REPORT OF THE

LEAD IN SOIL AND DUST

WORKING GROUP

Prepared for the

NSW GOVERNMENT LEAD TASKFORCE

January 1994

TERMS OF REFERENCE

Following is the Terms of Reference for the Lead in Soil and Dust Working Group of the NSW Lead Taskforce as minuted and accepted by the Group.

1. To analyse the issue of lead in soil and dust in the New South Wales context taking account of the Government's Lead Issue Paper.

2. To coordinate the resources and personnel appropriate to addressing this issue.

3. To identify measures required to alleviate the burden of lead as it impacts human and environmental health by means of one or more of the following:

    * phased reduction campaigns
    * health monitoring
    * decontamination programs
    * soil treatment/remediation programs
    * community education/awareness programs
    * provision of advice to interested parties
    * field studies and environmental monitoring systems
    * environmentally safe disposal methods
    * data collection
    * review of and/or assessment of the need for legislation

4. To report to the Taskforce on progress on a monthly basis, or more frequently as appropriate.

5. To provide a final proposed strategy for dealing with the issue of lead in soil and dust which includes an analysis of costs and distributional impacts, by the deadline specified in the Lead Issues Paper.

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RECOMMENDATIONS

The Lead in Soil and Dust Working Group recommend to the NSW LEAD TASKFORCE that:

1. the Taskforce ensure that a watching brief for worlds best practice be maintained for the environmental management of lead.

2. a preliminary self assessment questionnaire be developed as part of the community education material.

3. health risk assessment be coordinated between the different Working Groups and that an appropriate questionnaire be developed for use when undertaking blood lead tests.

4. comprehensive education campaigns be developed for important target groups such as local council officers, health-care providers, parents, property owners, day-care providers, and early childhood educators, in consultation and coordination with National, State and Local Governments, and the community.

5a. the uppermost 20 mm soil sample be taken for health risk assessment purposes, and the uppermost 50 mm soil sample for site assessment purposes.

b. during sample preparation sub-samples representing the less than 2 millimetre and less than 150 micrometre particles should be prepared for lead determination.

c. the above recommendations 5a and 5b be forwarded to Standards Australia for consideration by the Committee CH/28 Analysis of Soils and Biota.

d. the sampling program design, sampling techniques, sample preparation and sample analysis procedures once drafted by Standards Australia CH/28 be assessed by the Lead Taskforce, and if appropriate, be adopted as part of the lead strategy.

6a. research should be directed to provide a standardised method of house dust collection, sample preparation and sample analysis.

b. research should be directed to test domestic and industrial filters on vacuum cleaners and other appliances for their ability to filter fine dust particles of less than 5 micrometres in size.

c. techniques for cleaning lead containing dust from all exterior and interior household surfaces and objects should be evaluated, consistent with ecologically best practices.

7. research should be directed to provide a standardised method of assessment of bioavailability of lead from soil and dust.

8a. a program be directed to collect all available data to identify areas of risk and lead contaminated sites.

b. the information gained from 8a be coupled with results of available blood lead testing and related surveys to create the most accurate picture of community lead hazards including sources, exposure patterns and high risk populations.

c. the information gained from 8b form the basis of a primary prevention plan which should include education, infrastructure development and hazard abatement.

9. the Government provide regulations and/or guidelines on the abatement and safe removal of lead, and the training, certifying and monitoring of lead abatement contractors and assessors.

10. further research be conducted into disposal options for highly contaminated soils, dusts and sludges.

11. a review be conducted to assess the use, effectiveness and need for revision of the Department of Planning's Circular C-20, the stages in the planning process at which lead contamination issues should be considered, and Council s.149 certificates - notices of encumbrances.

12. the roles of Federal, State and Local Government in the lead strategy be clearly identified and appropriately resourced to undertake those roles.

13. the NSW Environment Protection Authority (EPA), possibly through the Taskforce, needs to address prevention strategies in a comprehensive manner consistent with ecologically sustainable development.

