

Australian Standard™

**Guide to the investigation of potentially
contaminated soil and deposited dust as
a source of lead available to humans**



This Australian Standard was prepared by Committee EV/9, Sampling and Analysis of Soils and Biota. It was approved on behalf of the Council of Standards Australia on 29 February 2000 and published on 26 April 2000.

The following interests are represented on Committee EV/9:

Agriculture Victoria
Association of Consulting Engineers, Australia
Australian Collaborative Land Evaluation Program
Australian Government Analytical Laboratory
Australian Institute of Environmental Health
Australian Institute of Medical Scientists
Australian Society of Soil Science Incorporated
CSIRO – Land and Water
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PREFACE

This Standard was prepared by the Joint Standards Australia/New Zealand Committee EV/9, Sampling and Analysis of Soils and Biota as part of a series on the identification, analytical methods and investigation procedures for the assessment of deposited dust and soil. The Standard is the result of consensus among representatives on the Joint Committee to produce it as an Australian Standard.

The Committee acknowledges the assistance of the following documents:

- (a) Jason Bawden-Smith, *Identification and remediation of lead sources in a child's home environment*, Public Health unit for Central and Southern Sydney, 1993.
- (b) *Inorganic Lead*. Environment health Criteria No. 165. Geneva: World Health Organization, 1995.
- (c) *Toxicological Profile for Lead*. Draft for Public Comment (Update). Atlanta: United States Department of Health and Human Sciences, 1997.
- (d) *Sampling House Dust for Lead*. Basic Concepts and Literature Review. Washington: United States Environmental Protection Agency, 1995.

The objective of this Standard is to derive the information that may be required to satisfy regulatory authorities, although additional detail may be required in some situations. The Standard does not prescribe levels of lead, which are considered to pose a risk to human health or the environment. Information on safe levels of lead in environmental media is prescribed in documents such as the criteria produced by ANZECC/NHMRC, or various regulatory agencies.

This Standard provides guidance for the sampling and investigation process to professionals engaged in these activities. The professionals should consider the relevance of the various components of this Standard to the particular situation that is being investigated and apply them accordingly. Where site-specific issues are raised, which are beyond the scope of this Standard, the relevant expertise should be sought and investigations targeted accordingly.

The contamination of houses, soil and groundwater by inorganic lead species has been well recognized and acted upon in Europe, North America and Australia. Inorganic lead from house dust and soil poses significant health risk to humans. Infants are known to be the most sensitive group of the population and it is generally acknowledged that their major pathway of uptake is through exposure to house dust.

Exposure to lead can cause intellectual and behavioural disabilities in children. For this reason, there is particular interest in sampling deposited dust from areas, particularly within houses, with which infants would come in contact. Although infants generally do not have significant contact with soil outside a dwelling, this medium may constitute a major pathway of exposure for older children and adults. In general, the layer from which most absorption will occur is the uppermost 20–50 mm.

It is assumed that executing the provisions of this Standard will be entrusted to appropriately qualified and experienced people. The Standard calls for the use of procedures that may be hazardous or injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Contaminated soils may also have an effect on the surrounding environment. Therefore, investigation of air, biota, surface water and groundwaters should be performed where appropriate. In addition, where adverse health effects resulting from house dust or soils contaminated by inorganic lead are suspected, suitable biological monitoring of the affected population should also be carried out.

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STANDARDS AUSTRALIA

Australian Standard

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Guide sets out procedures for the collection of deposited dust and soil samples to ascertain whether inorganic lead is present in sufficient quantities to cause toxicity in humans. Because infants constitute the most sensitive group as regards sublethal lead toxicity, special emphasis is placed upon the collection of samples from areas with which this population group would come into contact.

1.2 REFERENCED DOCUMENTS

AS

4482 Guide to the sampling and investigation of potentially contaminated soil

4482.1 Part 1: Non-volatile and semi-volatile compounds

ISO

3696 Water for analytical use—Specification and test methods

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.3.1 Area concentration

Concentration expressed as mass of dust or lead per unit area.

1.3.2 Cohesive soil

Cohesive soils are plastic soils, i.e. contain clay. When these soils dry out they are very hard. In the field they can only be penetrated one or two centimetres with considerable effort by thumb.

1.3.3 Composite sample

A sample resulting from the bulking and thorough mixing of dust or soil samples collected from more than one location to form a single sample for chemical analysis.

1.3.4 Contaminated

The state or condition of the area, where the concentration of lead exceeds the investigation value acceptable to the appropriate authority.

1.3.5 Contaminated house dust

Surface dust in residential dwellings that contain an area or mass concentration of lead, in excess of the investigation value, which is considered to pose a threat of adverse health effects in the population group likely to come into contact with the material.

1.3.6 Data quality objective (DQO)

A qualitative and quantitative statement derived from each of the following steps of the DQO process:

- (a) Clarification of the study objective.
- (b) Definition of the most appropriate type of data to collect.
- (c) Determination of the most appropriate conditions from which to collect data.
- (d) Specification of acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to produce a satisfactory assessment of exposure.

1.3.7 Dust loading

The area concentration of dust.

1.3.8 Exposure profile

The record of the subject's exposure as a function of time throughout the day.

1.3.9 Firm soil

In Engineering terms a 'firm' soil is one which is cohesive, has high compressibility and poor trafficability (i.e. trucks will bog in this soil).

