

LEAD PAINT, LEAD DUST AND CDM

SUMMARY

This Practice Note addresses an apparent widespread lack of awareness which can result in non-compliance. This has significant liability implications for clients, designers and the entire construction industry supply chain. Lead can seriously damage human health, whether ingested or inhaled, and it is increasingly recognised that there is no 'safe' level of lead exposure. Exposure risks from lead-containing paint, dust, and fume are most likely to occur in pre-1990 buildings, especially during repair, maintenance, refurbishment and demolition, if proper precautions are not followed. The older the building, the greater the likelihood of lead-containing paint being present and the higher its lead content is likely to be. Despite the introduction of the Control of Lead at Work Regulations in 1980 (updated in 2002) few construction professionals, including designers, seem to acknowledge their significance. This Practice Note reviews the risks from lead-based paint, where it is most likely to be found and provides related information on the issues.

INTRODUCTION

HSE guidance on lead exposure risk states:

“Lead can cause serious health effects including kidney damage, nerve and brain damage and infertility.

Long-term, low level, lead exposure which may not display any visible clinical symptoms, is recognised as a major health concern.

According to its 2014 statistics, official HSE figures for workers under medical surveillance for lead exposure in the UK were approximately 4,200 (2012/13). Anecdotal evidence suggests a more likely figure is in the range 100-200,000. US statistics show construction workers are a principal at-risk group, but no such sub-grouping exists in UK figures. It is worth noting that there are at least 150,000 painters and decorators in the UK and many others trades for whom the majority of work in older buildings is likely to give rise to 'significant' exposure risks.

Window renovation and replacement, scaffolding, carpentry, painting, plumbing and electrical work, together with other general trade, demolition and cleaning activities can all give rise to 'significant' exposure risks, whether directly or indirectly.

Exposure risks from lead paint and dust are likely to be greatest during construction work on pre-1970 buildings, but lead-based primers continued to be used in mass-produced windows and doors into the mid-1980s. Lead-based paint was banned for consumer use in 1988 but UK production for commercial applications, such as for structural steelwork and road marking continued into the 1990s. It can still be found in new-build projects using imported steelwork from outside the EU.

The HSE's webpage 'Working safely with lead' went on-line in late 2008. HSE pre-construction information advice recommends that "if preparing paintwork, lead surveys" should be carried out.

In September 2014, HSE published its own guidance on Old Lead Paint (cis79).

2.0 THE LEGISLATION

The Control of Lead at Work Regulations 2002, (known as 'CLAW'), came into force on 21st November 2002. CLAW 2002 contains the provisions of the Control of Lead at Work Regulations 1980 and 1998 (now revoked).

3.0 INTERPRETATION

The importance of CLAW compliance can be best appreciated with an understanding of what is considered to be 'significant' exposure, as defined in the Regulations:

- "significant" in relation to exposure to lead means exposure in the following circumstances
 - (a) where any employee is or is liable to be exposed to a concentration of lead in the atmosphere exceeding half the occupational exposure limit for lead;
 - (b) where there is a substantial risk of any employee ingesting lead;

The CLAW ACoP explains: "Lead can be present in two forms: fume, generated at temperatures greater than 500°C, and dust. Occupational exposure to lead is dependent not only on the concentrations of lead in workplace air but also on the personal hygiene and personal habits of the worker.

Any construction work or process involving lead which produces dust or fume can result in inhalation of lead, e.g. cutting, grinding, sanding, paint stripping and burning. However, every process/job involving lead (and its compounds) in any way can also give rise to exposure by ingestion.

UNDERSTANDING 'SIGNIFICANT' EXPOSURE RISK

Recognising that a 'significant' exposure risk to lead can arise even when lead levels are low is essential for an appreciation of the severity and extent of the problem.

HSE guidance, since 1999 (Operational Circular 298/15), has stated:

"If there is any evidence that employees do not always wear protective clothing as required, then they should be regarded as being significantly exposed.

