Code of Practice for Control of Lead at Work

Labour Department
Hong Kong
Code of Practice

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December 1986
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Introduction
The aim of this Code of Practice is to protect the health of people at work by controlling their exposure to lead and where such controls cannot reduce exposure to an acceptable level to monitor the lead absorption of the individual so that he or she can be removed from exposure before health has been affected. The Code applies to all work which exposes persons to lead in any form such that it may be ingested, inhaled or otherwise absorbed. Inhalation is the major source of absorption, therefore much of the Code is orientated towards preventing the inhalation of lead dust, fume and vapour. The Code contains the fundamental requirements needed to control exposure to lead with details of acceptable methods of meeting these requirements together with agreed standards.

The key to control is the requirement for the employer to assess the nature and extent of the exposure to lead so that, on the basis of that assessment, he may determine and implement the measures which will be adequate to prevent poisoning.

The basic measure to protect employees from absorbing lead is the prevention of the escape of lead dust, fume or vapour into the workplace and such action should ensure that the amount of lead in air in the breathing zone of any worker is below the agreed lead-in-air standard. Where the assessment shows that exposure to lead is significant, i.e. above the reference level of half the lead-in-air standard then air monitoring is to be carried out on a regular basis to check that control measures are working effectively and that the lead-in-air standard is not exceeded. There will be some work, e.g. maintenance operations, where effective engineering control measures are not reasonably practicable and in these cases a high standard of personal protection is necessary, including the provision of respiratory protective equipment.

Personal hygiene has an important role in controlling lead absorption, thus the provision and use of adequate washing facilities is a basic requirement. To avoid the risk of lead being ingested, food and drink should not be consumed in any place liable to be contaminated by lead and the employer should make adequate arrangements for employees to eat in a clean area. Where there is significant exposure to lead, adequate protective clothing and suitable clothing storage and changing facilities should be provided.

Employees should be given adequate information and training concerning the hazards of lead poisoning and the means of prevention. Employees should use the equipment and facilities provided and co-operate with the employer in restricting the spread of lead contamination.

Medical surveillance is required in cases where there is significant exposure to lead. As part of medical surveillance regular biological testing should be carried out to detect any absorption of lead before the disease becomes evident. The
results of biological tests may also be used to show that control measures are effective in keeping absorption down to an acceptable level.

The spread of contamination from the workplace is related both to process control measures and to the standard of general cleanliness. Adequate steps should be taken to control such spread of contamination thus giving protection to people in adjacent workplaces and also to people in the neighbourhood.
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Code of Practice for the Control of Lead at Work

Application of Code
1. This Code applies to work which exposes persons (both employees and other persons) to lead (i.e. to the metal and its alloys, to compounds of lead, both organic and inorganic and to lead as a constituent of any substance or material) when such lead is in a form in which it is liable to be inhaled, ingested or otherwise absorbed by the person.

2. In practice this means that the Code will apply to any work from which lead arises:

   (a) in the form of lead dust, fume or vapour which is liable to be inhaled;
   (b) in any form in which it is liable to be ingested, e.g. lead powder, dust, paint or paste;
   (c) in the form of lead compounds which are liable to be absorbed through the skin, e.g. concentrated lead alkyls.

Work in this context will include any type of work activity, e.g. handling, movement, storage, processing, disposal, repairing, maintenance etc. The Code will not apply to work with materials or substances containing lead when the work is such that lead cannot be inhaled, ingested or absorbed by persons, as in the handling of finished articles containing lead, e.g. pottery.

3. The extent to which the Code applies to any specific work activity will depend on the nature and degree of the exposure to lead. A reference level for significant exposure to lead is given at Paragraph 9 of this Code. Where exposure falls below this level the Code requiring the provision of protective clothing, air monitoring procedures, medical surveillance and biological testing will not apply.

4. The aim is to ensure that the level of protection in any particular case is appropriate to the nature and degree of the exposure to lead in that case.

Duty of employer to persons other than employees
5. The employer whose work creates a lead hazard has a responsibility to ensure that he protects not only his employees but also other persons who are engaged on any work at the premises where the employer's work with lead is carried out and which exposes them to lead. These persons would include for example outside maintenance contractors engaged on maintenance of lead plant, or other persons such as contract cleaners, not directly engaged upon work with lead but whose work could expose them to lead. Any employer of these persons has his own responsibilities and should satisfy himself in his own right that adequate precautions are taken to protect his own employees.

Assessment of work which exposes persons to lead
6. Where any work may expose persons to lead, the employer should determine the nature and degree of the exposure.
7. The assessment should be revised when there is reason to suspect that it is incorrect and when there is material change in the work.

8. If the employer cannot ensure competent assessment from his own resources he may approach the Occupational Health Division of the Labour Department for assistance.

