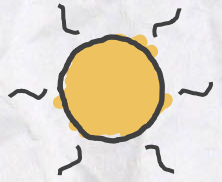


Dampness in Buildings

Presentation information sourced from a seminar presented by
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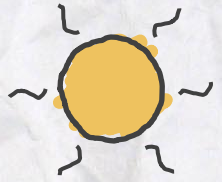


Aims



- Understand the causes and effects of dampness in buildings
- Look at the equipment used and their limitations
- Condensation – using data loggers to better understand internal conditions

What this presentation will not cover



- ❖ Drainage
- ❖ Flooding
- ❖ Structural defects
- ❖ Use of lime
- ❖ Issues with retrofitting solid floors
- ❖ Insect infestation & wet/dry rot

Dampness – A Brief History

- During the 19th Century there was various problems with dampness, buildings were constructed very close together. The lack of drainage and resultant high water tables resulted in diseases like Typhus , Cholera etc.
- Edwin Chadwick (noted for his work to reform the Poor Laws, the improvement of sanitary conditions and public health) in the early to mid 19th Century advocated the 3 ft. rule (space between buildings) to lower the water table, to have Proper drainage, separate buildings and a range of other damp busting measures i.e. reducing external abutting ground levels
- 1875 saw the introduction of the Public Health Act which recognized dampness problems linked to ill health for the first time
- In **1877** there was the introduction of the Model Building Bye-Laws and the first Physical damp proof courses. This was a quick solution until the infrastructure of connected drainage could be installed. The water closet was still to be introduced.

Therefore DPC's were invented due to overly hydrated site conditions, an inexpensive Welsh slate offered a quick fix to the problem in walls, but did not overcome the problem with solid flagstone floors. So suspended timber floors became the norm.

Effects of dampness in buildings

Direct effects on occupants

- Health disorders
- Damage to clothing and furnishings
- Loss of morale
- Health risk of waste or foul-sourced moisture

Effects on building

- Mould development
- Increased likelihood of fungal or insect attack to timber
- Distortion and expansion of timber, particularly across the grain
- Damage or disintegration to masonry walling, stones, bricks, bedding or jointing
- Loss of insulation quality
- Increase in weight of material
- Increase in electrical conductance
- Increase in likelihood of chemical damage (e.g sulphate attack)
- Physical damage (expansion or contraction movement)
- Frost damage
- Loss of adhesion
- Transportation of salts
- Slip hazards
- Decorative staining
- Corrosion of fixings or supports

Investigating dampness

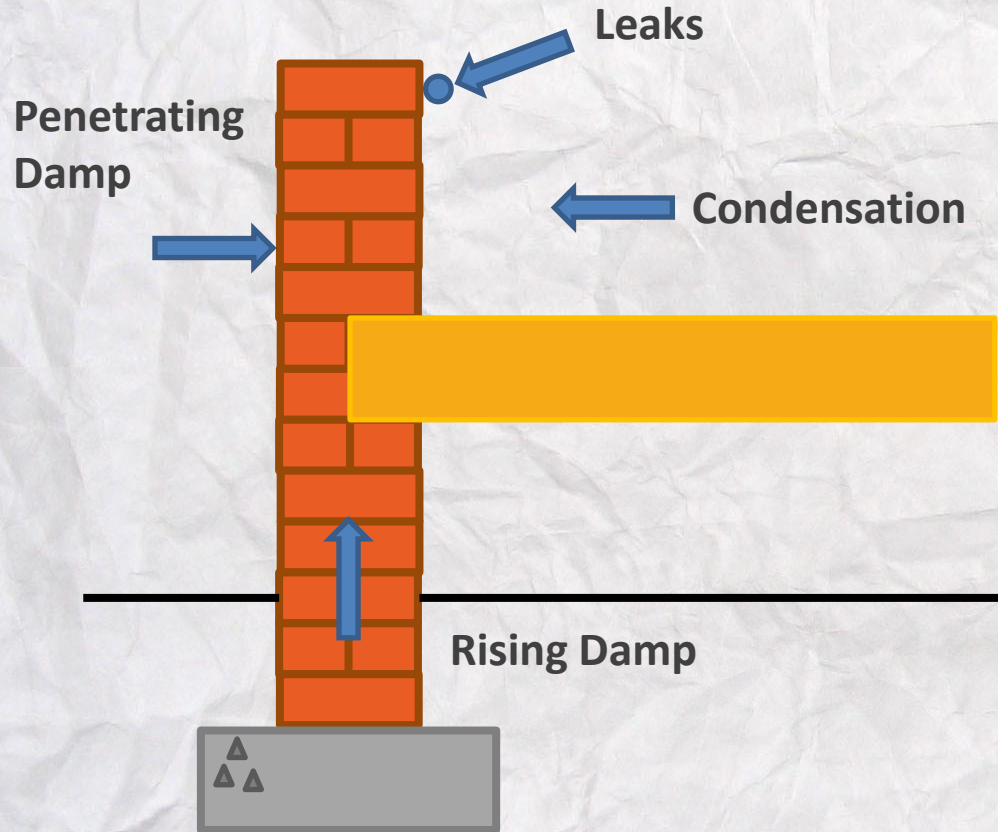
- A Holistic process – looking at all aspects
- Often involves invasive testing
- Good understanding of building failures
- Good understanding of building construction
- Applying the science -techniques and testing
- Historic records, local knowledge etc
- Independence i.e no vested interests



