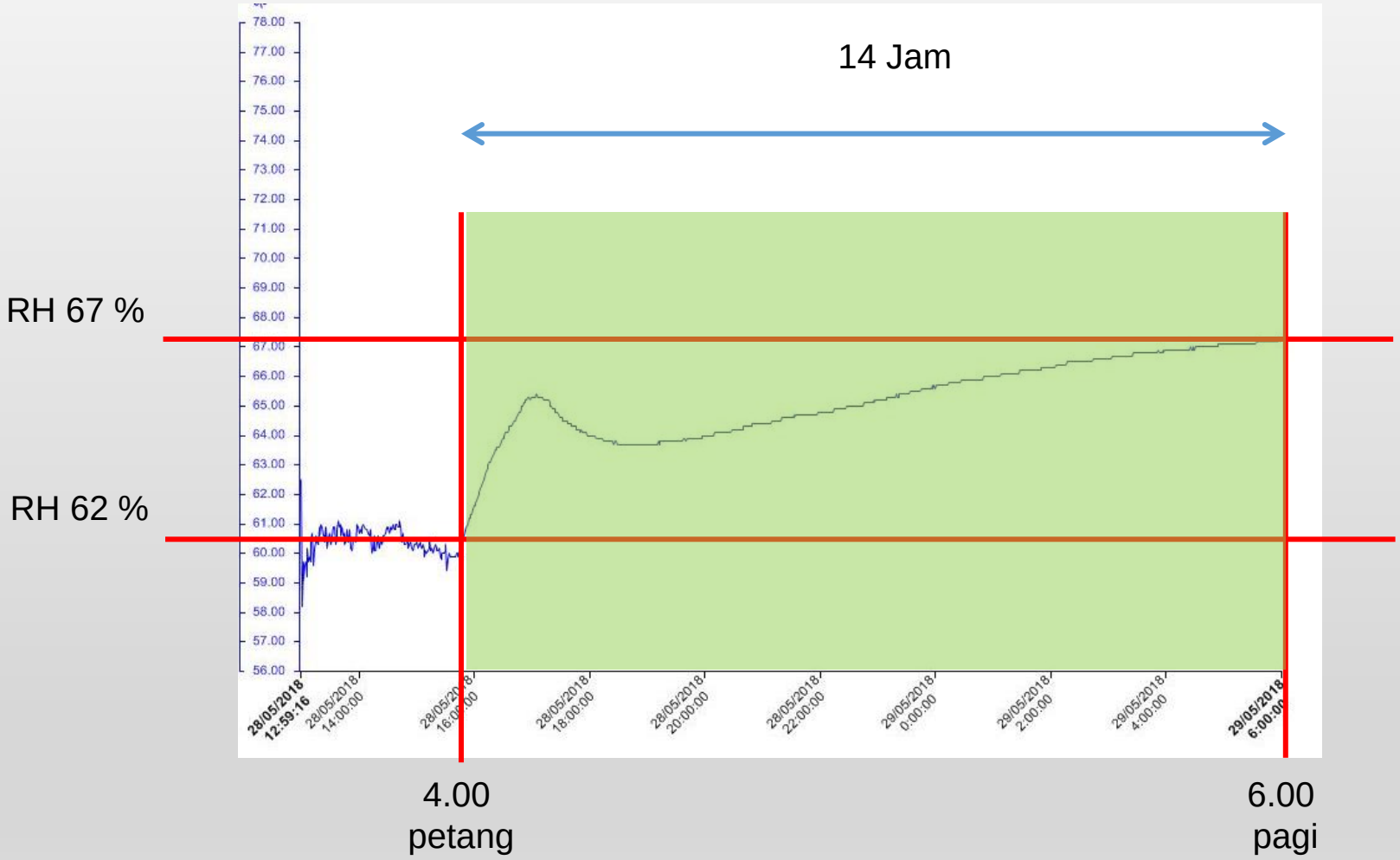
Masa

PENEMUAN



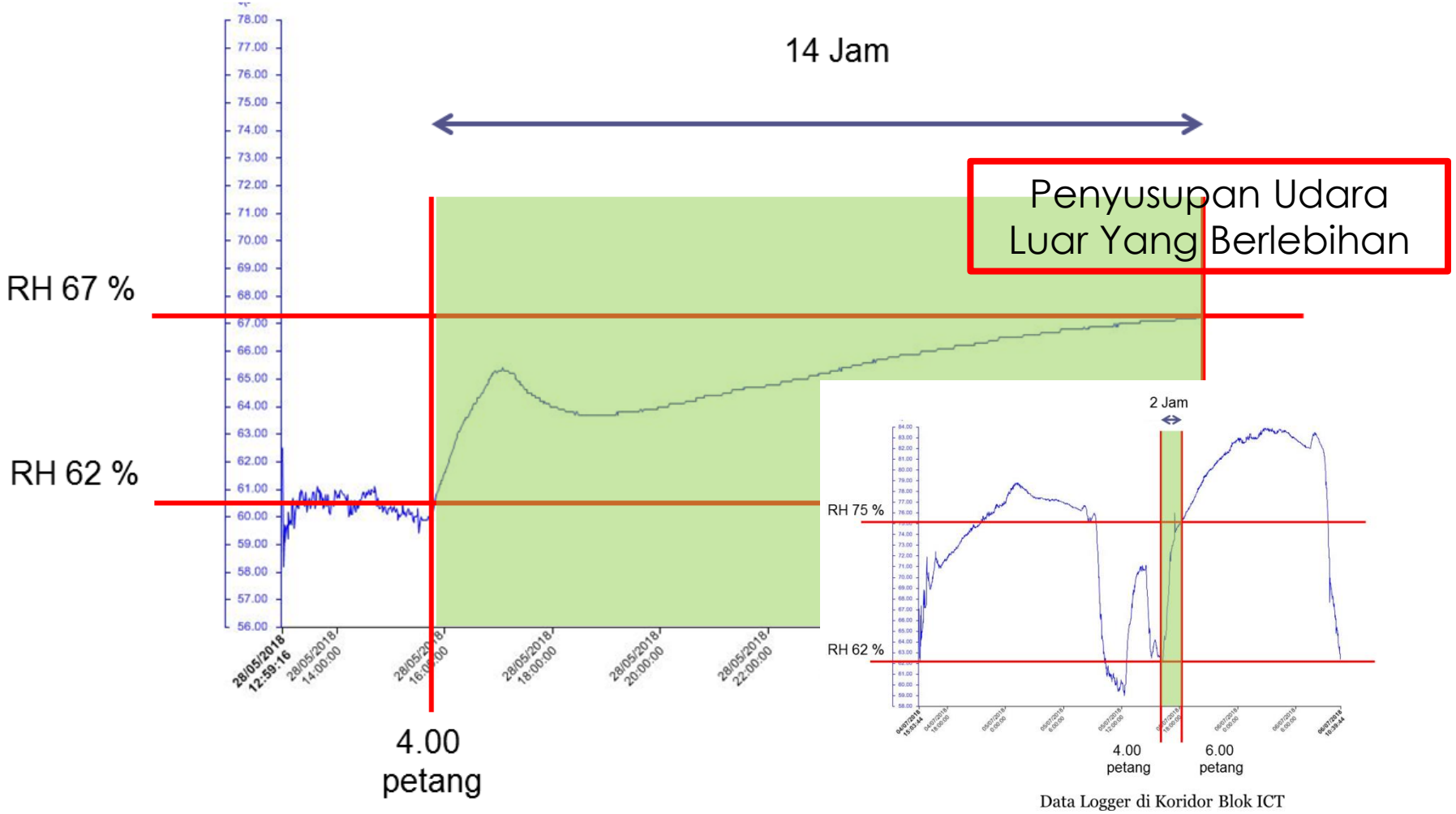
Data Logger di Koridor Blok ICT

PENEMUAN



Perbandingan Data
(RH% Di Menara KKR Blok G, Tingkat 28)

