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LEAD AND PUBLIC HEALTH:

RISK REDUCING LIFESTYLE CHOICES

Publication #153
ISBN# 978-1-77189-576-7

Contributed Papers
Ontario Public Health Association
38th Annual Meeting
Healthy Ontario 2000

November 15 - 18, 1987
The Sheraton Centre

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LEAD AND PUBLIC HEALTH: RISK REDUCING LIFESTYLE CHOICES

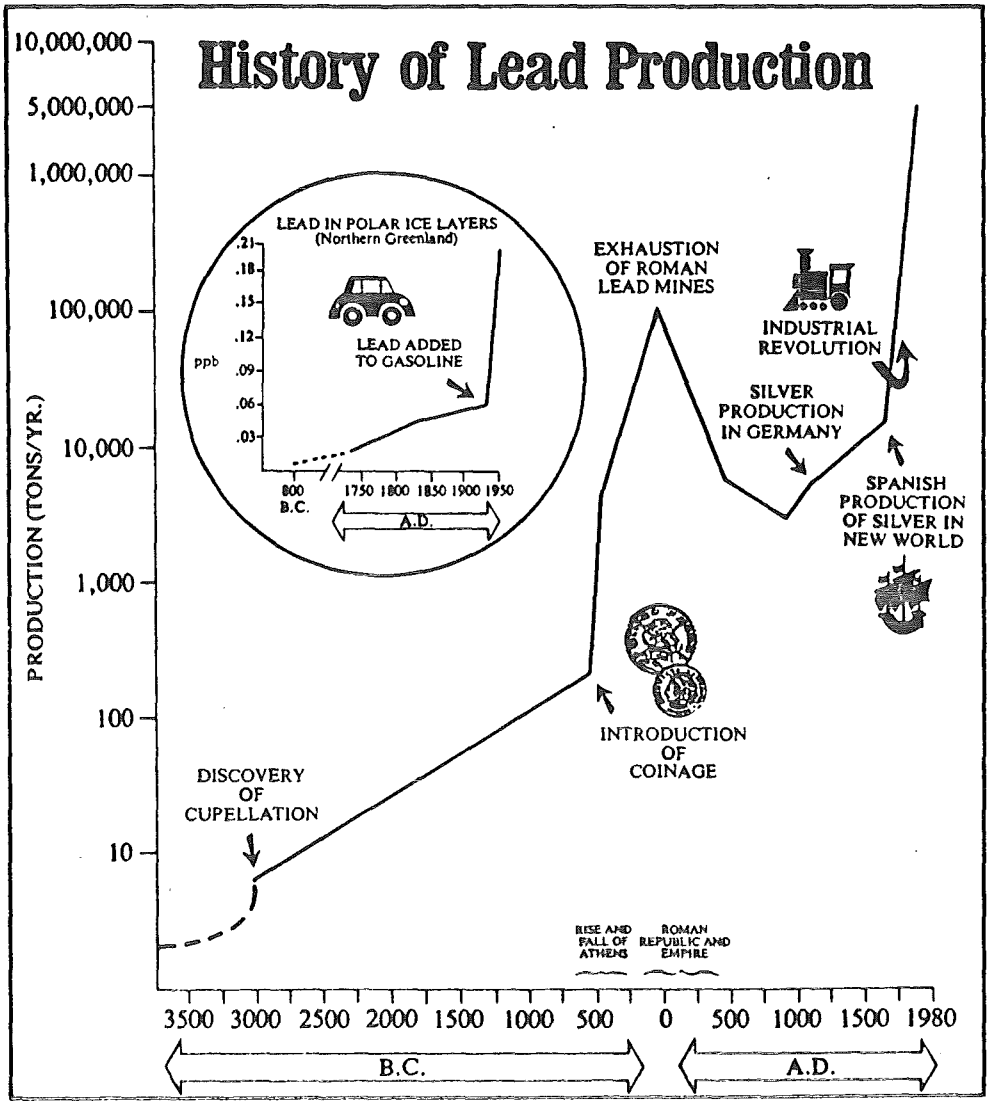
It is apparent that most Canadians seem to think that lead pollution is a problem isolated to places like Toronto's South Riverdale and Niagara neighbourhoods. The impression exists that children in these neighbourhoods have elevated blood-lead levels and the rest of the population is not unduly exposed. Alternatively, when there is agreement that lead is a more widespread environmental problem (particularly in cities) then the impression exists that regulatory action has been taken and that the problem has thankfully been addressed.