9. The exposure of persons at work should be considered significant if:
   
   (a) they are exposed to levels of airborne lead which are or are liable to be in excess of half the lead-in-air standard (see Appendix 1 for the lead-in-air standard);
   
   (b) there is substantial risk of ingesting lead;
   
   (c) there is a risk of skin contact with concentrated lead alkyls.

Where exposure of persons to lead is intermittent, e.g. a few hours a week, and such exposure is in excess of half the lead-in-air standard that exposure may be regarded as insignificant for the purposes of medical surveillance if the exposure level is below the lead-in-air standard (see Appendix 1) and in addition is below half the lead-in-air standard when averaged over a notional 40 hour week. Lead can be ingested inadvertently but the risk should only be regarded as substantial if the lead work is such that a person’s hands or face are liable to be considerably contaminated by lead which can then be ingested.

10. The results of an individual’s overall exposure to lead from inhalation, ingestion or skin absorption are best measured by means of suitable biological tests which measures the amount of lead absorbed by an individual or its biological effects.

11. There are some types of lead work where significant exposure to lead will occur unless adequate controls are provided. The following Table indicates such types of work and gives some examples of industries and processes where such work could be found. The information in the Table should not regarded as exhaustive.

<table>
<thead>
<tr>
<th>Types of lead work where there is liable to be significant exposure to lead (unless adequate controls are provided)</th>
<th>Examples of industries and processes where such work could be carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lead dust and fumes</strong></td>
<td>lead smelting and refining; casting of certain non-ferrous metals, e.g. gun metal; leaded steels manufacture; scrap metal and wire-patenting processes of lead coated and painted plant and surfaces in demolition work; shipbuilding, breaking and repairing; chemical industry; miscellaneous industries.</td>
</tr>
<tr>
<td>1. High temperature lead work (above 500°C), e.g. lead smelting, melting, refining, casting and recovery processes lead burning, welding and cutting</td>
<td></td>
</tr>
</tbody>
</table>
2. Work with lead compounds which give rise to lead dust in air, e.g. any work activity involving a wide variety of lead compounds (other than low solubility lead compounds as defined in Appendix 2)

3. Abrasion of lead giving rise to lead dust in air, e.g. dry discing, grinding, cutting by power tools

4. Spraying of lead paint and lead compounds other than paint conforming to BS 4310/68 and low solubility lead compounds (as defined in Appendix 2)

Lead alkyls
1. Production of concentrated lead alkyls
2. Inspection, cleaning and maintenance work inside tanks which have contained leaded gasoline, e.g. road, rail and sea tankers and fixed storage tanks

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12. There are some types of work where significant exposure to lead is not liable to occur unless the lead content and/or nature of the lead is altered by the work in such a way that there may be significant exposure to lead, e.g. in cases where, although the lead content is low, the lead is in a finely divided state which may be concentrated during processing. The following Table indicates the types of such work and gives some examples of industries and processes where such work could be found. The information in the Table should not be regarded as exhaustive.
### Types of lead work where there is not liable to be significant exposure to lead

<table>
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<tr>
<th>Lead dust and fumes</th>
<th>Examples of industries and processes where such work could be carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work with galena (lead sulphide)</td>
<td>mining and working of galena when its character or composition is not changed.</td>
</tr>
<tr>
<td>2. Low temperature melting of lead (below 500°C) (Such low temperatures control the fume but some care is still required in controlling any dust from dross)</td>
<td>plumbing; soldering; linotype and monotype casting processes in printing industry.</td>
</tr>
<tr>
<td>3. Work with low solubility inorganic lead compounds (when tested for low solubility as defined in Appendix 2)</td>
<td>painting with low solubility paints.</td>
</tr>
<tr>
<td>4. Work with materials which contain less than 1% total lead</td>
<td>brush painting with lead paint and the use of some stabilisers for plastics.</td>
</tr>
<tr>
<td>5. Work with lead in emulsion or paste form where the moisture content is such and is maintained so that lead and fume cannot be given off throughout the work duration</td>
<td>miscellaneous metal industries, metal stock-holding, general plumbing with sheet lead.</td>
</tr>
<tr>
<td>6. Handling of clean solid metallic lead e.g. ingots, pipes, sheets etc.</td>
<td>testing of petrol driven engines.</td>
</tr>
<tr>
<td>7. Lead emissions from petrol driven vehicles (other products of combustion such as carbon monoxide are the major risk)</td>
<td></td>
</tr>
</tbody>
</table>
industry or in relation to a specific work activity which enables an adequate assessment of exposure to be made;

(c) sufficient and suitable written information is available or has been obtained from manufacturers or suppliers of lead-bearing materials about their solubility and percentage lead content, e.g. of lead paints and colours.