Perbandingan Data



Perbandingan Data
(RH% Di Menara KKR Blok G, Tingkat 28)

PENEMUAN

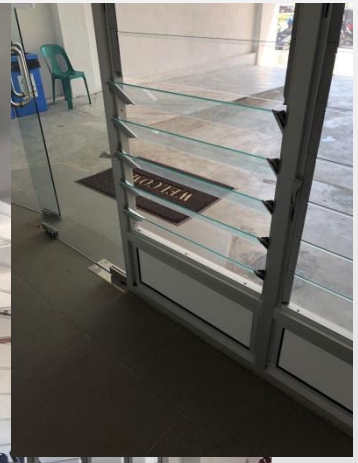
- Sistem penyaman udara beroperasi dengan baik

- Nilai RH% melebihi 70% pada waktu malam

- Nilai RH % meningkat dengan cepat setelah sistem penyaman udara ditutup.
  (Penyusupan eksesif udara luar)

Kenapa ?

Faktor Penyumbang



Tingkap yang terbuka

Celahan pintu dan tingkap

Parameter pintu kaca

Faktor Penyumbang

FCU Fresh Air Grille / Smoke Spill Exhaust Grille Yang Tidak Tertutup
(Udara masuk ke ruangan siling)

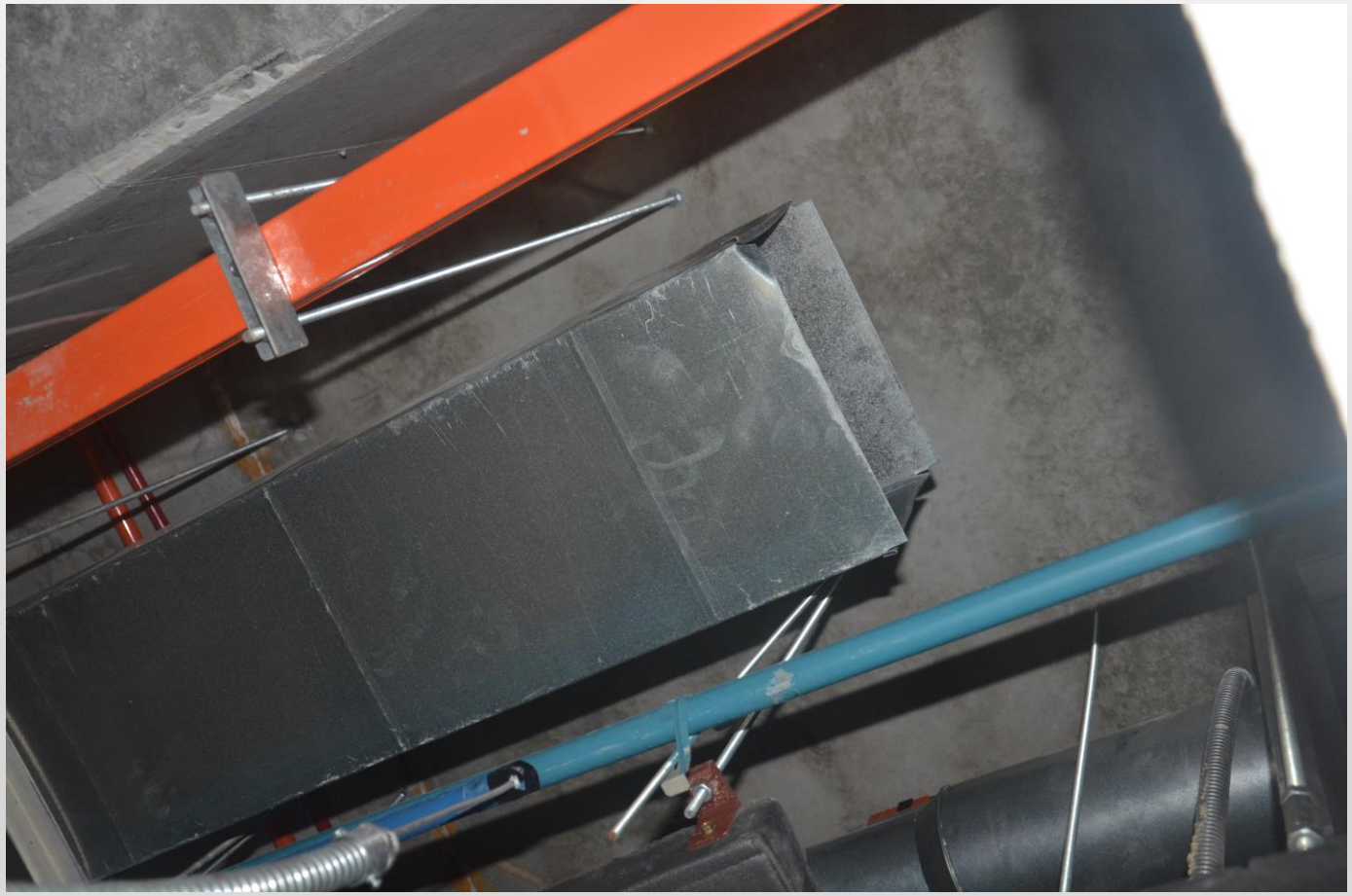
Faktor Penyumbang

Laluan Conduit Tidak Ditutup Dengan Sempurna

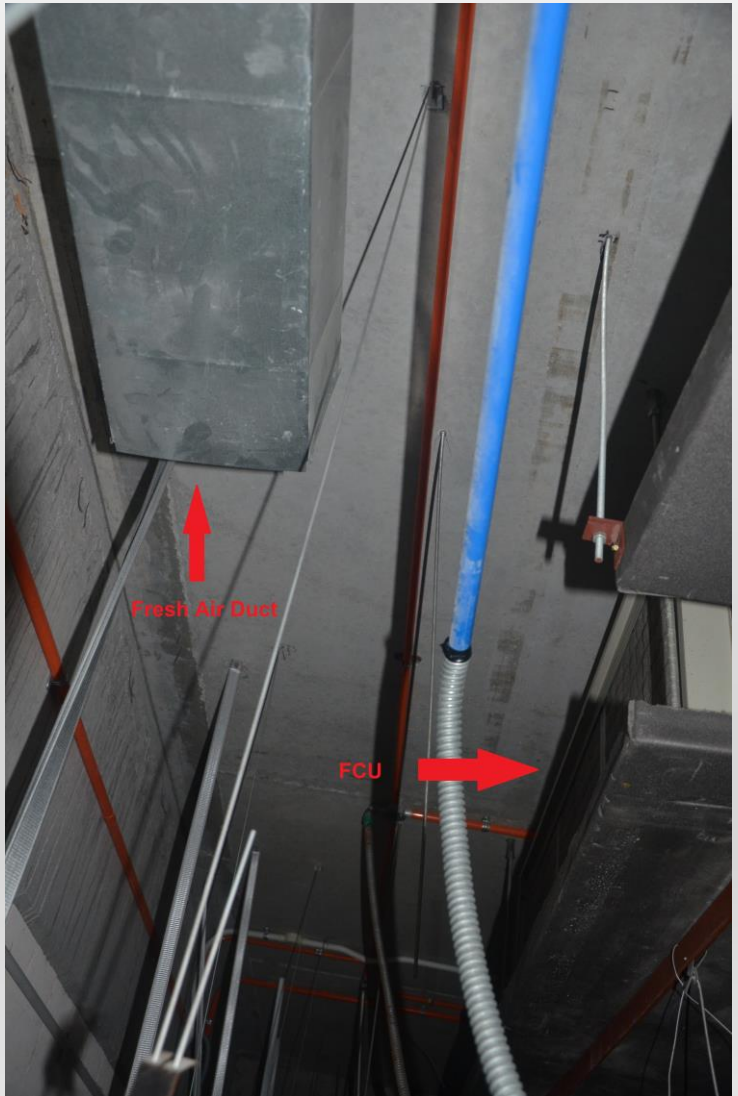
Dinding bukan *full height*

Cross Ventilation

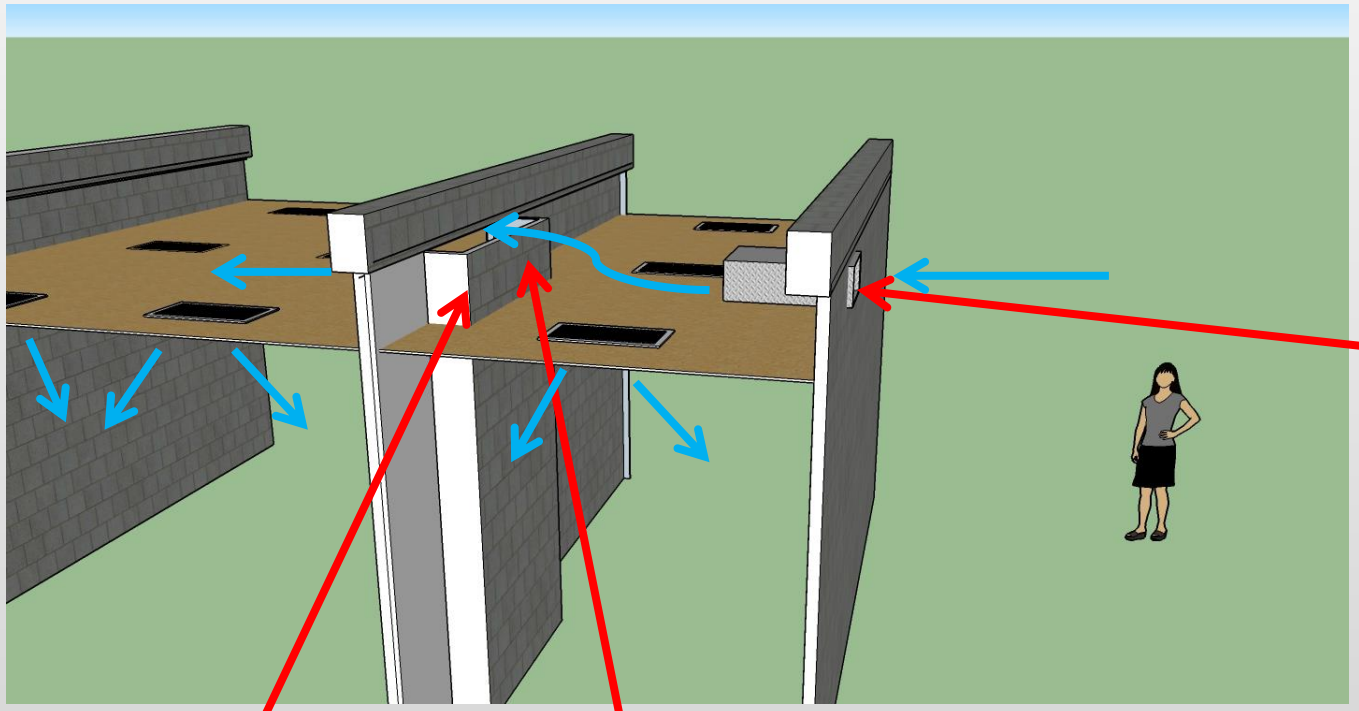
FAKTOR PENYUMBANG



KEMASUKAN UDARA LUAR MELALUI FRESH AIR DUCT

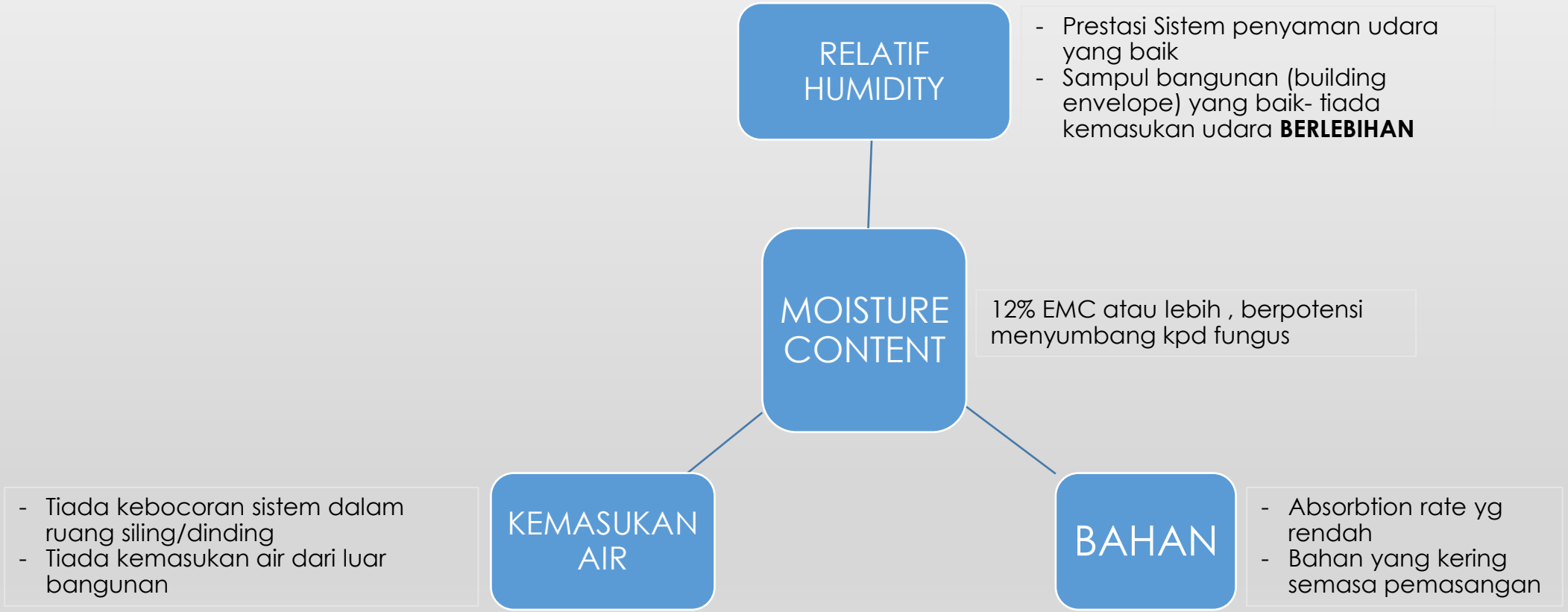


Faktor Penyumbang



Pergerakan Penyusupan Udara Luar

FAKTOR PENYUMBANG MOISTURE CONTENT – SILING/DINDING



FROM MANUFACTURER TO CUSTOMER : 2-3% normally