‘Surveying buildings is an art, verifying the cause of failure is a science’

Prof. Malcolm Hollis FRICS

How does moisture move



- Moisture will transmit through most building materials –Vapour permeable
- Water vapour laden air moves from a centre of high concentration to low concentration (Diffusion)
- Moisture will rise in porous materials; in masonry walls rising damp can reach around 1 meter in defiance of gravity.

Causes of Dampness

Penetrating Damp

- Raised ground levels externally
- Leaking gutters and rainwater pipes
- Leaking potable water pipes
- Poor external pointing
- Blocked cavity walls
- Rainsplash or pooled water
- Wind driven rain
- General building defects; defective mortar, sealant around windows & doors, defective stone window cills

Note: the commonality with that of rising damp causation

Rising Damp

- Bridged DPC; raised external ground levels
- Failure of DPC (very rare)
- Leaking potable water pipes i.e water mains, internal plumbing
- High water table – hydrostatic pressure
- Flooding – high water table or water from fire-fighting
- Leaking gutters and rainwater pipes
- Failed underground drainage
- Blocked cavity walls
- Blockage under suspended floors
- Leaking drainage or connections to stack
- Chimneys and fire hearths

Condensation

- **All of the elements that cause rising and penetrating damp plus:**
- Design layout of the building
- Open kitchens, high external wall surface, thermally inefficient building materials, perforation of vapour barriers in timber frame construction
- Entrapped moisture – interstitial condensation
- Use and occupation
- Under heating – fuel poverty
- Overcrowding
- Lack of adequate ventilation
- Blocked external vents to ground floors

What are the main causes of rising damp in masonry walls??

- 100 Chartered building surveyors asked
- Also according to the top commercial damp proofing contractors web sites

~~1. Failure of a physical damp proof course (DPC)~~

~~2. No damp proof course~~

3. Bridging of the damp proof course

Inappropriate Injected DPC's



What is dry? What is damp?

Dry	
Timber	8 - 14%
Plaster	0.2 – 0.5%
Mortar	0.2 – 1%
Brick (variations)	0.2 – 0.5%
Solid Floors	75% RH
Air	45 - 55% RH

Damp	
Timber	20-22%
Plaster	Above 1%
Mortar	Above 1%
Brick	Above 1%
Solid Floors	Above 80% RH
Air	Above 70% RH

How can dampness definitively be measured

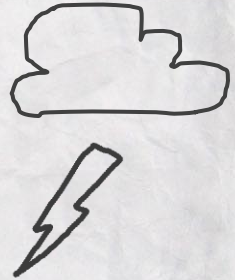
- Brick Calcium Carbide meter
- Wood Electrical Moisture meter
- Plaster Calcium Carbide meter
- Solid floors Hygrometer
- Air Hygrometer -Thermometer

Can we rely solely on the electrical moisture meter?