15. In assessing the work in relation to the exposure to lead of persons other than those at work, all sources of lead giving rise to potential contamination outside the workplace should be identified so that action may, where necessary, be taken.

16. A material change in the work activity should be one where the process, plant or method of work is altered in such a way that the alteration is likely to affect the nature of the hazard, e.g. the raising of working temperatures for molten lead or changes in the exhaust ventilation system or changes in work layout without a corresponding change in the ventilation system.

17. Reasons to suspect that the assessment is incorrect should include any material change as outlined above, increased or excessive lead absorption in people working in areas where such absorption on the basis of the original assessment would have appeared to be unlikely.

Information, instruction and training
18. Every employer shall ensure that adequate information, instruction and training is given to his employees or others who are liable to be exposed to lead so that they are aware of the risks from lead and the precautions which should be observed.

19. The information, instruction and training given to employees or others who may be exposed to lead hazard and those with supervisory functions should have the objective of familiarising them as appropriate with:

(a) the health hazards of lead;
(b) the reasons for the nature of both the general control measures etc. which are required to protect themselves and other persons including their families who may be affected by their work with lead and the specific control measures etc. which are necessary in relations to each employee's own job;
(c) how the control measures etc. should be used if they are to be effective, e.g. the correct way of using respiratory protective equipment;
(d) the significance of air and biological monitoring;
(e) the role of medical surveillance;
(f) their responsibilities under the Code with particular emphasis on:
   (i) the need for correct use of the control measures etc. provided including personal protective equipment;
(ii) the need for cleanliness and to practice a high standard of personal hygiene;
(iii) the need to attend at the appointed time for medical examinations and biological tests;
(iv) the need to report any defects or inadequacies in the control measures which could affect the health of persons.

20. The methods used to achieve these objectives should preferably be integrated with and be a normal part of any information, instruction and training which is given to enable persons to carry out their job function, for example as part of practical training on how to use particular plant or equipment. In some cases formal training by means of seminars, lectures and discussion groups could be appropriate whereas in other cases on the job training by a knowledgeable supervisor could be more suitable. Refresher training should be given as appropriate to ensure that the over-all objectives are attained.

Control measures for materials, plant and process
21. Every employer should, so far as is reasonably practicable, provide such control measures for materials, plant and processes as will adequately control the exposure of his employees to lead otherwise than by the use of respiratory protective equipment or protective clothing by those employees.

22. The control measures for materials, plant and processes should be considered adequate when they effectively control the exposure of employees to:

(a) lead-in-air concentrations not exceeding the lead-in-air standard (see Appendix 1 for the lead-in-air standard and its interpretation);
(b) lead which can be ingested;
(c) lead which can be absorbed through the skin (e.g. concentrated lead alkyls).

23. The measures adopted to control such exposures should include where appropriate and reasonably practicable the use of one or more of the following:

(a) substitution by lead free materials or low solubility lead compounds as defined in Appendix 2;
(b) the use of lead or lead compounds in emulsion or paste form to prevent or minimise the formation of dust;
(c) the use of temperature controls to control the temperature of molten lead to below 500°C at which levels fume emission is insignificant. (But it should be noted that the formation of lead oxide and the emission of dust is still possible below this temperature.);
(d) the containment of lead in totally enclosed plant and in enclosed containers such as drums and bags. The enclosure should not allow lead to leak out and where opening of the enclosure is required, this should be done under exhaust ventilation where reasonably practicable;
where total enclosure is not reasonably practicable, an effective
exhaust ventilation system which should normally consist of:

(i) partial enclosures such as booths which enclose the lead at source
and prevent its escape outside the enclosure by the application of
an exhaust draught;

(ii) various types of hoods which are used when it is not reasonably
practicable to enclose the source of pollution. The air movement
in the hoods should entrain the lead dust, fume or vapour and
carry it into the exhaust system. To be effective these hoods
should be placed as near as practicable to the point of origin of
the lead dust, fume or vapour and draw the dust, fume or vapour
away from any person’s breathing zone;

(iii) ductwork with an airflow of adequate conveying velocity;

(iv) a dust and/or fume collection unit with filtration or arrestment
equipment as necessary. Lead contaminated air from the exhaust
system should not be discharged after filtration from the system
into:

(1) work areas unless the concentration of lead in the exhaust air
is less than one-tenth of the lead-in-air standard (see
Appendix 1 for the lead-in-air standard);

(2) other areas such as the general environment unless it has
been adequately treated;

(v) fans or other air movers of a suitable type for the system which
should be placed in the system after the collection and filtration
unit so that the unit is kept under negative pressure thus
minimising the escape of lead.

(f) wet methods which include:

(i) the wetting of lead and lead materials, e.g. wet grinding and
pasting processes. Wet methods should be used for rubbing or
scraping down lead painted surfaces;

(ii) the wetting of floors and work benches while work is being
carried out, e.g. certain work with dry lead compounds and
pasting processes in the manufacture of batteries.

