Rubbing salt in the wound

The presence of chloride and nitrate salts in a building may not be caused by rising damp, says Mike Parrett, but may come from any number of other sources – from soot and detergents to animal urine and fertilisers

Damp investigations into low-level, ground floor masonry walls can often be complex, with multifarious causes originating from different sources.

The original version of BRE Digest 245, *Rising damp in walls: Diagnosis and treatment*[1], associated chloride and nitrate salts with dampness that had originated from the ground (although these references were removed from the 2007 version[2] – see later). However, there is well-documented research (Kyte, Oliver, Coleman, et al) showing that chloride and nitrate salts are often associated with a number of other common materials found in buildings, and can be linked to where the building is located, and/or how it has been used and constructed.

The potential scale of this issue is huge. In 2009 in England alone, it was reported that 651,000 homes still suffer from rising damp, 701,000 from penetrating damp and 895,000 from condensation and mould[3]. Therefore the key question is: can an analysis for the presence of chloride and nitrate salts be relied upon for the diagnosis of rising damp in masonry walls from the ground?

Other sources

It is known from studies into the soot deposits in chimneys, and the effects on air pollution from wood- and coal-burning chimneys, that a range of different ammonium salts can be formed and easily converted to chloride and nitrate. Activated by either rainwater or condensation[4], this can result in a leachate of chloride and nitrate salts to the surface of the chimney breast.

In older properties (pre-1920s) with suspended timber floors, chimneys and fire hearths, the incoming potable water main supply is often found under the suspended floor. I have found many cases in older buildings, where the face of the chimney breast has become visibly very damp at low level and in which the incoming potable lead or steel water main pipe has been found to be cracked, corroded or perforated.

This causes water to escape and soak into the hearth support (fender) walls, which often do not contain a physical horizontal damp proof course (DPC) below the finished floor level. This results in capillarity to occur in the fender walls, transferring dampness vertically onto the face of the chimney breast, leading to rising damp.

The cause is not a failure of the physical horizontal DPC or dampness originating from the soil[5], but is solely the leaking water main.

Potable drinking water in England, Scotland and Wales contains both chloride and nitrate. Having eliminated all the other common causes of these elements, the presence of groundwater is normally confirmed when the chloride content is 50mg/l and the nitrate content is 75mg/l. When potable tap water is confirmed as the sole source of dampness in masonry walls, then the chloride content is normally 50mg/l with a very low to negligible trace of nitrate (see point 5, later).

The common practice among many bricklayers of using washing-up liquid mixed with mortar in the construction of modern masonry walls has also proven to be a good source of chloride and trace elements of nitrates.

Knowledge of the historical use of the building, and awareness of the common areas where chloride and nitrate can appear, are vital prior to taking samples of masonry for testing. For example, a case study in *Understanding dampness*[6] discusses the internal walls of a converted stable block and that the source of staining had originated from animal urine (known to contain levels of both chloride and nitrate) or from the curing of bacon. In addition, soot was regularly used as a source of fertiliser in farming.

Other readings

Other minerals and materials found in walls and floors can result in high readings from both electrical resistance and capacitance moisture meters, including salts and buried electrical cables.

Fly ash and clinker blockwork made from pulverised fuel ash were used widely in the construction of buildings between 1918 and 1940 (fly ash bricks are making a comeback in the modern building era as a sustainable building material). Magnesium oxychloride used in floor screeds up to the 1960s is also a material that is a good conductor, as are metal-foil backed wallpaper and plasterboards.

When detecting chloride and nitrate salts, there are limitations to identifying a single cause due to the various sources of these soluble salts; however, their detection can provide valuable clues to a potential cause and source. The absence of these salts could, for example, be extremely useful in eliminating a number of potential sources of dampness.

Figure 1 is a brief comparative study of different authors and researchers covering identification of the sources of soluble salts. These more common sources of potentially high conductivity in building elements can mislead practitioners into diagnosing the presence of dampness, when in fact the electrical moisture meter may have come into contact with a dry conductive material.

However, if the moisture meter confirmed a low reading in a masonry wall, then it would indeed confirm that the wall was dry as the low reading would not be recording any element that could trigger a high reading, including dampness. Perhaps these types of meters could also be called dry meters in relation to walls and damp meters in relation to timber, to which they are calibrated.

Sources	1976 BRE 245	2003 Diagnosing Damp[5]	2004 Understanding Dampness[6]	2005 BS 6576:2005[4]	2007 BRE 245	Others: Coleman (1990), Richardson (1995), Kyte (1997), Oliver (1999)
Groundwater	✓	✓	✓	✓	No – only mentions soluble salts	✓
Use of unwashed sand in construction	No	✓	✓	✓	No	✓
Mortar additives containing chloride	No	No	✓	✓	No	✓
Salt water exposure – de-icing salts on roads	No	✓	✓	✓	No	✓
Agricultural buildings contaminated by animal excreta (urine and faeces) and stored materials	No	✓	✓	✓	No	✓
Tap water	No	✓	✓	No	No	✓
Chimney flue – gas, coal- and wood-burning	No	✓	✓	No	No	✓
Types of bricks	No	✓	✓	No	No	✓
Detergents, i.e. washing-up liquid	No	✓	No	No	No	✓