- Use only as an indicator – a RELATIVE reading.
- In masonry use as a DRY meter or a indicator of potential damp.

Can also give HIGH READINGS from:

- Carbonaceous material
- Magnesium Oxychloride
- Buried electrical cables
- Foil backed wall paper
- Salts



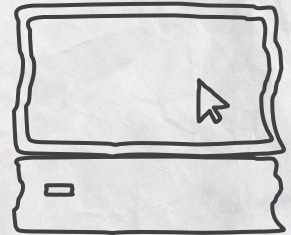
The 4 stage approach



- **STAGE 1** – Visual
- **STAGE 2** – Visual plus the sole use of a non invasive electrical resistance or capacitance moisture meter.
- **STAGE 3** – Using additional equipment attached to electrical moisture meter i.e. hygrometer.
- **STAGE 4** – Involves opening up and sampling building materials, lifting floorboards etc. using optical equipment etc.

Equipment used in stage 4

- Electrical Moisture meter, Air hygrometer, IR thermometer
- Optical Endoscope
- Dataloggers
- Salts analysis kits – Chloride and Nitrate Ions
- Calcium Carbide tester
- Listening stick –water leakage
- Drain testing equipment
- Floor hygrometer
- Sleeved hygrometer ERH (equilibrium relative humidity)
- Thermo-graphic camera
- Metal detector –Cavity wall tie locator
- Stud detector



Protimeter MMS2 Survey Kit

Model: BLD8800-C-S

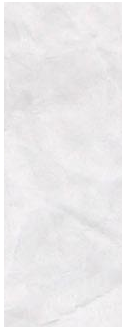
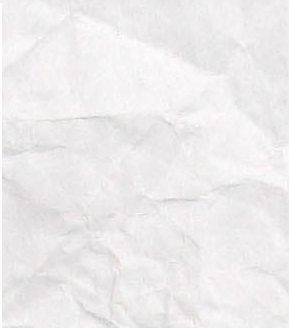
Supplied with:

- + QuikStick Short
- + Hyrostick
- + Hyrostick extension lead
- + Heavy duty moisture probe
- + Deep wall probes 5" (127mm)
- + Surface Temperature Sensor

Which allows you to do:

- Condensation risk assessments
- Moisture profiling
- Full moisture diagnostics
- Invasive & non invasive tests

Equipment



Why test for salts?

No Chloride or Nitrate = CONDENSATE / RAINWATER

If there is a presence of Chloride + Nitrate it could be from the following sources:

- Groundwater (normally 50mg/l Chloride, 75mg/l Nitrate)
- Use of unwashed sand in construction
- Mortar additives containing chlorides
- Salt water exposure - de-icing salts on roads
- Agricultural buildings contaminated by animal excreta and stored material
- Tap water (normally 50mg/l Chloride, with a low/trace of Nitrate)
- Chimney flue – gas, coal and wood burning (water mixed with soot produces salts)
- Certain types of bricks
- Detergents i.e washing up liquid (sometimes used as a plasticiser in mortars)

The original version of BRE 245, *Rising damp in walls: Diagnosis and treatment*, claimed that the presence of chloride and nitrate salts were purely down to groundwater. It has since been proven that this is not the case as you can see above these salts can be linked with a number of common materials found in buildings.

Process of elimination example

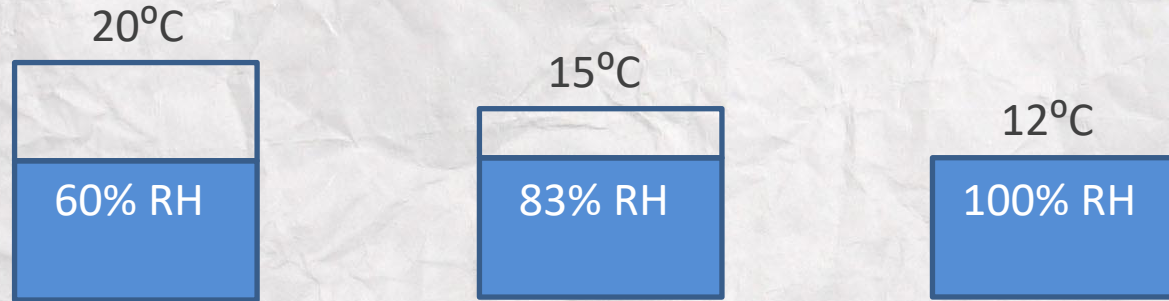
1. Visual assessment of damp patch and checking outside for clues – building defects? Green stains? Blocked drainage? Past history? Construction type?
2. Check wall and adjacent timber with moisture meter - certain moisture profiles could point to source
3. Check salts – no salts would eliminate below ground moisture
4. Check for water main leak – using a listening stick could eliminate this
5. Check the boiler – no loss of pressure could eliminate this