14. funding be provided to establish a dedicated lead program which incorporates all aspects of lead health problems and lead in the environment including responsibility for coordination of issues related to health, education, monitoring, research and abatement. The program should report annually to Parliament and be reviewed after 5 years.

15. financial and other liabilities in respect of contaminated site remediation need to be addressed and that the Lead Taskforce refer the matter for resolution to the Australian and New Zealand Environment and Conservation Council (ANZECC).

16. the Taskforce's final report contain a glossary of terms and/or definitions to ensure a common understanding of the issues, for example, the meanings of remediation and abatement.

INTRODUCTION

The Lead in Soil and Dust Working Group (LSDWG) analysed the issue of lead in soil and dust in the NSW context taking account of the Government's Lead Issue Paper. It found the issues to be very complex and interrelated to various pathways that were being analysed by other Working Groups. It was noted that a combination of approaches may be necessary to achieve the outcome of identification of the sources of lead available for ingestion by children.

The focus of the LSDWG was on ingestion of lead by children under the age of seven.

The Working Group acknowledged that blood lead level in children was the trigger for further investigation. Subsequently the LSDWG formed three sub-committees to report on health risk assessment, analytical methodology and the biophysical environment. These reports are noted later in this document and support the recommendations of the Working Group.

There were 24 members of the LSDWG, noted later in this report. Included were eminent scientists in the lead field, and representatives of industry, specific lead community groups, general community groups, and the public and private sectors.

The Terms of Reference for the LSDWG is necessarily broad and a comprehensive analysis of all the lead issues related to soil and dust was not possible. The priority was lead in young children. Considering children only, a partial analysis, provides a restricted basis for identifying strategies to prevent lead pollution and to restore contaminated soils and dusts. In practical terms, the protection of adults, including risk groups such as men and women trying to conceive, and the environment is affected by lead pollution of soils and dusts. A wider range of prevention strategies would be forthcoming were the full impacts of lead pollution to be assessed.

The Working Group reported its progress to the Lead Taskforce on a monthly basis, with the LSDWG Chair attending all Taskforce meetings and providing copies of Working Group minutes. Activities of the LSDWG were undertaken, and recommendations produced within the time frame set by the NSW Government Lead Issues Paper.

The proposed strategy for dealing with the issue of lead in soil and dust is outlined in the following sections of this report.

ACKNOWLEDGMENTS

The Chair of the Lead in Soil and Dust Working Group, sincerely acknowledges the contributions made by the members and secretariat of the group. In particular, thanks are due to the Coordinators and members of the sub-committees on Health Risk Assessment, Analytical Methodology and Biophysical Environment.

A final note of thanks to Kerry Brooks, Ian Armstrong and Bill Balding who assisted in putting the final draft together, and Pauline Cain and Natalie Swan for word processing.

ISSUE OF LEAD IN SOIL AND DUST

Because of the interrelationship of the various pathways that relate to children's blood lead levels, the Lead in Soil and Dust Working Group supports lead reduction strategies which eliminate sources of ongoing airborne lead pollution which contribute to deposits in soil and dust. The Working Group also supports, and has made recommendations to the Taskforce on, an education campaign for community awareness of the lead issue.

However, the most important facet that any strategy must accommodate is health risk assessment with a dominant focus on children under seven years of age. These children are the most susceptible to the effects of lead poisoning.

The strategy for dealing with the lead health hazard to children, proposed by the LSDWG, includes (figure 1):

* develop appropriate health risk assessment techniques
* develop appropriate analytical methodology
* develop appropriate abatement and remediation guidelines and procedures.

This strategy effectively prioritises and targets action to individuals or groups that are demonstrably at greatest risk. Importantly, it does not involve the community in unnecessary intervention or remediation in areas that are demonstrably **not at risk** and hence does not dilute resources unnecessarily.