"Before an assessment of significant exposure is reduced to 'not significant' as a result of additional control measures, inspectors should check that the reassessment takes into account the confidence which can be placed in the new control measures and the likelihood that they will be able to guarantee a continued and reliable reduction in exposure.

"Where there is reliance on the use of RPE to minimize exposure there will probably not be sufficient confidence in this as a control measure to allow an assessment of significant exposure to be reduced purely because RPE is provided."

4.0 PREVENTING EXPOSURE

Employers have a duty, so far as reasonably practicable, to protect any person likely to be affected by work involving lead or substances or materials containing it. As well as their own employees, this includes:

- (a) other workers, including those employed by another employer not engaged on work with lead, such as scaffolders, maintenance staff, cleaners etc.
- (b) visitors to the worksite;
- (c) families of those who are exposed to lead at work and who may be affected by lead carried home unintentionally on clothing and footwear;
- (d) occupiers present in buildings where work is going on around them.

4.0 PREVENTING EXPOSURE

continued

Work directly involving lead containing materials (LCMs) can be expected to substantially increase any pre-existing background 'legacy' lead exposure levels arising from the normal use and occupancy of a building. Poor maintenance, friction from opening and closing old windows and damage to impact surfaces can all give rise to lead dust and lead paint chips. designers must be aware that, from a compliance perspective, such 'background' lead dust levels should be considered in assessing a pre- construction 'significant' risk, that may demand appropriate precautions.

Where indirect or incidental exposure to lead exists, other employers of people at a workplace also have duties, under Section 2 of the Health and Safety at Work etc. Act and the Management of Health and Safety at Work Regulations 1999, to satisfy themselves that they are taking adequate precautions to protect their employees. This creates, therefore, an implicit 'duty' to manage lead paint hazards and exposure risks.

Leaded petrol, banned in the UK from 2000, has contributed significantly to lead's status as the most widespread environmental toxin. This airborne particulate form of lead contamination, which affects soil and water supplies (unrelated to the water contamination attributable to lead pipework and soldered joints), also accumulated in attics and roof voids. Workers converting or insulating pre-2000 roof spaces, or retrofitting energy efficient heating/ventilation systems and replacement windows are potentially exposing themselves and building occupants to 'significant' risks without knowing it.

5.0 PROHIBITIONS

When considering prospective employees, specific guidance relates to the prohibition of young people and women "of reproductive capacity" from certain activities. Failure to do so could be considered sex discrimination.

6.0 RISK ASSESSMENTS

"An employer shall not carry out work which is liable to expose any employees unless he has – made a suitable and sufficient risk assessment... "The risk assessment shall include –

- (a) the hazardous properties of the lead;
- (b) information on health effects...
- (c) the level, type and duration of exposure;
- (d) the circumstances of the work, including the amount of lead involved;
- (g) the effect of preventive and control measures which have been or will be taken...
- (h) the results of relevant medical surveillance;"

Pre- construction monitoring of blood lead levels; preliminary air monitoring and contamination (dust/vapour) control are mandatory (see 8.1).

Particular consideration should be given to workers, at non-permanent or outdoor locations, whose exposure to lead may vary in its extent from day to day. Such work could include:

- construction, maintenance or demolition of buildings, bridges and other structures;
- installation or maintenance of electricity, water, telephone or railway systems.

These activities may give rise to lead exposure through lead burning, paint removal, soldering and handling metallic materials. Although such work with lead may be brief and carried out in the open air, it could still result in exposure to a very high concentration of lead dust or fume before it has had the chance to disperse, for example:

- welding or cutting lead-painted or lead-containing materials (LCMs) carried out close to an employee's breathing zone; or
- lead burning activities carried out during demolition work, especially in a confined area within a building or structure;
- removal of old lead paint by chipping or by wet or dry shot-blasting.

"When such activities are planned, it is an essential part of the assessment to identify whether lead paint or other lead-containing material (LCM) is present." (CLAW ACoP).

