A STATUS REPORT ON THE LEAD CONCENTRATION IN SOD AND SOIL FOR FLIN FLON-CHANNING, MANITOBA, 1982

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A STATUS REPORT ON THE LEAD CONCENTRATION IN SOD AND SOIL FOR FLIN FLON-CHANNING, MANITOBA, 1982

BY

D. C. JONES

TERRESTRIAL STANDARDS AND STUDIES SECTION
ENVIRONMENTAL MANAGEMENT SERVICES BRANCH
ENVIRONMENTAL MANAGEMENT DIVISION

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Introduction

The use of lead dates back to early civilization when the Egyptians used lead glazed pottery and the Romans used lead pipe to convey water.[6] Although lead has provided many useful products, it is also one of our oldest known toxins. [3,4,6] It has been well established that exposure at high concentrations may pose a human health hazard.

Lead is released into our environment from many sources. Primary lead sources include emissions from the combustion of leaded gasoline, emissions from the smelting industry and particulates from lead based products such as paint. The most common exposure to humans is by ingestion and inhalation. Young children are particularly vulnerable to the potential effects of lead exposure. [1, 2, 8, 9]

The Environmental Management Division is concerned about lead contamination in Manitoba and has developed a program to monitor lead levels in surface soils of urban centres. The Division has adopted the recommended Ontario Ministry of the Environment guideline for lead in soil. This guideline specifies that lead in sod or soil of residential areas or areas frequented by children should not exceed 2600 µg/g.

Lead is persistent in soil and there is concern for the indirect effects such as the pica habit of small children, contamination of edible vegetables grown in soil of high lead concentration and the re-entrainment of lead particles in the air. It is therefore recommended by Environmental Management that the sod and soil be removed and replaced if the lead concentration is in the unacceptable range.[5]

The determination of lead in soil through lead surveys provides information on the historical accumulation of lead in soils. Subsequent sampling can provide data to determine current deposition rates or estimates of future accumulation. However, the detection of areas containing elevated concentrations of lead is of utmost importance. Such areas can then be isolated and where required, preventive action taken.

Sampling Method

For each area to be evaluated, a sampling pattern is designed with the objective of providing a representative analyses of the soils of that area.

An Oakfield soil corer is used to sample sod, where available, and the upper 5 cm of surface soil. Samples are sealed in plastic bags and submitted to the W. M. Ward Technical Services Laboratory, 745 Logan Avenue, Winnipeg, for analysis by atomic absorption spectrophotometry. Soil samples are air dried prior to analysis.

This report includes a map of the survey area with locations of all sampling sites in addition to a table displaying the level of lead found in both the sod and soil from each site. The results are discussed and summarized. A Glossary of Terms is located at the back of the report for additional information on terminology and procedures used.

Results and Discussion

A survey of surface sod and soil in the Flin Flon-Channing area was conducted on June 3, 1982. The sampling pattern was selected to investigate deposition and accumulation of lead from the two major potential sources in the community. Those emission sources are the mining and smelting complex and the combustion of leaded gasoline from vehicles.

Sample sites were chosen to provide baseline data for the town site on a gradient away from the Hudson Bay Mining and Smelting Complex operation as one point source of lead deposition. In addition, sample sites were located on gradients away from major thoroughfare intersections in order to reflect any patterns of lead deposition due to automobile exhaust emissions (Figure 1).

Lead analysis results for all samples of sod and soil are presented in Table 1. Lead concentrations ranged from 90 µg/g to 750 µg/g in sod and from 20 µg/g to 690 µg/g in the soil. The mean lead concentration for all 23 sites sampled was 171 µg/g in soil and 356 µg/g in sod.