HEALTH RISK ASSESSMENT

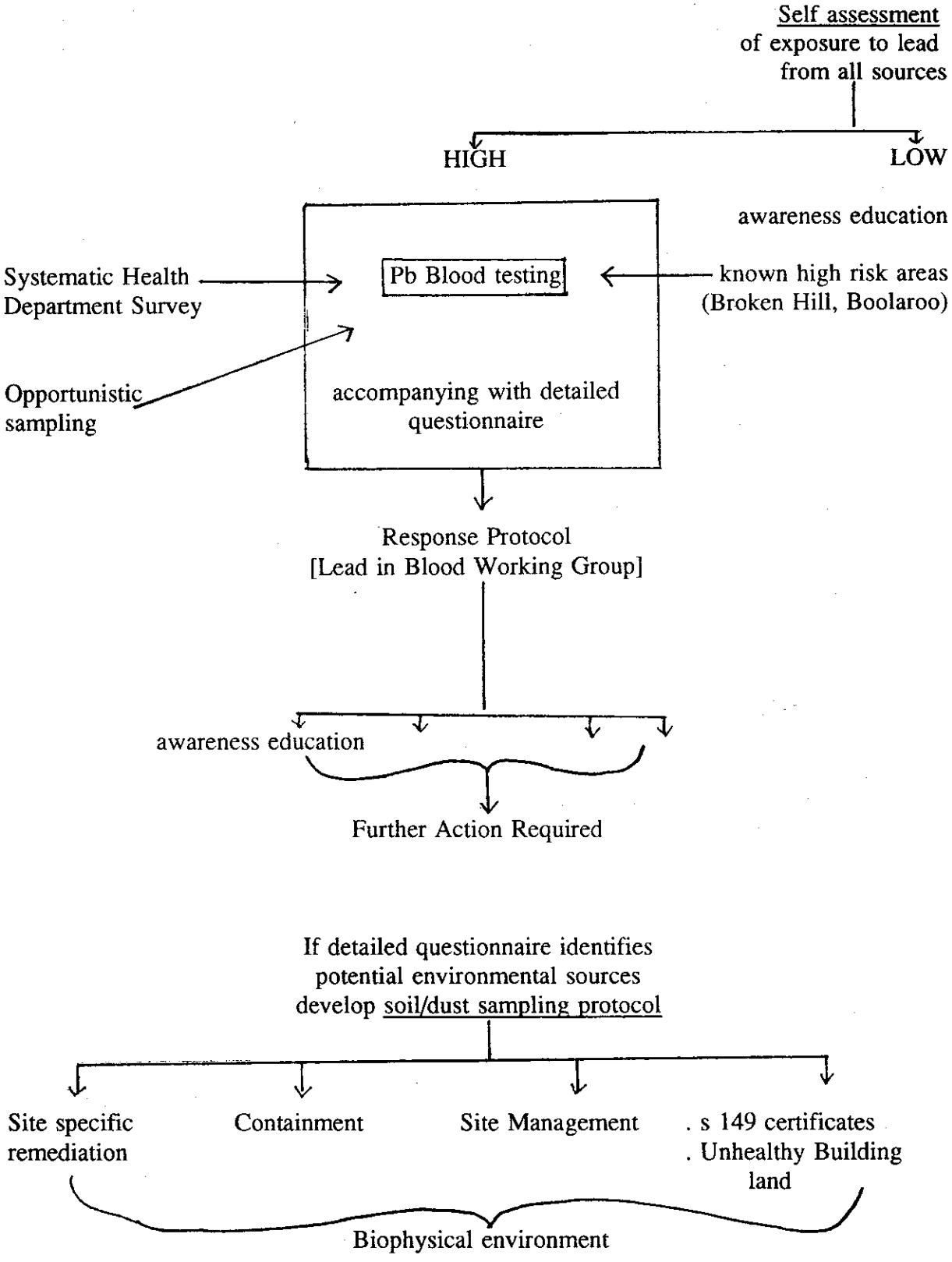
The key component of any effective strategy for the management of individual health risk in the community is measurement of blood lead. A blood lead test will usually be done for one of the following reasons:

. systematic screening of known high risk communities;
. Health Department survey;
. opportunistic sampling where children present for other clinical reasons and a blood sample is required;
. parents are concerned that their child could have high blood lead.