7.0 LEAD SURVEY AND SAMPLING

The CLAW ACoP provides no guidance for carrying out a lead survey although, as a hazardous material with its own Regulations, adopting an 'asbestos' mind-set to surveying methodologies is considered a sensible approach. The details of lead survey practices and procedures are beyond the scope of this Practice Note, however, where a demolition or refurbishment lead survey is required much of the established good practice for equivalent asbestos surveys can be followed.

The inadequacy of CLAW for construction compliance is most apparent in the ACoP, which states: "If necessary, a sample of the paint or material concerned should be analysed to find out if it contains lead". This advice, if followed, would fall well short of the requirement for a "suitable and sufficient risk assessment".

The lead content variability in paint throughout a project can be substantial. The belief that analysis of one or two paint samples can be sufficient is, at best, misguided. At worst, as a basis for project-wide decisions, it can lead to substantially increased costs and programme times.

Considering the amount of lead involved is not just a CLAW requirement. The Site Waste Management Plans Regulations, 1998, require an "(4)(b) estimate (of) the quantity of each different waste type expected to be produced". 'Qualitative' testing for lead in paint content, therefore, is insufficient for compliance purposes. Accurate 'quantitative' testing that allows calculation of (likely) hazardous waste quantities is what is needed.

7.1 Physical (Destructive) Sampling

Generally, physical samples of suspected lead paint are obtained and submitted to a laboratory for analysis. Sampling is frequently done by non-specialists with little or no training. As a result samples may not be representative or complete. Whatever the lead content reported, it is likely to present an artificially low indication of the full on-site exposure risk potential.

Laboratories generally report the lead content of paint samples in mg/kg or $\mu\text{g/g}$. These are mass/mass units of measurement which describe the proportion or ratio of lead content in a particular sample relative to the total weight of that sample. These units are more easily understood when expressed in parts per million (ppm) or as a percentage (%).

Such results, though able to report accurately lead levels below 3ppm, have little practical application beyond the definitive 'qualitative' confirmation of lead being present. For example 1kg, 10kg and 100kg paint samples could all contain 10% lead, but the total lead content in each would be rather different. 'Total lead is' what needs to be measured.

If, however, the lead mass of a sample can be related to the size of the surface from which it is taken the lead content can be expressed, say, in units of $\mu\text{g/cm}^2$. This would be a true 'quantitative' measure. Reporting the total lead amount in a given sample size, quoted as a mass/area measurement, makes for easy calculation of potential airborne lead dust levels and hazardous waste quantities.

7.2 In-situ (Non-Destructive) Testing

For high volume, low cost-per-sample 'screening' applications the standard equipment for lead paint survey work is a handheld XRF-i (X-Ray Fluorescence isotope) instrument. These devices have emerged as the technology of choice for surveys of the 'buried' lead in paint that is so widespread. The best instruments match the accreditation standards required of specialist 'bricks-and-mortar' lead laboratories.

Because 100s (sometimes 1000+) of XRF-i readings, in mass/area units ($\mu\text{g/cm}^2$), can be taken during the course of a day there is no more cost-effective way of evaluating the location and extent of lead paint hazards, wherever they may exist. And the 'interactive' nature of its use allows a more dynamic and complete approach for risk assessment purposes.

7.0 LEAD SURVEY AND SAMPLING continued

The inherent advantage of XRF-i lead surveys is the ability to distinguish high and low/no risk areas in order to gain cost and programme advantages. Increasingly, health and safety practitioners have been realising that XRF-i lead surveys are an essential part of the PCI gathering process.

NOTE 1: XRF-i equipment, designed specifically for lead paint analysis across the full range or potential lead content levels, should not be confused with XRF (cathode ray tube) instruments. These 'non-isotope' devices have been banned in France for lead surveys because of their inferior performance.

NOTE 2: Because they contain radioactive material XRF-i analysers are specialist and expensive equipment that would not normally be suitable or affordable for occasional use by surveyors/architects. XRF-i lead surveys are a specialist activity.