The wetting should be thorough enough to prevent the formation of
dust and the wetted materials or surfaces should not be allowed to dry
out as this can create dry lead dust which is liable to be hazardous if it
becomes airborne. Water sprays should not normally be used to
to control an airborne dust cloud as they are unlikely to be effective.
Wetting should not be used where such methods are liable to be
unsafe, e.g. at furnaces where the use of wet methods could constitute
an explosion risk. Neither should wetting be used where lead materials
containing arsenides or antimonides could on contact with water
evolve arsine or stibine gases.

24. The control of lead in the workplace should not be at the expense of the
external environment which is controlled by the Air Pollution Control
Ordinance. Where emission of lead dust, fume or vapour to the general environment may occur there should be consultation with the Air Pollution Control Division of the Labour Department.

25. Special attention should be given to the design of plant and systems of work so as to eliminate or reduce persons' exposure to lead. Care should be taken to avoid external ledges on plant on which lead dust can settle; plant surfaces should be smooth and impervious so far as is reasonably practicable to facilitate cleaning; good joints and seals should be provided to prevent leakages. In particular when new plant is commissioned, checks should be made to ensure that design specifications are in fact adequate for the specific work activity and that compliance can be achieved under full production operating conditions. It is desirable that the design of ventilation plant should be carried out by ventilation specialists.

26. Control measures should always be set in the context of the total work environment with the aim of reducing exposure to lead through all stages of the work cycle. Particular attention should be given to methods of work, e.g. when exhaust booths are used for weighing out lead material attention should be given to how the material is brought to the booth and how it is handled after work has been completed inside the booth, as it is not sufficient to concentrate only on one aspect of the work to the neglect of other aspects which can be equally hazardous.

Respiratory protective equipment

27. Appropriate respiratory protective equipment should be provided for any person who is exposed to airborne concentrations of lead in his breathing zone in excess of the lead-in-air standard (See Appendix 1 for the lead-in-air standard).

28. The objective should be to reduce lead-in-air concentrations by means of control measures for materials, plant and processes so as to eliminate the need to wear respiratory protection. There are however certain situations, e.g. some maintenance operations, etc. where respiratory protective equipment will always be required.

29. Selection of respiratory protective equipment should be based upon:
   (a) the extent of the airborne hazard as indicated by air monitoring;
   (b) the nature of the hazard;
   (c) the standard of protective afforded by different types of respiratory equipment;
   (d) work requirements and conditions, e.g. the length of time the equipment is to be worn, the type of work to be done;
   (e) facepiece fit for the wearer.

30. Arrangements should be made to ensure that no person uses respiratory protective equipment which has previously been used by another person unless it has been thoroughly washed and cleaned.
31. All respiratory protective equipment should be properly maintained.

Protective clothing

32. Adequate protective clothing should be provided to reduce exposure to lead by protecting personal clothing and the body from contamination by lead and help prevent the spread of lead by reducing the chance of contaminated clothing being taken home. The type and design of the clothing and the material from which it is made will be governed by the nature and amount of lead to which the employees are exposed. Where exposure to lead exists in conjunction with hazards such as molten metal, corrosives, wet processes or bad weather, then these should be taken into account and a balance achieved to afford the best protection that is reasonably practicable.

33. In many cases normal overalls should give adequate protection provided that they are in good repair and are kept clean. Where there is no accumulation of lead dust on the floor it is unlikely that protective footwear would be required. Protection for the face and hands should not normally be considered necessary but is essential for the prevention of skin absorption of lead alkyls and some other organic lead compounds which can be absorbed through the skin if they are used in certain carrier media.

34. If outer protective clothing e.g. boiler suit or overalls, cannot be worn in such a way that the clothing underneath is not contaminated by lead, then such clothing should be classified and issued as protective clothing. Similarly if additional clothing is required, e.g. for outdoor work in bad weather, then if that clothing is worn on top of the overalls, it too should be classified and issued as protective clothing.

35. Where the assessment indicates that the amount of lead to which employees are liable to be exposed is such that normal overalls would not afford adequate protection, then the selection of the protective clothing should take into account:

(a) the ability of the material to resist penetration by lead dust;
(b) the dust release characteristics of the material;
(c) the design of the clothing, e.g. close fitting at neck and arm openings.

36. For lead alkyls where the work presents risk of skin contact, impermeable protective clothing is essential. For certain maintenance operations and entry into vessels which have contained lead alkyls such clothing should afford full protection and could comprise for example an air-supplied suit and helmet or hood together with suitable footwear.