What we end up with is the likely cause of the problem, we will know which sources of moisture can be eliminated and which are still possibilities.

Condensation

Condensation is generally the most common form of dampness in buildings and will only get more common as fuel poverty increases.

Temperature and relative humidity

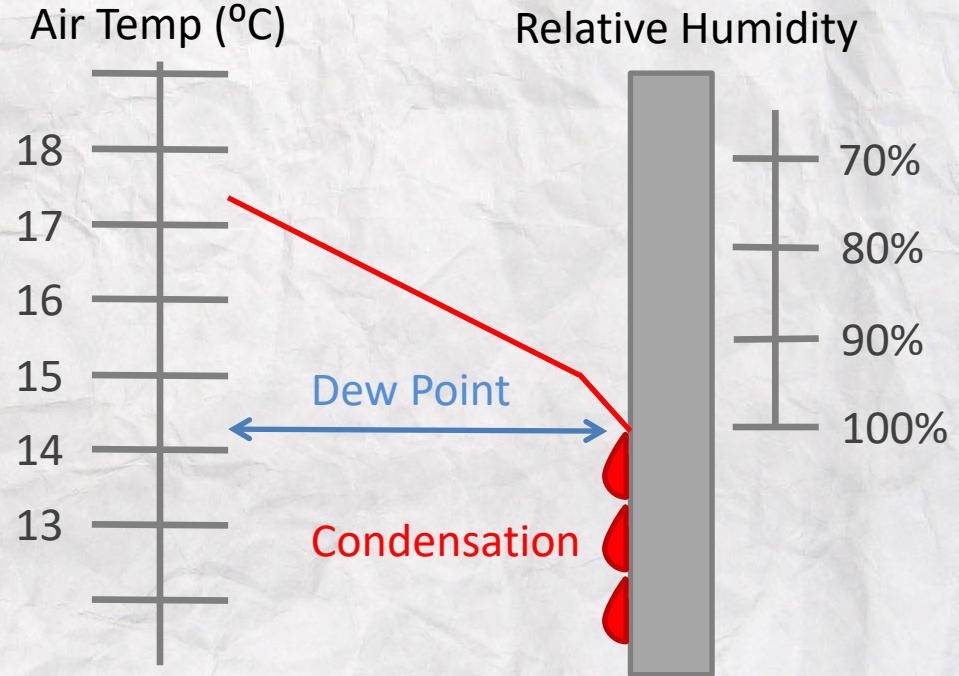


- 4 people sleeping 8 hours - 2Ltr
- 2 people active for 16hrs - 2Ltr
- Cooking - 4Ltr
- Bathing / dishwashing - 2Ltr
- Washing clothes - 1Ltr
- Non vented tumble dryer - 7.5Ltr
- Other sources; showers, floor mopping, pets, liquid fuel heaters