7.3 Lead Paint and Dust Standards

Once the lead content of a paint sample is known it needs to be compared with established limit or threshold values however none exist.

The definition of lead paint provided in certain British Standards has no relevance to the determination of occupational exposure risks where any amount of lead content could possibly be considered a 'significant' risk.

IN UK LEGISLATION THERE IS NO DEFINITION FOR IN-SITU LEAD PAINT NOR IS THERE A THRESHOLD LEVEL FOR A 'SAFE' LEVEL OF LEAD IN SUCH PAINT.

IMPORTANT NOTE: Some accredited laboratories are making a flawed reference to the existence of a 1% threshold level cited in Table 2 (paragraph 65) of the CLAW ACoP, which lists examples of 'Work with lead not liable to result in significant exposure'. Paragraph 66, however, states: "...activities in Table 2 may give rise to significant exposure." Failure to appreciate this fundamental distinction can raise important questions about lead survey and laboratory competence when interpreting analytical results.

7.4 Other Measures

In addition to lead paint sampling and analysis air sampling is a key requirement of CLAW as part of the obligation to monitor lead exposure levels. Other monitoring can also be used for more comprehensive understanding.

AIR: Preliminary air monitoring should always be undertaken to quantify airborne concentrations, to help determine the appropriate air monitoring strategy during the lead related work.

DUST: Surface dust contamination checks, using dust wipe sampling, can provide valuable feedback on the effectiveness of containment and control measures. They can also be used for 'clearance' testing purposes to confirm that work areas have been left safe for re-occupation. This kind of information is likely to be of considerable value for inclusion in the Health and Safety File.

SOIL: Soil samples can also be taken to confirm background levels of contamination as a benchmark for determining the effectiveness of any external clean-up following a breach of containment and at project completion.

Air filter papers, dust wipe and soil samples can all be submitted to laboratories for analysis. Non-destructive XRF-i analysis can also be used and can be cheaper and quicker.

7.0 LEAD SURVEY AND SAMPLING

continued

7.5 A little lead and 'significant' exposure

How much lead constitutes 'significant'? For comparison purposes only, a 'dual' non-UK standard exists that links a laboratory lead concentration of 5,000ppm with an XRF-i lead in paint level of 1,000 $\mu\text{g}/\text{cm}^2$ as limits that are applied by the same law. If 1 cm^2 of 1,000 $\mu\text{g}/\text{cm}^2$ (1,000 micrograms/ cm^2) lead-based paint became airborne dust it would be enough to contaminate 13.3 m^2 at the UK 'significant' exposure level for airborne lead of 75 $\mu\text{g}/\text{m}^3$ (0.075 mg/m^3). Or put another way enough to contaminate about 5 m^2 of floor space at levels known to affect the health of children, if ingested. With levels of lead in paint commonly exceeding 10-20,000 $\mu\text{g}/\text{cm}^2$ the severity and extent of potential exposure problems is clear.

Technically, even a 1ppm lead content could suggest an occupationally 'significant' exposure risk. In order to maintain a proportionate approach to managing low-level exposures, individual air monitoring and exposure screening, with a blood lead or saliva check, can provide cost-effective insights. Once obtained, these can be used to inform subsequent decision-making.

8.0 DUTY TO MANAGE

Confirmation of the presence of lead paint hazards imposes an obligation on employers to comply with CLAW.

For occupiers of buildings where lead exposure risks are incidental to their work, this may simply involve the adoption of in-place management procedures, such as the use of HEPA filtered vacuum cleaners and wet-mopping, to control dust levels. Creating a Lead Register, along the lines of an asbestos register, would facilitate effective management of these risks and provide a useful reference for building repair, maintenance and refurbishment work likely to disturb areas where a lead paint hazard has been identified.

8.1 Health monitoring

In accordance with the CLAW ACoP employers are required to check the blood lead levels of new employees who are likely to have been exposed to lead in the previous 3 months. This requirement applies regardless of whether their new employment will involve 'significant' exposure to lead. Given the widespread nature of lead paint and dust hazards, which are more likely to be present than not in refurbishment and similar projects, the majority of the industry has overlooked this requirement.