37. Protective clothing and footwear should be issued on a personal basis or job basis as appropriate and should be clearly identifiable so that it can be easily sorted and correctly allocated after cleaning or repair. For most items of clothing at least two sets should be provided; one to wear and one for cleaning and/or repair with more sets being issued as appropriate.
Washing and changing facilities

38. Washing and changing facilities should be provided to enable persons at work to meet a high standard of personal hygiene so as to minimise the risk of them ingesting or otherwise absorbing lead. The design of the washing facilities should be related to the nature and degree of exposure to lead as indicated by the assessment carried out. Where there is significant exposure of persons to lead and if wash basins alone would not be adequate, the washing facilities should include showers or baths, e.g. where work is carried out in dusty conditions which could result in whole body contamination by lead, then the provision of showers or baths would be essential.

39. Where a need is indicated by the assessment, special attention should be paid to the location of the facilities to prevent the spread of contamination by lead from protective clothing to personal clothing and from one facility to another. This should be achieved by:

(a) separation of the changing and storage accommodation for protective clothing, protective footwear and respiratory protective equipment from that for personal clothing and footwear not worn during working hours by means of having separate rooms or having rooms divided into clean (personal clothing) and dirty (protective clothing) areas. Personal clothing should not be allowed in the dirty room or area and protective clothing should not be allowed in the clean room or area. The separation of a room into clean and dirty areas should only be considered acceptable when the standard afforded is similar to that which would be achieved by the use of separate rooms.

(b) where space permits and where the risk of contamination cannot be otherwise effectively controlled, the washing and shower facilities should be integrated with the clothing and changing accommodation so that they are located between the facilities for personal clothing and those for protective clothing to enable:

(i) persons to remove lead contaminated clothing and footwear in one room or area;

(ii) then to pass into the washing and bathing area; and

(iii) finally pass into the clean room or area where they can put on clean clothing and footwear.

40. For certain types of work, such as lead work carried out at premises or sites where such work is not regularly done, e.g. certain tank cleaning and lead burning operations, mobile caravan-type facilities of suitable design should be provided. Such facilities could also be considered for use in premises where space for further buildings is limited.

41. The facilities should be laid out, so far as is practicable, to encourage the correct directional flow of persons between the facilities and avoid congestion. Consideration should be given to their location in relation to other facilities such as clothing issue rooms, drying rooms, refreshment facilities and clocking-on points so as to minimise the spread of contamination and also to enable the facilities to be conveniently used.
42. Attention should also be paid to design features. Walls, ceilings, floors, wash basins, baths and showers should have smooth impervious surface which can be easily washed or cleaned and which cannot trap lead and dirt in corners and crevices. Smooth painted washable surfaces, ceramic surfaces and stainless steel surfaces should be considered suitable.

43. In the clothing accommodation, sufficient lockers, hangers, hooks or other storage appliances should be provided to cope with the clothing of the maximum number of persons who will require the use of the accommodation. Adequate provision should be made for any outside contractors or visitors who may be exposed to lead arising from the work activities.

44. The washing and shower facilities should be supplied with:
   (a) wash basins of sufficient dimensions to enable arms to be immersed up to the elbow;
   (b) a constant supply of running hot and cold or warm water;
   (c) soap or other cleaning materials;
   (d) nailbrushes;
   (e) individual towels or other means of drying.

Towels dispensed from roller tower machines should be considered suitable as long as they afford a clean drying surface for each person. Communal towel should not be provided.

45. The number of wash basins, showers or baths provided should enable the maximum number of persons expected to use them at any one time to do so without undue delay. Account should be taken of starting and finishing times and the time available for the use of the facilities. For persons significantly exposed to lead at work and expected to use the facilities at any one time there should be provided:
   (a) (i) one wash basin for every 5 persons or
        (ii) 600 mm of trough for every 5 persons;
   (b) (i) one shower or bath for every 5 persons who may be expected to shower or bath daily at one time;
        (ii) an adequate number of showers or baths for people such as maintenance staff and cleaners who are likely to do occasional dirty jobs which may expose them to a high degree of contamination.

Eating, drinking and smoking

46. Employers should ensure that employees do not eat, drink or smoke in any workplace where there is a lead hazard. Suitable arrangements should be made for eating, drinking and smoking in a place which is not liable to lead contamination.

47. An employee should not eat, drink or smoke in any place he has reason to believe to be contaminated by lead.
48. Suitable arrangements for employees to eat, drink or smoke in a place which is not contaminated by lead will be vary according to circumstances. Where exposure to lead is liable to be significant (see paragraph 9), suitable arrangements for use where persons remain at their workplace during main meal intervals should consist of a canteen, mess room or other suitably designated clean eating area. Whenever it is reasonably practicable, such facilities should be provided with suitable tables and chairs and suitable facilities for the storage of food and drink, whether the food and drink is supplied by the employer or the employees. In order to reduce the risk of contamination of the facilities and of the food and drink, persons should remove contaminated clothing and wash before partaking of food and drink; the relative locations of the eating and drinking arrangements and the washing and changing accommodation should be such as to facilitate meeting this objective. Where exposure to lead is not significant any clean area located away from where lead work activities are carried out would be acceptable.