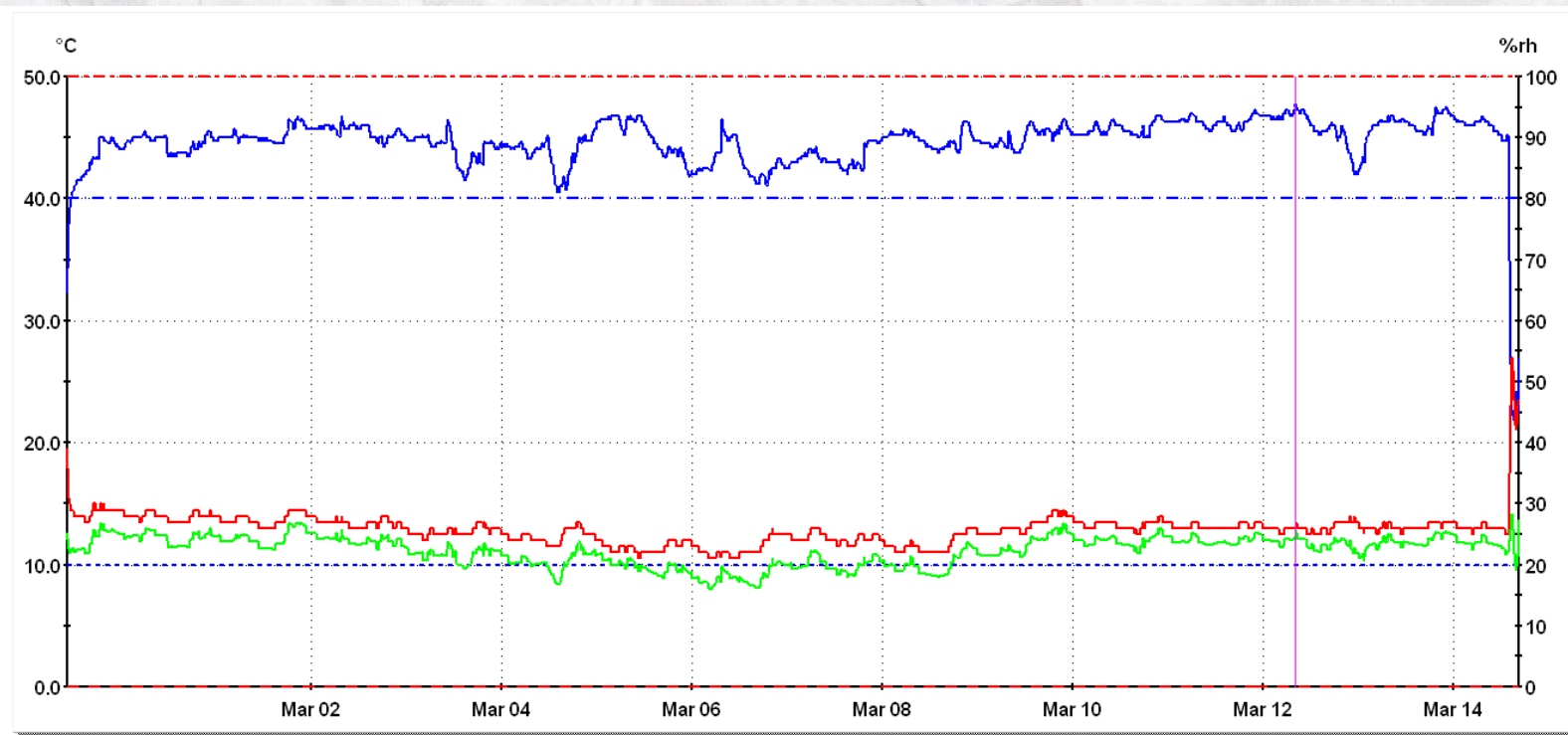
Effects of humidity

Surface Condensation

- Saturation 100%
- Mould on glass wool > 96%
- Mould on brick and Paint > 90%
- Materials damp to touch > 85%
- Mould on leather > 76%
- Mould begins to form > 70%
- Min Survival for dust mites 40%
- Min Comfort level for humans 45%