All surveys should be accompanied by a questionnaire to identify potential environmental and behavioural factors if the child's blood lead is of concern. Statistical analysis of these surveys could improve the prediction of high risk groups.

To assist parents to identify if their child should have a blood test, a preliminary self assessment protocol is outlined in the Health Risk Assessment Section.

Figure 1: LEAD IN SOIL AND DUST STRATEGY SUMMARY DIAGRAM



Where the response protocol from a high blood lead result [provided by the Lead in Childrens Blood W/G] indicates further action, and the detailed questionnaire is consistent with an environmental source, then appropriate sampling protocols should be developed. The protocol should be site specific and take into account activity patterns of the child of concern. Site specific environmental modification will be based on the result of these studies. Individual cases are likely to warrant management protocols that differ significantly from other cases.

ANALYTICAL METHODOLOGY

If results for the determination of lead in soil and dust (and water) are to be comparable and reliable, there is a need to standardise procedures for sampling, sample preparation and analytical methodology.

Standards Australia are to produce an Australian Standard for Analysis of Soils and Biota (Committee CH/28) which is scheduled to be available during 1994. This standard will address design of sampling program, pre-treatment of soil samples for chemical analysis, and analysis of soil samples.

Design of Sampling Program

- For a meaningful assessment of lead contamination at a site, an appropriate sampling pattern producing a statistically adequate number of samples will be required.

- It is recognised that the approach to sampling a site for contaminated site assessment will be different to the sampling of a site for health risk assessment in regard to exposure of children to lead. The LSDWG prefer to use the term "sites that pose a health hazard". When further investigation is necessary there is a subsequent need to make distinctions between various sites and need to have different sampling protocols for each of these different sites. A suite of standards is likely to be developed. This will enable multiple entry points to the assessment process. Checklists and guidelines could also be relevant. It is also most important to record how the sampling protocol was undertaken and the analytical methods used.

- For health risk assessment purposes, a combination of judgemental and either grid or random sampling is probably the most appropriate sampling pattern.

- Australian Standards Committee CH/28 (Analysis of Soils and Biota) will address the design of a sampling program.

Sampling, Sample Preparation and Analysis

- It is recognised that for health risk assessment purposes, surface soils (the upper 20 mm) would probably be the most "toxicologically significant" sampling medium. For other purposes, the upper 50 mm sample may be more appropriate.

- It is recognised that the lead content of the less than 100 um size fraction of a soil sample may be a more toxicologically significant parameter than the "fine earth fraction" (i.e. less than 2 mm size fraction). Since less than 100 um sized soil particles readily adhere to skin and bioavailability is a function of surface area (among other things), it has been suggested that the less than 100 um sized soil particles will be of more significance than coarser sized material, at least in regard to children's ingestion of lead.

Bioavailability

- Bioavailability is recognised as probably the most important parameter that should be measured. Although methods are available for predictive purposes, there appears to be no general agreement for suitability, so a suitable standard, particularly for prediction of children's ingestion of lead, is not available.

- The United States Environment Protection Authority (USEPA) recognises that "further animal feeding studies and epidemiological studies are needed to assess the bioavailability of lead from soil and dust".

- Bioavailability is probably a function of surface area (among other things) and so the lead content of fine material (e.g., less than 100 um sized soil particles) may be of higher toxicological significance rather than coarser sized soil particles.

Dust Issues

- Dust is a totally different media from soil. Whilst sampling protocols for soil are comparatively standardised and accepted internationally, those for dust are totally inadequate. USEPA is presently assessing these methods with the view of providing a standardised method.

- Lead in house dust is recognised as one of the best predictors of childhood lead poisoning, but is the least understood and has the greatest divergence of opinion on sampling protocols.

- Lead loading measurements (micrograms of lead per square metre) more directly measure lead available for a child to ingest and so better predict children's blood levels than do dust lead concentrations (micrograms of lead per gram of dust).