49. Where exposure of persons to lead is liable to be significant, it should be considered that additional drinking facilities are required for the welfare of employees when it is not reasonably practicable to use the main facilities for short breaks such as tea breaks. Under these circumstances vending machines dispensing only liquid refreshment in disposable containers may be provided. If such machines are used, they should be so designed, located and controlled that both the drink and the container are protected against contamination by lead. They should also be located near washing facilities so that employees may wash their hands and faces before drinking. If drinking fountains are provided they should be similarly so designed, located and controlled as to protect the water against contamination by lead.

Cleaning

50. Where an employee is liable to be exposed to lead, the employer should take adequate steps to secure the cleanliness of work places, premises, plant, respiratory protective equipment and protective clothing.

51. Workplaces and premises should include:
   
   (a) areas in which lead is liable to be present;
   
   (b) changing and clothing accommodation;
   
   (c) washing and bathing facilities;
   
   (d) eating and drinking facilities.

52. Adequate steps should include:
   
   (a) having a procedure for cleaning and that procedure should specify:
       (i) the name or job status (e.g. shift foreman) of the person responsible for overall supervision of the cleaning procedure;
       (ii) the area, plant, equipment or clothing to be cleaned;
       (iii) the minimum frequencies for such cleaning;
       (iv) the method of cleaning;
providing, particularly in areas where lead dust is liable to accumulate, smooth and impervious surface for floors, inside walls, ceilings, workbenches and external surfaces of plant, so that cleaning is facilitated.

53. The cleaning should be done as frequently as is necessary to secure cleanliness and the removal of lead deposits thus reducing the risk of inhalation and ingestion of lead. In particular the following should be cleaned at the minimum frequencies given below:

(a) floors and workbenches at least once a day;
(b) external plant surfaces where readily accessible once a day;
(c) respiratory protective equipment at the end of every shift or work period;
(d) protective clothing should be washed, cleaned or renewed at least once a week; and
(e) washing and changing facilities and facilities for eating and drinking should be washed, cleaned etc. at least once a day.

The frequency of cleaning inside walls and ceilings will vary according to the degree of contamination. Overhead ledges and other fixtures should be cleaned as frequently as necessary to prevent the accumulation of lead deposits which can be dislodged and become airborne.

54. The methods of cleaning should not create a risk from lead to the cleaners or other persons or spread contamination. Acceptable methods include:

(a) wet cleaning;
(b) the use of mobile or fixed vacuum cleaning apparatus equipped with high-efficiency filters.

When wet cleaning is carried out care should be taken to ensure that surfaces are kept free from wet sludge which could be transferred by internal transport systems to other lead free areas and which, if it dries not, can create a substantial amount of airborne dust. Dry brushing and sweeping methods should not be used to remove lead dust.

55. Respiratory protective equipment should be thoroughly washed and cleaned in accordance with the maker’s instruction.

56. Protective clothing and towels should preferably be cleaned at the premises where work with lead is carried out. If protective clothing and towels are sent to outside agencies for cleaning, the agencies should be alerted to the lead risk and the need to ensure that cleaning is carried out without risk to persons. Protective clothing and towels should not be taken home by employees for cleaning.

57. When lead contaminated clothing is sent out for cleaning it should be placed in suitable impermeable containers or bags which should be labelled ‘lead contaminated clothing’. Where in-plant laundering is carried out
arrangements should be made which are sufficient to prevent spread of contamination.

58. The employee who carries out a particular job should in general be made responsible for the clearance of any spillages from it.

Avoidance of spread of lead contamination

59. Employers and employees should prevent the spread of contamination by lead for the place where work is carried out.

60. The objective should be to prevent lead being spread outside lead work areas resulting in the exposure to lead of:
   (a) other employees not engaged on lead work;
   (b) other persons such as the families of employees and the general public.

61. This objective should be achieved by:
   (a) the control and containment of lead in the areas where it is worked;
   (b) the control of all lead emissions from these areas by whatever means they are carried, e.g. air, water, vehicle wheels, etc.

62. Control measures if properly used should contain most of the lead within lead work areas. Areas where there is a significant risk of contamination should be suitably demarcated from other areas, for example by means of the use of separate rooms or of clearly identifiable layouts. Lead should be contained within these demarcated areas which should cover every aspect of the work from the storage of the raw materials to the despatch of the finished product.

63. Airborne emissions from lead work should be controlled by limiting the amount of lead discharged, for example by the use of process controls, filtration or arrestment plant. Lead processes as defined in the legislation are subject to licencing under the Air Pollution Control Ordinance.