There does not appear to be any pattern of lead concentration with increasing distance from the smelting complex. However, there does appear to be a consistent pattern of elevated

lead levels along major traffic routes compared with streets of lower traffic volume. For example, of the 12 sites (2, 3, 4, 5, 6, 8, 9, 11, 12, 13, 14, and 15) located along major traffic corridors, 10 sites recorded the highest levels of lead in the sod samples collected. Corresponding soil samples from each of these 10 sites generally follow the same pattern as sod; however, the levels with few exceptions are considerably less. Of the remaining 11 sites located along streets of much lower vehicular movement, 8 have lower lead concentrations in both sod and soil.

Sample	Flin Flon-Channing Lead Levels	
Site #	Sod (µg/g)	Soil (µg/g)
1	---	---
2	480	480
3	360	140
4	420	380
5	680	390
6	530	690
7	300	20
8	580	300
9	370	50
10	240	160
11	100	80
12	750	20
13	530	90
14	250	180
15	750	140
16	200	280
17	200	60
18	230	80
19	230	70
20	160	110
21	90	70
22	210	50
23	280	50
24	260	60
Mean	356	171

Table 1: Lead levels in sod and soil collected at Flin Flon – Channing, June 3, 1982

The levels of lead found in both sod and soil are well below the 2600 µg/g guideline. The range of lead levels for both sod and soil is consistent with the range of background levels. Also. the pattern of lead deposition is consistent with a survey of lead accumulation in the Winnipeg area.[5,10]