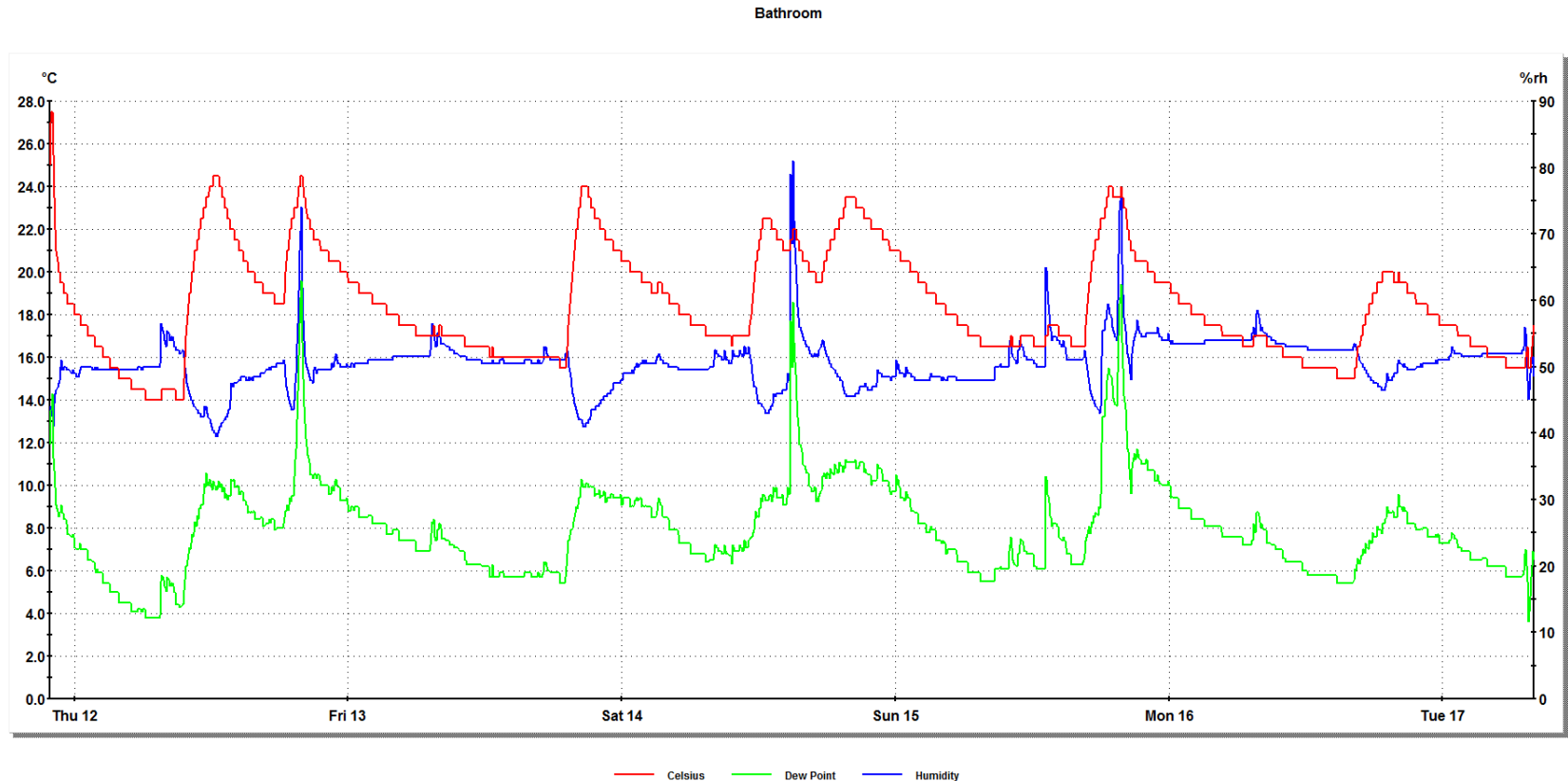
Data logger results from a damp property



— Celsius — High Alarm — Low Alarm — dew point — Humidity — High Alarm rh — Low Alarm rh