Employers and employees should be mindful that a 'lead poisoning' diagnosis from a medical practitioner can occur at blood lead levels well below the so-called Action and Suspension Levels for occupational lead exposure.

Low level lead contamination levels presenting a 'significant' exposure risk in 'informal' eating and food storage & preparation areas, have been reported by H&S Advisers as 'Dangerous Occurrences'.

Blood Lead Levels (BLLs) are measured in micrograms of lead per decilitre of blood, written as $\mu\text{g}/\text{dl}$. They are important for identifying a person's level of lead exposure so that appropriate action can be taken to prevent or minimise further exposure to lead as far as possible. A 'low' blood lead reading, should not be taken to mean that it is either a 'safe' level or that measures need not, or cannot, be taken to reduce that level further. Smokers ingest more lead than non-smokers.

A BLL at or above 2 $\mu\text{g}/\text{dl}$ is sufficient to justify closer investigation of potential sources of lead exposure at work or at home. Long-term, low-level lead exposure harms health, even though adverse effects are unlikely to show physical symptoms. Even less than 1 $\mu\text{g}/\text{dl}$ blood lead in a child is still enough to affect brain development, behaviour and learning. Workers can have BLLs high enough to be suspended under the Regulations, but feel perfectly well.

There are standards for those at risk from occupational lead exposure and standards for others, such as DIYers, who may be exposed to non-occupational sources. These include take-home lead contamination by those who work in refurbishment, demolition, blasting, window repairs, paint stripping, painting and decorating.

9.0 INFORMATION, EDUCATION AND TRAINING

9.1 During the construction phase

CLAW compliance requires employers to provide appropriate information, education and training to their employees. A similar duty exists to those who “are on the premises where the work is being carried out” for whom there is also a requirement to provide both air monitoring and guidance on dealing with accidents.

CDM duty holders are also legally obliged to provide information for the construction team on significant risk issues - issues that are difficult to manage or maybe beyond the knowledge/experience of a competent contractor. It is likely that some projects could fall into either or one of these categories making the information flow from the designers to the contractors on lead risk an important part of any pre construction information.

The ‘Worked Examples’ guidance for lead risk assessments, produced by the Department for Communities and Local Government as part of the Housing Health and Safety Rating System (HHSRS), advises: “occupants should be temporarily re-housed during stripping and re-painting”. This is a useful reminder, for such seemingly lower risk construction projects, for the separation of the public/building users from any construction work for reasons of general risk management.

Upgrading roof insulation; window replacement; kitchen and bathroom upgrades and retrofitting energy efficient heating and ventilation systems are all activities which, when lead paint or dust are present and likely to be disturbed, will generate ‘significant’ exposure risks for workers and residents alike.

This has far-reaching liability implications, particularly in the areas of (social) housing and (primary/nursery) schools refurbishment.

9.2 After the construction phase

Information relating to any lead surveys, lead paint removal, clearance testing and related information should be retained in the Health and Safety File. The same information could be retained separately as a Lead Register to be kept alongside and cross-referenced with the Asbestos Register. It is not unusual for ACMs to have been coated with lead-based paints. Indeed, a survey for managing lead hazards would not be considered complete unless known ACM materials had been tested. From this it will be understood that clearance testing for asbestos removal work will sometimes need to be extended to lead dust contamination.

10.0 LEAD-SAFE WORK PRACTICES

Once identified, lead hazards and exposure risks are relatively straightforward to manage if lead-safe work methods are followed. Lead-safe methods are little different to those recommended for general dust management, as promoted by the HSE-led Construction Dust Partnership. Whereas many still ignore the need for implementing dust controls, regardless of the potential exposure risks, the toxicity of lead is such that poor controls and even minor lapses can dramatically increase the risk of ‘significant’ exposure.