Figure 1 – Common sources of chloride and nitrate salts (Parrett, 2011)

Correct diagnosis

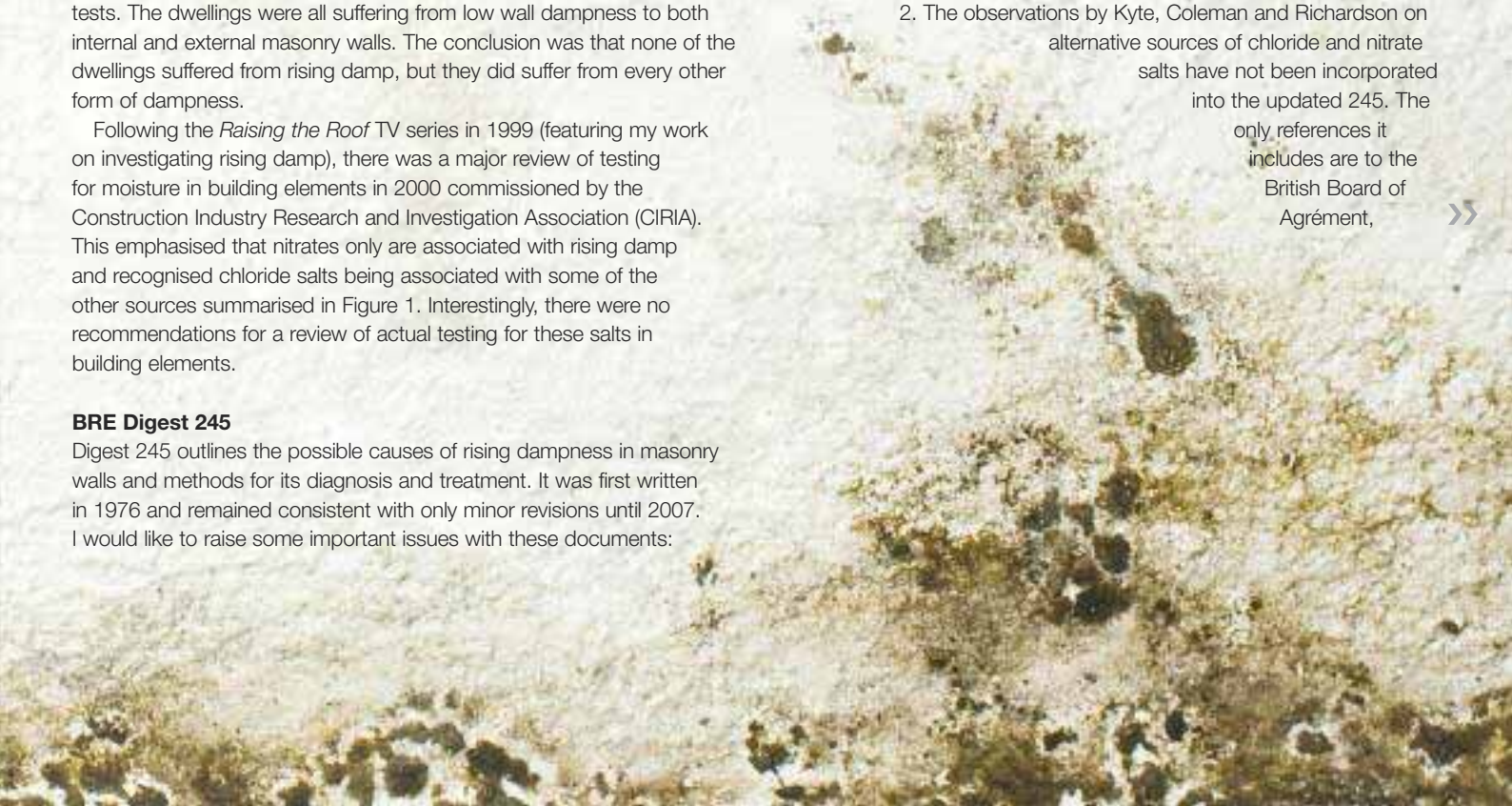
The importance of making the correct diagnosis of the cause or source of damp is demonstrated by work I performed for Lewisham Council[7]. This found that, despite reported dampness in ground-floor walls by a commercial damp-proofing company, rising dampness caused by a failure of a physical horizontal DPC was non-existent across the entire housing stock. A further study[8] investigated 80 ground-floor flats constructed of solid masonry walls with slate horizontal DPCs using the full range of techniques to a level 4 survey, including chloride and nitrate tests. The dwellings were all suffering from low wall dampness to both internal and external masonry walls. The conclusion was that none of the dwellings suffered from rising damp, but they did suffer from every other form of dampness.

Following the *Raising the Roof* TV series in 1999 (featuring my work on investigating rising damp), there was a major review of testing for moisture in building elements in 2000 commissioned by the Construction Industry Research and Investigation Association (CIRIA). This emphasised that nitrates only are associated with rising damp and recognised chloride salts being associated with some of the other sources summarised in Figure 1. Interestingly, there were no recommendations for a review of actual testing for these salts in building elements.