64. Waterborne emissions should be controlled in accordance with the Water Pollution Control Ordinance.

65. Other sources of contamination should be controlled in particular by:
   (a) high standards of cleanliness;
   (b) the decontamination of lead contaminated plant, containers, tools, transport vehicles etc. by suitable methods such as water washing before they leave the premises where lead work is carried out. Special attention should be paid to the washing of wheels and wheel arches of transport vehicles;
   (c) preventing loss of material, by sheeting or other methods, from vehicles transporting lead in a form liable to spill on to roadways or to release dust to the atmosphere;
   (d) given careful attention to land routes such as internal roadways, yards and passageways which should have hard even surfaces which can be kept clean;
(e) locating the washing and changing facilities, where reasonably practicable, so as to ensure that persons leaving work do not have to pass through lead contaminated areas after using the facilities;

(f) taking steps to ensure that employees do not carry lead outside the premises on their persons, clothing, stocks, footwear etc. (see Paragraph 56).

66. Employees should:

(a) use any control measures provided to prevent the spread of contamination by lead;

(b) take particular care to practise a high standard of personal hygiene and use the hygiene controls provided so that lead is not taken outside the premises on any part of their bodies and clothing including socks and footwear as this could put their families at risk;

(c) ensure that contaminated clothing and towels are not taken home to be laundered or for any other reason.

67. When there is reason to suspect that lead workers' families or other members of the public may be affected by lead arising from work activities, employers should maintain a close liaison with local authorities who have wide responsibilities for maintaining public health.

Use of control measures

68. There should be procedures for ensuring that control measures are properly used or applied and these should be part of the normal supervisory function. Procedures will therefore vary but they should include:

(a) visual checks at least once a shift where appropriate;

(b) note of when and where the control measures are not being properly used or applied;

(c) the institution of prompt remedial action.

69. Employees should use the control measures in the way they were intended to be used, e.g. if an exhaust booth is provided, the work should be done inside the booth where it is under the influence of the existing draught.

70. Employees should in particular:

(a) use the control measures provided for materials, plant and processes;

(b) wear in the proper manner respiratory protective equipment and protective clothing provided when the control measures for materials, plant and processes cannot provide adequate protection. Any clothing such as cardigans and pullovers should not be worn on top of protective clothing;

(c) keep the respiratory protective equipment and protective clothing only in the accommodation provided for them and not elsewhere. Protective clothing should not be kept in the accommodation for personal clothing not worn during working hours and personal clothing should not be kept in the accommodation for protective clothing;
(d) remove protective clothing before eating and drinking at main meal
breaks and on other occasions if it is likely that lead on the protective
clothing could contaminate the food, drink and related facilities;
(e) remove protective clothing and place it in the accommodation
provided for it before leaving the premises where work with lead is
carried out;
(f) make proper use of the washing facilities—
   (i) before eating, drinking, smoking or carrying out any activity
       which could cause lead to be ingested; and
   (ii) before leaving the premises to prevent lead being carried outside
       the premises;
(g) make proper use, before leaving the premises, of any shower or bath
facilities provided if they are employed in jobs where there is a high
risk of bodily contamination;
(h) keep the place of work clean and co-operate fully in relation to the
    cleaning procedures adopted;
(i) use the canteen, messroom or other eating and drinking facilities
    provided and in particular use any facilities provided for the storage
    of food and drink which should not be kept or stored in lead
    contaminated areas.

Maintenance of control measures
71. Control measures, respiratory protective equipment and protective
clothing should be maintained in an efficient state, in efficient working order and
good repair.

72. The object of the maintenance should be to ensure that control measures
are effective in protecting persons from lead and that any defects which could
result in a loss of efficiency of the controls are detected and remedied.

73. Maintenance in this context should not merely refer to work carried out by
maintenance workers engaged for example on plant repair but also to any work
which is carried out to secure the efficiency of control measures which may be
the responsibility of workers other than maintenance workers.

74. Maintenance procedures should be drawn up to suit the individual work
situation but the procedure should be such that it is clear:
   (a) what control measures require maintenance;
   (b) how the maintenance should be carried out;
   (c) when the maintenance should be done;
   (d) how any defects disclosed by such maintenance should be remedied;
   (e) who is responsible for that maintenance.

75. The control measures to be maintained should include:
   (a) materials, plant and process control measures;
   (b) respiratory protective equipment;
   (c) protective clothing;
(d) washing and changing facilities;
(e) arrangements to ensure that employees do not eat and drink in places which are contaminated by lead;
(f) cleanliness controls;
(g) controls to prevent the spread of contamination.

76. The maintenance methods should include:
(a) visual checks to detect obvious defects in the control measures;
(b) more thorough examination and tests using instruments where appropriate to assess the efficiency of technical controls such as exhaust ventilation system.