Unfortunately, none of these impressions are justified in light of the extent of environmental lead contamination, the health effects at low levels of lead exposure and inadequate regulatory action by the federal government. Canadians are far too complacent and unfortunately misinformed about what is actually a serious public health issue.

The Evidence Is In

Lead is one of the most thoroughly researched pollutants. We know how long we have been using lead and the extent to which we have brought about global environmental lead contamination. Figure 1 illustrates this situation graphically. We are also extremely well-informed about how lead can affect us. Research continues to accummulate documenting the harmful affects of lead at lower and lower blood-lead levels. At a conference dealing

Figure 1



Estimated tons of lead produced per year worldwide since about 3000 B.C. The present level is about 5 million tons per year. Note that the scale for tons per year is logarithmic (each unit of increase is ten times larger than the preceding unit of increase). The insert shows measurements of lead in parts per billion in polar ice layers since about 1750.

Note: *One ton equals about 0.98 metric tonnes.*

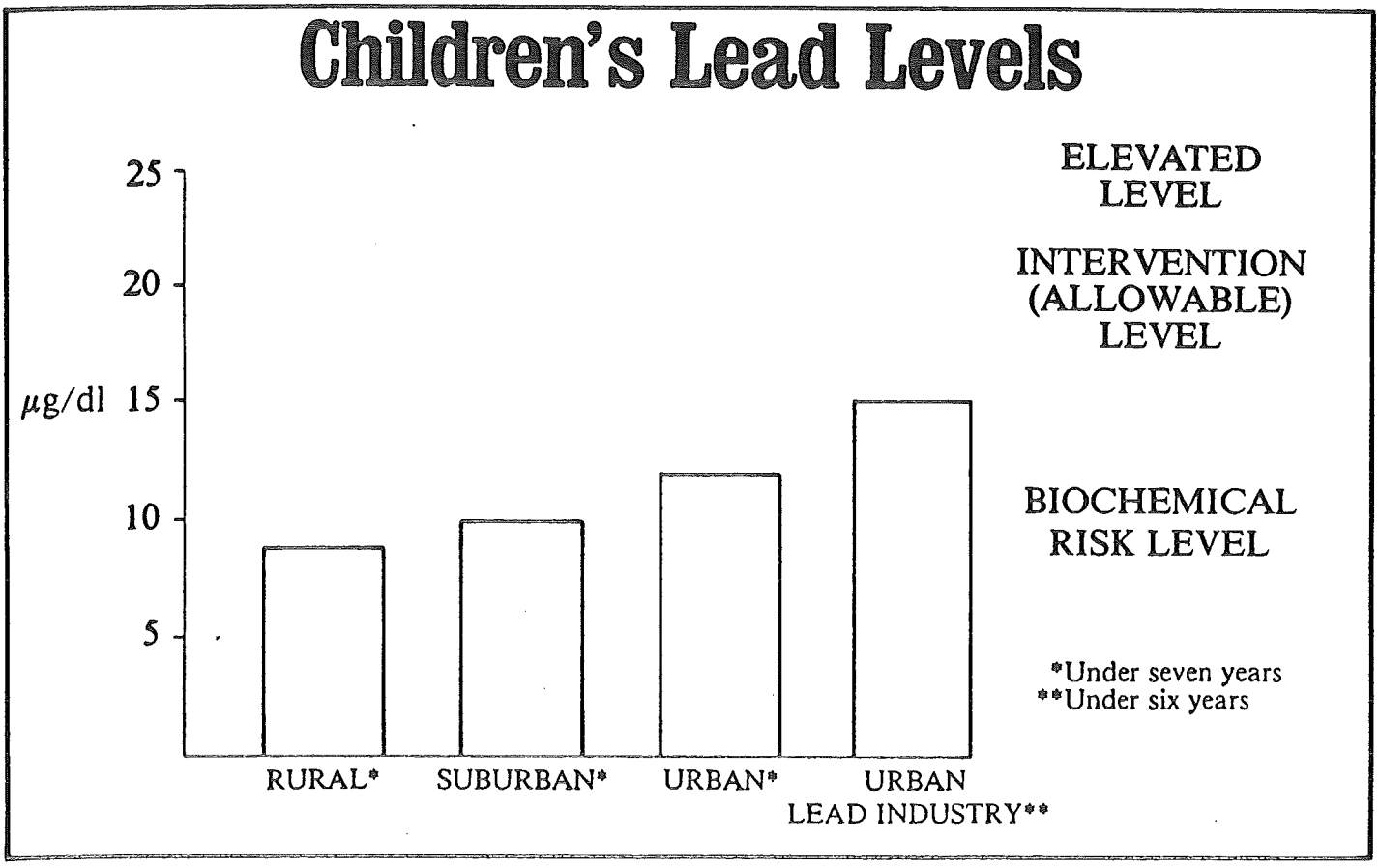
Sources: *Adapted from D.M. Settle and C.C. Patterson, Science, 207: 1167-1176, 1980; M. Murozumi, T.J. Chow, and C.C. Patterson, Geochim. Cosmochim. Acta, 33: 1969, 1247-1294.*