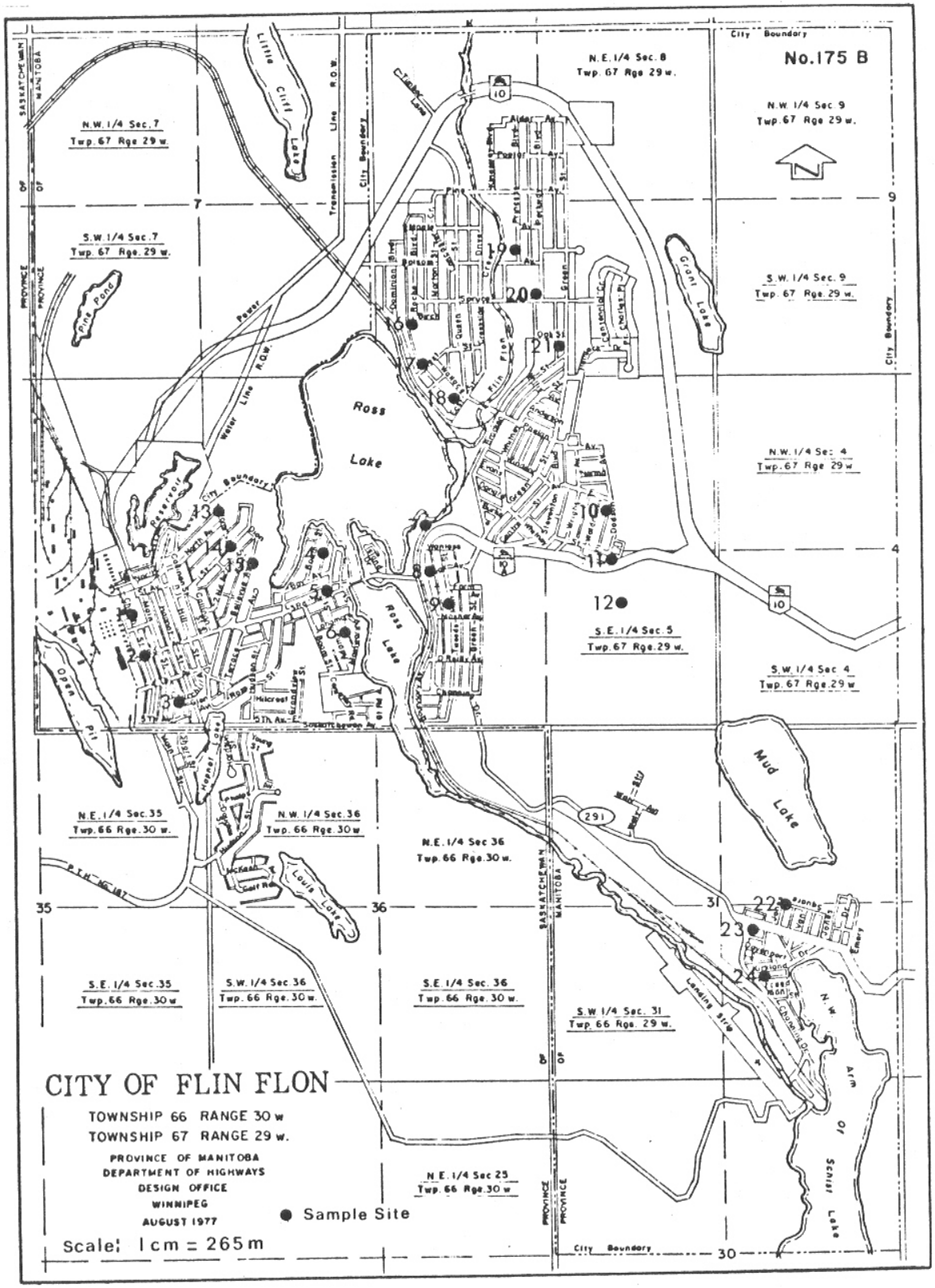

Figure 1: Sample site locations for lead levels in sod and soil for the City of Flin Flon-Channing, Manitoba, June 3, 1982.

Summary

The results of this survey indicate that lead is being deposited to the residential soil of the Flin Flon-Channing area. The highest lead level found was 750 µg/g in the sod adjacent to a major traffic artery. This is similar to levels which have been found in other centres.[5,6,7] In other studies, higher accumulations of lead are generally found in soils adjacent to more heavily traveled roadways. It would appear that the smelter emissions do not contribute significantly to lead levels in the surface soils of the community.

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Glossary of Terms

Atomic Absorption Spectrophotometry - a method of determining the concentration of a metal usually in an acid digested solution.

Lead - a chemical element, Pb, atomic number 82 and atomic weight 207.19. Lead is a heavy metal (specific gravity of 11.34 at 16°C). Lead compounds are toxic with the greatest hazard arising from inhalation. Ingestion is considered the primary pathway for young children.

Lead Concentration - a quantitative value reported as µg/g (micrograms of total lead per gram of sample weight). One microgram is 10^{-6} grams.

Lead Level (Background) - the concentration of or range of concentrations of lead considered as representative of a non-contaminated sample. Sometimes referred to as a control to which other suspected contaminated material is compared. Lead in soil background levels usually range from 2-200 µg/g but in urban soils a background value of 600 µg/g is generally accepted.

Sod - the surface layer of earth containing grass plants with their matted roots.

Sod Core - the upper section of the core sample, consisting of the vegetative layer of grass having a mat of root material inter-spaced with soil particles. The vegetative component of the sod core is removed by sieving and the separated soil material used for analysis.

Soil - the surface layer of earth supporting plant life. For the purposes of this study it was considered as the predominantly organic layer of top soil immediately under the sod or where there is no overlying sod it is the surface layer of soil.

Soil Core - the lower section of the core sample consisting of soil particles conspicuously absent of vegetative material.

Soil Corer (Oakfield) - a stainless steel instrument with a 2 cm diameter cutting edge which is driven into the surface sod and soil to a depth of 5 cm and which on extraction provides a core of sample material.

Soil Processing - soil core and sod core material are ground separately using a mortar and pestle to pass through a fine screen. A minimum of one gram of sieved material is required. The sieving to a fine, flour-like, particle size facilitates acid digestion in the analysis process.

Standard Sieve (Canadian) - a series of stainless steel screens of various mesh size (e.g. #80 size sieve refers to the number of uniform mesh openings per square inch of mesh) that can be used to stratify soil samples into quantifiable particle sizes.