- High lead concentration values may indicate that sources of lead (e.g. contaminated soil or deteriorating lead paint) may be present.

- As part of household maintenance to assist in reducing likely problems from lead in dust, ceilings should be adequately sealed and maintained to minimise dust entering the house.

- A good grass cover assists in maintaining low dust levels and limits access of children to soil and dust.

- Dust control, in general, is needed in construction areas and demolition sites. The LSDWG acknowledges existing NSW Environment Protection Authority (EPA) controls in this regard. However it is recommended that appropriate guidelines need to be published and circularised to Local Government and the Building/Development Industry, particularly for locations potentially affected by lead.

ABATEMENT AND REMEDIATION

Lead contaminated soil and dust from any source acts as a significant but variable exposure pathway to children. Lead deposited into soil and dust is a long-term potential exposure risk.

Management strategies should focus on protecting human health at minimum environmental cost. Unjustified widespread remediation of urban properties that require large scale importation of clean soil from relatively untouched sustainable rural locations may result in real environmental damage with very little benefit to human health outcomes and no environmental improvement. Remediation of contaminated urban soils should only be undertaken where there is either a high probability of a positive health outcome, or observed high blood lead levels. Identified sites affected by significant lead contamination such as Broken Hill and Boolaroo obviously require specific management plans to address remediation.

Existing legislation should be used where appropriate, to minimise current emissions (and therefore future contamination) and isolate the sources (sites that are currently contaminated) from existing pathways that cause significant uptake of lead by individuals. Point source emissions can be controlled by existing legislation, the effectiveness of this control relies on enforcement. Effective control would be enhanced by ongoing, continuously repeated, education campaigns targeted at renovators and the community. Development of an effective education campaign is of paramount importance to modifying behaviour.

The legislation was designed essentially to deal with properties that were contaminated by the current occupier, or properties for which the party responsible for the contamination can be clearly identified. For the majority of residential properties where contamination may be due to traffic, the widespread legal use of leaded paints or the historical (lawful) emission of contaminants, it is inequitable to use legislation to direct current occupiers to bear the full cost of site specific management of problems caused by accepted, lawful community and industry activities in the past.

The distribution of high lead contamination should be considered during planning processes. The unnecessary placing of high risk populations (children) in these areas should be avoided (e.g. preschools). Where unavoidable, information on risk minimising practices should be made available.

The following factors are considered important in developing a soil and dust lead management strategy. The strategy should:

* be effective and feasible,

* measurably reduce the impact(s) of lead on health,

* not create other associated health or environmental problems,
* be equitable,

* be acceptable to the community,

* maximise the use of existing regulatory, financial and educational mechanisms, and

* establish guideline criteria as action trigger levels for different soil remediation actions.

While it is argued that generic action levels should not be set and that each individual site should be considered site specifically, this is largely unacceptable to the community and may result in the adoption of inappropriate lead levels in guidelines as across the board defacto action levels. Therefore, soil lead action guidelines should be established to guide individuals in decision making processes.

The establishment of criteria is a complex process which is continually evolving as more research is undertaken on contaminant toxicology and exposure pathways. As a consequence of the difficulty of incorporating behaviour patterns into criteria derivation, regulating authorities tend to rely on site specific risk assessment processes. This protocol is supported by the ANZECC and NHMRC.

In the absence of better data and on the strict understanding that further validation work must be done the following remediation strategy could be used as a guideline for site specific/child specific residential property implementation provided there is reference to sampling and analytical techniques and evaluation of analytical data to justify the action.

Soil lead (mg/kg)	**Action**
<300	No action
300 - 1,500	Grass cover or other appropriate barrier
1,500 - 5,000	Top dress with 50 mm clean soil and grass or other appropriate barrier
>5,000	Soil replacement (top 200 mm)

It should be noted that it is not possible to reliably estimate the number of properties in NSW that pose a health hazard (tentively >300 mg/kg lead). This will not be possible until more soil survey data are available. The cost of providing this data at the necessary level of detail would be substantial.