1.3.10 Lead loading

The area of concentration of lead.

1.3.11 Mass concentration

The concentration of lead, expressed as mass of lead per unit mass of dust.

1.3.12 Sandy or loose soil

In engineering terms, a soil which is non-cohesive and has low compressibility.

1.3.13 Wipe sampling

The collection of dust by wiping surfaces with a medium (e.g. laboratory wipes), which will retain particles in the size range of interest. Usually, the collection medium is moistened with a liquid such as dilute mineral acid or denatured alcohol.

1.3.14 Vacuum sampling

The collection of dust by application of a vacuum to the surface under investigation. The collected dust is trapped either in a suitable receptacle or on a particle filter.

1.4 PRINCIPLE

The sampling areas are selected by determining the places to which the population has maximal exposure. In all instances, the habits of the population should be taken into account in choosing the areas to be sampled. In the case of deposited dust, wipe sampling is advocated for sampling smooth surfaces (e.g. polished wooden floors, window sills) and collection with a purpose-built filter unit, connected to a vacuum pump is advocated for sampling rough surfaces such as carpets. The latter type of apparatus is also used for sampling of accumulated dust from pavements and gutters. In the case of soil, the upper 20-50 mm are removed with the aid of a stainless steel trowel.

SECTION 2 BACKGROUND INFORMATION

2.1 GENERAL

All the media from which lead can be absorbed have different characteristics. In this Standard, some basic information on lead in these media is presented. Depending upon its origin, deposited dust may contain a variety of particle sizes. For example, a significant proportion of house dust consists of fine particles.

2.2 HOUSE DUST

2.2.1 General

The sources of dust, its distribution and availability to humans vary greatly. This variation, as well as the choice of sampling method, will therefore affect the interpretation of results from surveys of house dust.

2.2.2 Sample collection

A very large number of methods for the collection of house dust samples have been devised and their applicability varies according to the site from which the dust is to be collected (e.g. different methods are required for collecting dust from carpets as opposed to collecting dust from polished furniture). It should be noted that the sampling methods are not necessarily equivalent, nor is any one method applicable to all situations. Because collection of samples from different surfaces requires the use of specific methods, surveys of lead in house dust will generally involve the use of more than one sampling technique.

2.2.3 Route of entry

It is generally agreed that house dust enters the gastrointestinal system through ingestion of particles that adhere to infants' hands. Most studies indicate that lead in deposited house dust is concentrated in the smaller particles and gastrointestinal absorption of lead is most efficient from particles in the lower size range. It has been shown that lead is most likely to be absorbed from dust particles less than 250 µm in diameter.

2.2.4 Sources of lead

Lead in deposited house dust comes from a range of sources and can be expected to contain a variety of lead compounds. The lead deposited in a house will be the product of a number of factors including:

- (a) Area of exposed soil adjacent to the building.
- (b) Material of which the house is constructed and the age of the dwelling.
- (c) Renovation activities being conducted on the building.
- (d) Distance from roads.
- (e) Distance from commercial garages.
- (f) Distance from mining and smelting operations.
- (g) Dustfall rates and suspended particles indoors.
- (h) Carpet wear.
- (i) Presence of a fireplace.
- (j) Conduct of hobbies involving lead (e.g. soldering).
- (k) Nature of internal paintwork materials.

2.3 EXTERNAL DEPOSITED DUST

2.3.1 General

As with internal house dust, external deposited dust may arise from a number of sources and the material collected in a sample will be a product of the sampling method and sampling locations chosen. The concentration of lead in external deposited dust may vary widely between samples taken from different locations.

2.3.2 Sample collection

External dust, accumulates on a variety of surfaces and can be collected by brushing from hard and brushable surfaces.

2.3.3 Route of entry

As with house dust, the lead levels are highest in the smallest particles (see Clause 2.2.3). In the case of deposited external dust, children not infants are the major population group at risk through exposure. Hence, different pathways are probably operative, as regards uptake of lead from the dust.

2.3.4 Sources of lead in deposited external dust

Lead in deposited external dust comes from a variety of sources. Thus, external dust can be expected to contain a range of lead compounds. The lead deposited on an external surface will be the product of a number of factors, including:

- (a) Area of exposed soil, adjacent to the site.
- (b) Material of which adjacent buildings are constructed and the age of the buildings.
- (c) Renovation activities being conducted on adjacent buildings.
- (d) Distance from roads.
- (e) Distance from commercial garages.
- (f) Distance from mining and smelting operations.
- (g) Dustfall rates and suspended particles.
- (h) Prevailing winds immediately prior to sampling.

2.4 SOIL

2.4.1 General

Lead-contaminated soil is found in a number of areas. Variation in lead concentration occurs in both horizontal and vertical directions. Where the lead has been deposited as dust on the surface of the soil, maximum lead concentration occurs on the soil surface.

2.4.2 Sample collection

Lead may be restricted to the surface layer of the soil or be distributed throughout the soil profile, depending upon the source of the contamination. Because the aim of the investigation is to assess the risk of human exposure, samples are collected from the uppermost layer only.

2.4.3 Route of entry

As with deposited dust, the lead levels are highest in the smallest particles. In the case of soil, children not infants are the major population group at risk through exposure. Hence, different pathways are probably operative, as regards uptake of lead from the soil and there is a higher probability that absorption will also occur from particles in the larger size range.