with the health effects of low-level lead exposure held in New Orleans in September, 1987, a very strong international consensus existed that blood-lead levels between 10 and 15 micrograms per decilitre (ug/dl) in children are of serious concern. (For comparison, the average blood-lead level of urban-dwelling Ontario children in 1984 was 12 ug/dl.)[1]

Figure 2 compares blood-lead levels in children living in rural, suburban and urban areas and near urban lead industries. The "elevated level" of 25 ug/dl coincides with the definition of lead poisoning as stated by the Centers for Disease Control in Atlanta, Georgia. The "intervention level" of 20 ug/dl is the level chosen by the Toronto Department of Public Health to justify further investigation of lead exposure in a child's daily environment. The "biochemical risk level" of 10 ug/dl coincides with the level where, when this diagram was first developed, it was known that sub-clinical effects begin to occur in the normal functioning of the circulatory and central nervous systems of children. Recent research from around the world has confirmed prior suspicions that the effects that occur between 10 and 15 ug/dl are of serious concern for young children.

The most important point to be drawn from the information now available on the current situation of environmental lead contamination and average blood-lead levels in Canadian children is the fact that there is absolutely no safety margin between children's blood-lead levels and the levels where health effects

Figure 2



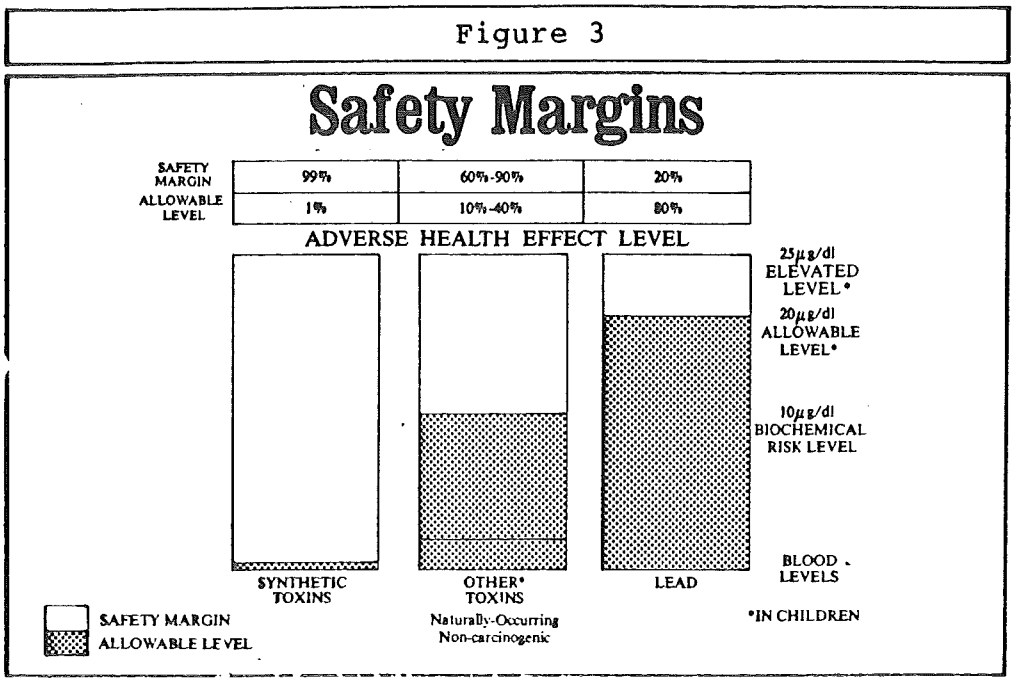
Average blood lead levels in µg/dl in young Canadian children in 1984 and 1985 for children living in rural, urban, and urban lead industry areas.