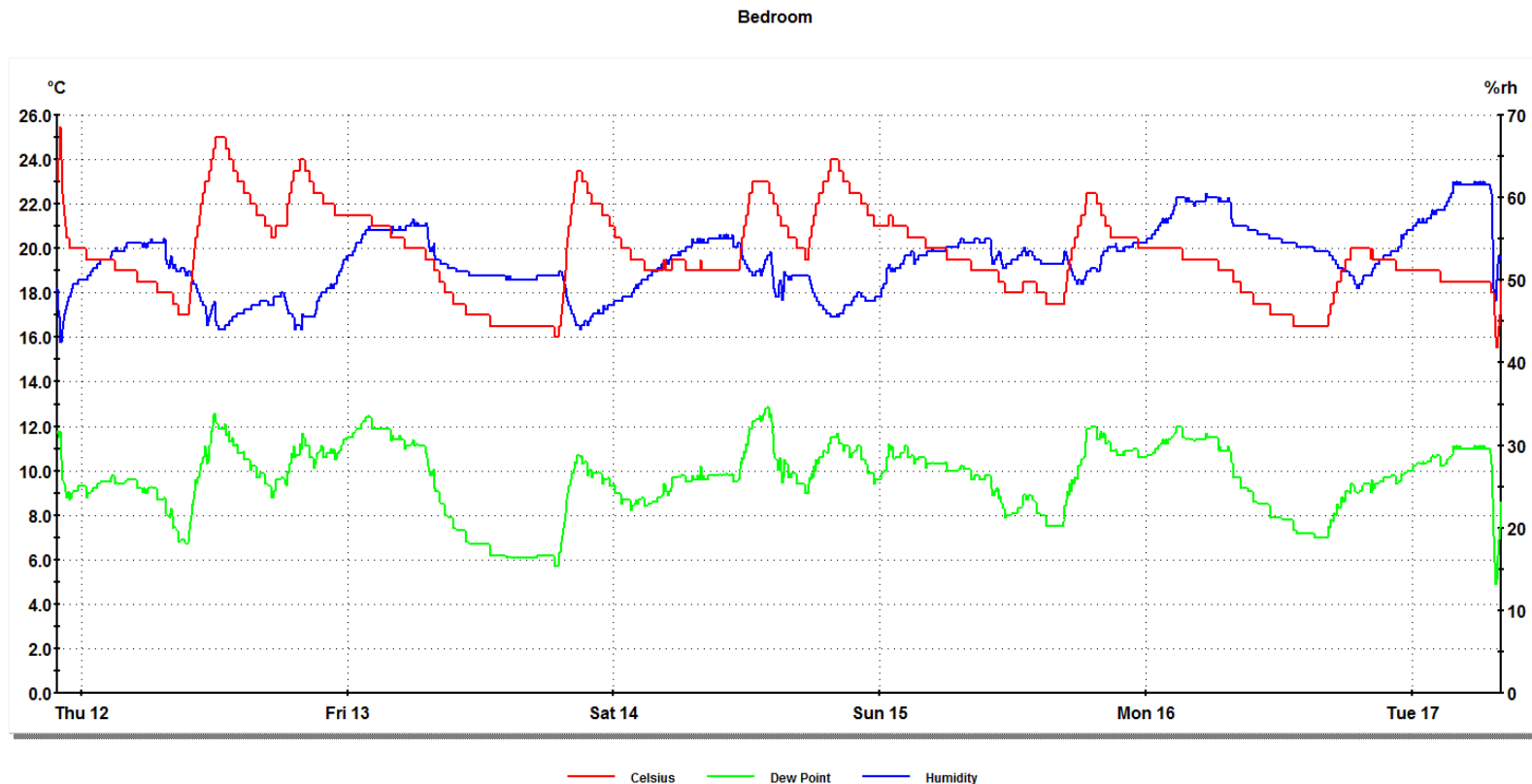
12 March 2012 08:10:00 : 13.0°C, 12.3°C, 95.5%rh

Data logger result from my own house



From:- 11 March 2015 21:50:09 To:- 17 March 2015 08:00:09

Data logger result from my own house



From:- 11 March 2015 21:48:13 To:- 17 March 2015 08:03:13

Effects of lifestyle on condensation

Overcrowding

- Creation of additional sources of moisture

Cooking

- Cooking without pan lids
- Excessive steaming or boiling of food
- Steam allowed to disperse to other rooms

Heating

- Heating with gas bottle or paraffin heater
- Radiators with TRVs shut
- Lack of programming of central heating
- Fuel poverty - leading to under-heating

Cleaning

- Soaking floors when mopping

Reporting repairs

- Defects not being reported by the tenant

Ventilation

- Blocking or closing off vents - windows, floor, wall vents
- Too much ventilation - making it harder to keep in warmth
- Curtains kept closed restricting ventilation
- Lack of extraction or ventilation to main moisture generation spaces
- Poor positioning or height of extract