77. The intervals between visual checks and thorough examinations and tests should be determined according to the individual work situation but:
(a) a general visual check should be carried out at least once a week;
(b) respiratory protective equipment should be checked before and after each occasion of use and in addition self-contained and airline breathing apparatus should be thoroughly examined and tested at least once a month by a competent person;
(c) exhaust ventilation equipment should be thoroughly examined and tested at least once a year by a competent person.

78. The weekly visual check on an exhaust ventilation system should be aimed at identifying obvious defects in the equipment, such as damage, wear, malfunctioning etc. which could result in ineffective extraction and leakage of lead dust, fume or vapour from the system.

79. The yearly thorough examination and test of an exhaust ventilation system should include:
(a) a thorough examination, both internally and externally where appropriate, of the condition of all parts of the system, i.e. exhaust openings, collection hooks or suction points, ductwork, dust collection and filtration units, fans or air movers;
(b) measurements of static pressure at a point in the duct immediately behind each exhaust opening, collection hood or suction point when the equipment is simultaneously extracting from all points served;
(c) measurements of air velocities at the plane of openings to enclosures, collection hoods or suction points for which standard velocities have been specified;
(d) an assessment of whether or not the lead dust, fume or vapour is being effectively controlled at each exhaust opening, collection hood or suction point.

80. Procedures for remedying defects should include provision for replacement, repair and remedial action within specified time limits which will range from immediate action to action within a few weeks or months dependent on the degree of risk.
81. Checking and maintenance procedures should where feasible be integrated with the normal production activity, e.g. visual checks to detect obvious defects such as damaged protective clothing and leakages from enclosures should be carried out by persons as part of their daily work routine. Some employers might wish to delegate maintenance to supervisors while giving the responsibility for overall supervision of maintenance procedures to one person. Persons with special skills should be made responsible for the thorough examination and tests of breathing apparatus and exhaust ventilation systems.

82. Records should be kept of the monthly examination and test of breathing apparatus and the yearly examination and test of exhaust ventilation plant. Other records should be kept as appropriate where their keeping is conductive to securing adequate maintenance.

Monitoring

83. Monitoring of lead-in-air levels and of exposed persons should be carried out when lead exposure is significant. The two approaches have complementary roles.

84. Measurements of the concentrations of lead in the air in the breathing zone of employees and in the general workplace atmosphere, with reference to a lead-in-air standard, provide the most direct and suitable basis upon which engineering provisions for the control of airborne lead can be introduced, assessed for effectiveness, improved and monitored for performance. On the other hand, measurements of blood lead or, in the case of alkyls, urinary lead provided for each employee, or for a group of employees, an index of lead absorption over a period of exposure. The results of biological testing can be thus reflect the effectiveness of hygiene provisions and precautions in general. Complete and effective occupational hygiene practice, where there is significant exposure to lead, thus requires periodic measurements to be made of both lead-in-air concentrations and lead absorption.

85. If an employer cannot provide reliable environmental and biological monitoring from his own resources he may approach the Occupational Health Division for assistance.

86. If employers are using their own professional staff to ensure lead safety and such staff are invited to establish contact with the Occupational Health Division, which will be able to give advice and assistance if required. Detailed information on environmental and biological monitoring and record keeping is available in such circumstances to provide the guidelines for effective control action.
APPENDIX 1

The Lead-in-Air Standard

The standard of lead-in-air is an 8-hour time-weighted average concentration:

Lead (except for tetraethyl lead) (as Pb) 0.15 mg/m$^3$ of air

Tetraethyl lead (as Pb) 0.10 mg/m$^3$ of air
Definition of a low solubility inorganic lead compound

1. A low solubility lead compound is a compound which does not yield to dilute hydrochloric acid more than 5% of its dry weight of a soluble lead compound calculated as lead monoxide when determined in the manner described in the standard test below. If a lead compound is dispersed in a liquid, e.g. paint, then the solid matter should be separated by a suitable method, e.g. centrifuging, before applying the standard test and the results should be reported as a percentage of soluble lead in solid material.

2. The standard test is as follows:
   a weighed quantity of the material in the form in which it is used or processed which has been dried at 100°C and thoroughly mixed is to be continuously shaken for one hour at 23°C ±2°C with 1 000 times its weight of 0.07N hydrochloric acid. This solution is thereafter to be allowed to stand for one hour and then filtered before being analysed by means of suitable analytical techniques which include colorimetry, polarography, anodic stripping voltametry and atomic absorption spectroscopy. Atomic absorption spectroscopy has the least inaccuracy (0.1 µg/ml) and is the preferred technique.
Code of practice for control of lead at work
Hong Kong : Labour Dept. , [1986]