Sources: *C. Duncan et al, "Blood Lead and Associated Risk Factors in Ontario Children, 1984," Ontario Ministries of Environment, Health, and Labour, 1985, p. VIII-6; and E. Ellis, Toronto Department of Public Health, personal communication, May, 1986.*

can begin to occur (see Figure 3). Indeed, at the average blood-lead level found in Canadian children, sub-clinical health effects are already occurring including an increased risk of premature birth, lower birth weight and slower neurological development. In infants, effects are seen in memory, learning, problem-solving ability, and sensory-perceptual acuity and discrimination. A recent study reported in Lancet[2] showed effects on cognitive and educational attainment at blood-lead levels of 10.4 ug/dl. Figure 4, "The Domino Effect" shows the many impacts of lead-caused reductions in haeme, the essential oxygen-carrying element in the blood. Not all of these effects occur at low blood-lead levels but the diagram is useful in showing how the brain and nervous system are impacted from several directions as lead affects different body systems. (For a detailed discussion of Figure 4, see endnote 3).

At the New Orlean's Conference, of those in attendance, the small minority of opposition to the opinion about new concern levels for children's blood-lead came from representatives of the lead industry and a few government officials from the U.K.[4] Unfortunately, in light of Canada's policy on gasoline lead phase-down, our high allowable levels of lead in paint, food and other consumer products, it seems likely that the Canadian Government can also be included in this small group still dissenting from the opinion of the international scientific community.