BRE Digest 245

Digest 245 outlines the possible causes of rising dampness in masonry walls and methods for its diagnosis and treatment. It was first written in 1976 and remained consistent with only minor revisions until 2007. I would like to raise some important issues with these documents:

1. The original 245 associated chloride and nitrate salts with dampness from the ground (soil). However, all references to these elements disappear from the 2007 version, which only discusses the generic term 'soluble salts' (despite sharing the same author as *Understanding Dampness*[6], which recognises virtually all of the common causes of chloride and nitrate salts in buildings). The original 245 had lasted for 40 years with only minor revisions – why after such a long period would all reference to chloride and nitrate concentrations then be removed from the updated document?
2. The observations by Kyte, Coleman and Richardson on alternative sources of chloride and nitrate salts have not been incorporated into the updated 245. The only references it includes are to the British Board of Agrément,



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The 2007 edition of Digest 245 says this is a wall with rising damp (left image) but BR466 *Understanding dampness* says this is *not* a case of rising damp (right image) but is due to animal urine

BS 6576[4] and other BRE documents. It also does not include details of the other common sources of potential high conductivity, e.g. fly/clinker ash.

3. The case study in the original 245 suggested concentrations of chloride and nitrate that had "persisted for 80 years". I believe this could not have possibly been monitored for this length of time, nor can it be supported with accurate scientific research, which is why it had to be removed from the 2007 version. But why did it take so long, given the contrary evidence that has been available?
4. The photograph used on the front cover of the updated 245 (indicating "Staining to wallpaper on a wall affected by rising damp") appears to be the same one used in a case study in *Understanding dampness* (page 191), which says it is *not* a case of rising damp, but a stain caused by animal urine (known to contain chloride and nitrate salts) likely to have arisen from the previous use of the building as a stable block (see above images). Interestingly, the same author is connected to both publications.
5. Despite the findings of research into potable drinking water (see above) and the conversion of chimney soot salts activated by rainwater penetration or due to condensation in chimney cavities, Figure 1 in the original 245 shows an example of rising damp at low level to a chimney breast.
6. Both the original and updated 245 digests recognise the limitations of using electrical moisture meters for testing for actual dampness in masonry and plaster, although neither version provide examples of the different types of conductive materials commonly found in buildings.

I can imagine that legal cases for disrepair, statutory nuisance and claims against long-term damp-proofing guarantees have been won or lost on the evidence of chloride and nitrate tests, particularly based on the guidance of the old 245. The 2007 update presented an opportunity to advance the detection of rising dampness in walls by the recognition and awareness that soluble chloride and nitrate can be encountered in masonry walls due to a number of common causes. This would have been a helpful step towards a more holistic view of this phenomenon.

Risk of misdiagnosis

I fear Figure 1 shows that both versions of 245 do not aid the proper identification of the sources of soluble salts and may cause confusion for property professionals. This could potentially lead to the misdiagnosis of rising damp, especially with the changes to the updated document. I look forward to hearing BRE's response on these matters so that our industry can fully debate the issues and develop guidance based on all of the research available.

At best, rising dampness is misdiagnosed and at worst, completely misunderstood – both with potentially costly results. The presence of chloride and nitrate salts can be found in a number of different sources that come into contact with buildings. What is not known are the concentrations of these salts when they have passed through various building materials in the built environment over differing lengths of time and the effects on salt concentrations due to rates of evaporation.

To determine whether dampness has risen vertically in a wall by capillarity from a source of moisture in the ground (soil) or due to a failed, missing or bridged DPC, more research is needed into different salt groups and their concentrations that become manifest in different building elements triggered by dampness and various contaminates. This would identify a qualitative and quantitative methodology to help enhance our understanding of dampness in buildings and greatly assist targeting the correct remediation to manage or cure the problem.

A longer, fully referenced version of this article is available from the author, which was written as part of the RICS-accredited IDBE (Interdisciplinary Design for the Built Environment) Masters course offered jointly by the Departments of Architecture and Engineering, University of Cambridge, www.idbe.org

Further information

[1] *Digest 245 – Rising damp in walls: Diagnosis and treatment*, Building Research Establishment, 1976

[2] *Digest 245 – Rising damp in walls: Diagnosis and treatment*, Building Research Establishment, 2007

[3] *English Housing Survey, Headline report 2009-2010*, DCLG, February 2011

[4] BS 6576:2005, *Code of practice for diagnosis of rising damp in walls of buildings and installation of chemical damp-proof courses*, BSI, 2005

[5] *Diagnosing damp*, Burkinshaw, R, Parrett, M J, RICS Books, 2003

[6] *Understanding Dampness* (BR466), Trotman et al, BRE, 2004

[7] *Diagnosing Damp: How to investigate the true causes of damp*, 2000

[8] See *Stop the rot*, page 16, *Building Surveying Journal*, Jan/Feb 2009

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Defects and deterioration in buildings is available for reference from *www.rics.org/ebooks*

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