Washing / drying

- Drying clothes on radiators
- Tumble dryer - incorrect hose, couplings etc

Building alterations

- Internal doors removed

Bathing

- Excessive steam generation (use cold first then warm)
- Intensive usage of baths or showers

Recommendations for condensation

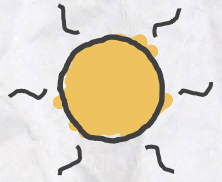
- Avoid drying clothes on radiators in cooler months (in fact at any time)
- Permanently vent tumble dryers through the wall to the outside air
- Keep the kitchen and bathroom doors closed at all times during cooking, washing, bathing (self-closing door mechanisms could assist in this)
- Tackle overcrowding
- Encourage occupants to keep heating on for longer periods during winter months, with a min background temp of around 15°C and to top up the heat to higher levels adjusted for comfort
- Remove the mould, treat walls with anti-fungicidal agent
- Check radiators are correct size (B&Q have a Radiator BTU calculator)
- Run winter campaigns on how to control moisture
- Check income levels and maximise take up of under-claimed benefits
- Consider replacing fans in kitchen and bathroom with fans of a higher rate of extraction, re-site at high level with self activating humidistat controlled fans
- Consider planned maintenance energy efficiency schemes to improve U-values to current standards
- Teaching tenant on how to use heating controls when they move in

Keeping good records

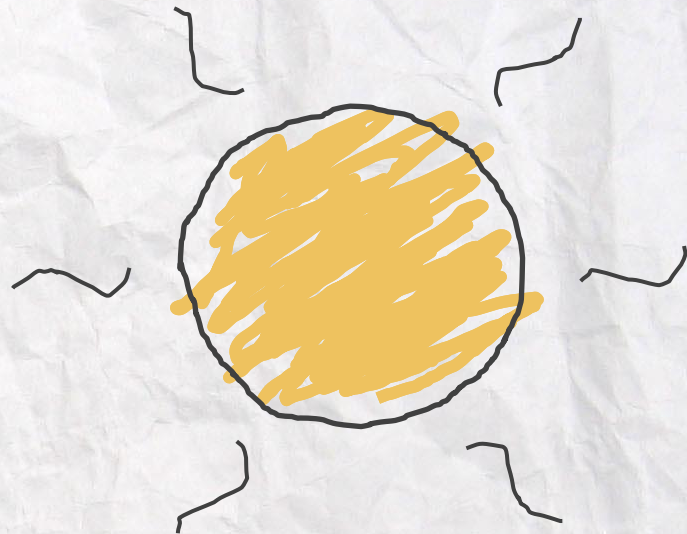


- The most important factor is to allow enough time to survey and to write the report.
- Surveys for dampness must be holistic.
- Structural movement cases, like complex condensation cases require long term monitoring and measurement and to record patterns.
- Always include plan and elevation sketches to illustrate the dampness internally and any external defects – patterns will emerge.
- Always take photographs of the defects.
- Drainage surveys, Local soil conditions, water table. (iGeology App on iphone can give soil conditions)
- Materials used in construction.
- Listen carefully to the occupiers and note their comments.
- Record remedial action recommended: checking water mains, reducing raised external ground levels, clear gutters and drain outlets etc.
- In extreme cases, record and collate information from other agencies i.e. Local Conservator, Planning department, Building Control, Environmental Health, national Rivers Authority, Environment Agency etc.
- Develop a standard format of report that encompasses the main investigations that you undertake.

Summary



- Remember Do not rely solely on the results of an electrical moisture meter. Often this is where the survey starts not where it finishes.
- Investigations are holistic and you must be prepared to investigate to a level 4 to prove where the water is coming from
- Use the right equipment and know its limitations
- Allow sufficient time, take photographs, record results of testing
- Keep good and comprehensive records
- Monitor if required
- Check ground conditions
- Regular training –access to good technical information (BRE Digests etc.)
- Be proactive to educate and inform tenants
- use the correct materials!
- Measure twice cut once!



Thank you