Cadangan Penyelesaian

- Semua parameter pintu ditutup dengan menggunakan *door seal*
  - Menutup semua lubang di atas siling dengan bahan yang bersesuaian (tiada *cross ventilation*)
  - Pemasangan *motorised damper* pada semua *fresh air grille* dan *smoke spill exhaust grille* supaya ianya ditutup ketika sistem tidak beroperasi bagi mengelakkan penyusupan udara luar

PEMBELAJARAN

- Penyusupan udara yang berlebihan boleh dielakkan dengan adanya sampul bangunan yang kedap (air tight building)
- Kadar kelembapan udara yang melebihi 80% menyumbang masalah fungus corak yang khusus
- RH yang tinggi dan udara mati akan menambahkan lagi masalah fungus corak ini.
- *Cross ventilation* dalam ruang siling tidak dibenarkan sama sekali

RINGKASAN

RH	**<70%**	
SUHU	MIN 23°C	AKTIF
PERGERAKAN UDARA/AIRCHANGE PER HR	MIN 6 AC / HR	AKTIF
KADAR KELEMBAPAN SILING	<10 % MOISTURE CONTENT	PASIF & AKTIF
SAMPUL BANGUNAN	MINIMUM	PASIF

PERINCIAN SILA RUJUK GUIDELINE ON PREVENTION MOULD GROWTH IN BUILDINGS - 2009

Terima kasih

Q&A ?