Lead safe work practices can include:

- Wet scraping, wet sanding and ‘misting’ to minimise airborne dust and contamination;
- Power sanders or other tools fitted with HEPA-filtered vacuum/exhaust systems;
- Pre-set low heat methods, such as infrared;
- Wet/chemical stripping on or off-site.

Any or all of the above should be used in conjunction with:

- effective containment and dust protection;
- suitable PPE and RPE (min. FFP3 or P3 ‘toxic dust’ rated respirators);
- appropriate signage;
- dedicated ‘lead-safe’ welfare facilities and meticulous attention to decontamination and personal hygiene.

10.0 LEAD-SAFE WORK PRACTICES continued

NOTE: Although dry sanding is the most widely used method of surface preparation for painted surfaces, paint manufacturer Safety Data Sheets clearly state: "Thoroughly rub down previously painted surfaces, using 'wet flattening' methods where possible". This guidance relates to all paintwork, not just that with a lead content.

11.0 ARCHIVING PROJECT FILES

The presence of lead in any residue or waste material is likely to render it 'hazardous' and in need of special provisions for collection, on-site storage and ultimate disposal. Lead run-off from wet processes must be fully contained.

Lead-painted windows present particular challenges and opportunities for the design and ongoing management and project life-cycle costs for, as long as lead painted surfaces remain, they will always be a hazard which may turn into exposure risks.

Careful consideration must be given to balancing short-term budgetary constraints with the longer-term payback of addressing lead paint hazards sooner rather than later.

12.0 COMPETENCE

The requirement for lead surveys in refurbishment is non-negotiable and does not need to be assessed as necessary. The default position has to be to assume lead is present and to recognise the need to quantify it properly. Anyone involved in assessing the risks of "significant" exposure to lead is likely to need training and / or information. Risk assessments will be required for the surveyor carrying out the assessment and information on any lead risks relating to any proposed work should be passed on to contractors.

Training is required if you are exposed to lead at or above the action level or if you suffer from skin or eye irritation from lead.

Training should cover:

- Current regulations;
 - Effects of lead on your health;
 - Typical hazards;
 - Protective measures (PPE and RPE);
 - Good work practices and personal hygiene;
 - Blood testing and medical examinations.
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13.0 ENFORCEMENT

Periodic unannounced HSE inspections of refurbishment sites now include lead paint. Their findings reported in 2014 showed that the Risk Gap for every example of non-compliant lead exposure activity was defined as "Extreme", with the exception of "very small, one-off activities (unlikely to be repeated)"; and all but one of their related "Consequences and Likelihood" outcomes were described as having a "serious health effect".

It should be pointed out that HSE inspections do not involve on-the-spot testing for lead in paint or dust (in the likely absence of a lead survey) and are based on a subjective assessment. As a result, it is only the 'worst' examples of (likely) non-compliance that are being identified with the majority of 'significant' but less obvious exposure risk situations being largely ignored. Lead exposure related prosecutions have all been directed at the offending contractors, ignoring the fact that it is clients and their advisers who have a responsibility to identify lead hazards in pre-construction information. With the majority of professional advisers and Principal Designers failing to identify this particular compliance issue, it is probably only a matter of time before prosecutions are directed elsewhere.

The HSE's position on non-compliance is very clear:

"...where we discover that employers are failing in this duty (to protect employees from exposure to lead) we can and will take action."

14.0 SOURCES OF FURTHER INFORMATION

Regulations:

Control of Lead at Work Regulations, 2002 SI 2002 No. 2676

Guidance: Approved Code of Practice

Control of Lead at Work Regulations, 2002 L132

Guidance: Other

HSE website: hse.gov.uk/lead

NBS – National Building Specification

British Coatings Federation guide: 'Old Lead Painted Surfaces'

Construction Skills: Construction Site Safety (GE700) & Toolbox Talks (GT700)

Painting & Decorating Association Health & Safety Manual

Lead Paint Safety Association: lipsa.org.uk