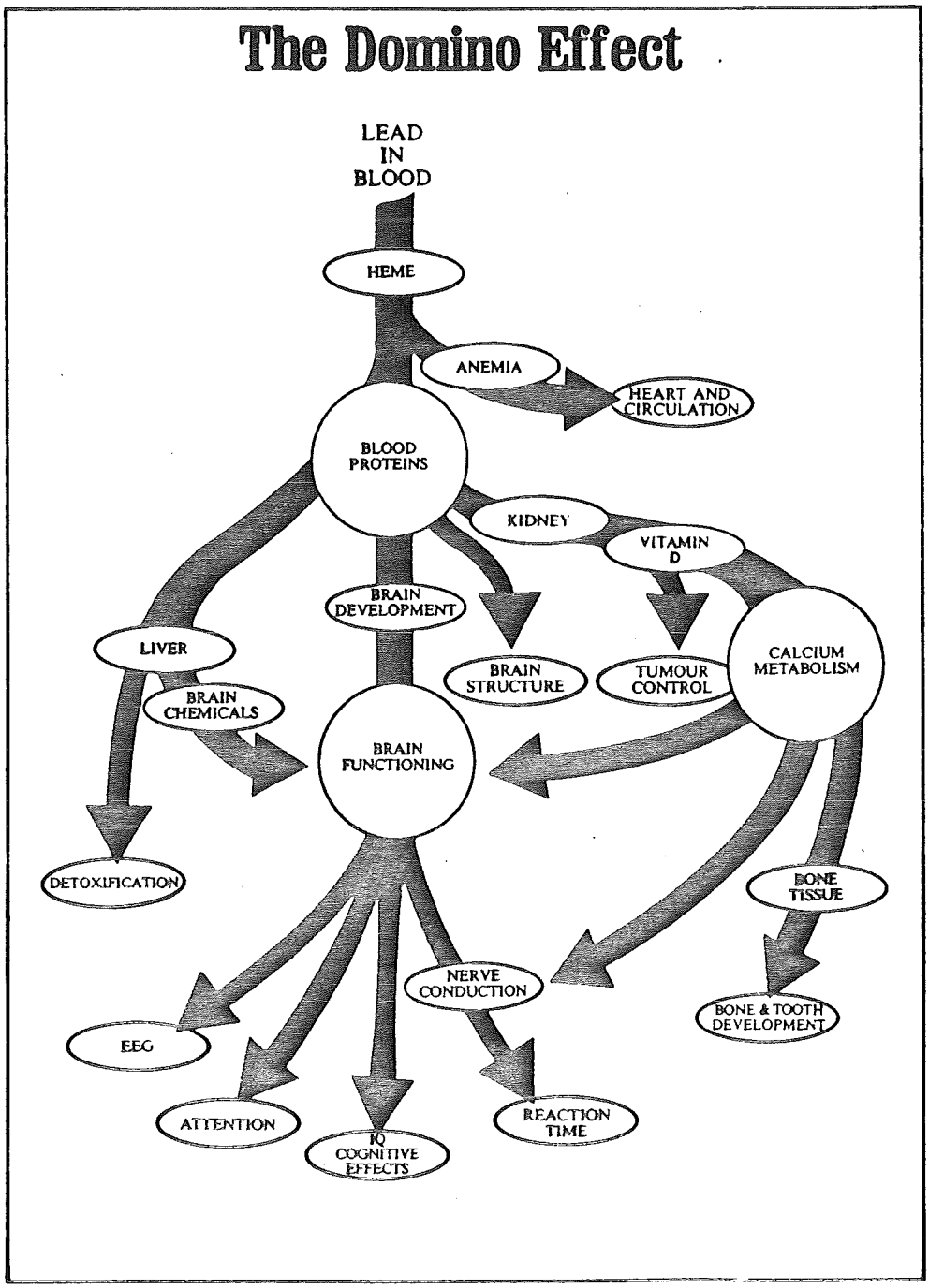
Figure 3



A comparison of the small safety margin for Lead with those for Synthetic Toxins and Other Toxins (naturally occurring, non-carcinogenic). A blood level of 10µg/dl for lead corresponds to the upper-limit, allowable level for Other Toxins. A blood level of 15µg/dl for lead would provide a 40% safety margin.

Source: *R. Elias, U.S. Environmental Protection Agency, personal communication, February, 1986; and J. Pirkle, Centers for Disease Control, personal communication, December, 1985.*

Figure 4



The many impacts of lead-caused reductions in heme. See text.
Source: *Adapted from U.S. Environmental Protection Agency, "Air Quality Criteria for Lead," (EPA-600/8-83-028B), 1984, p. 1-138.*

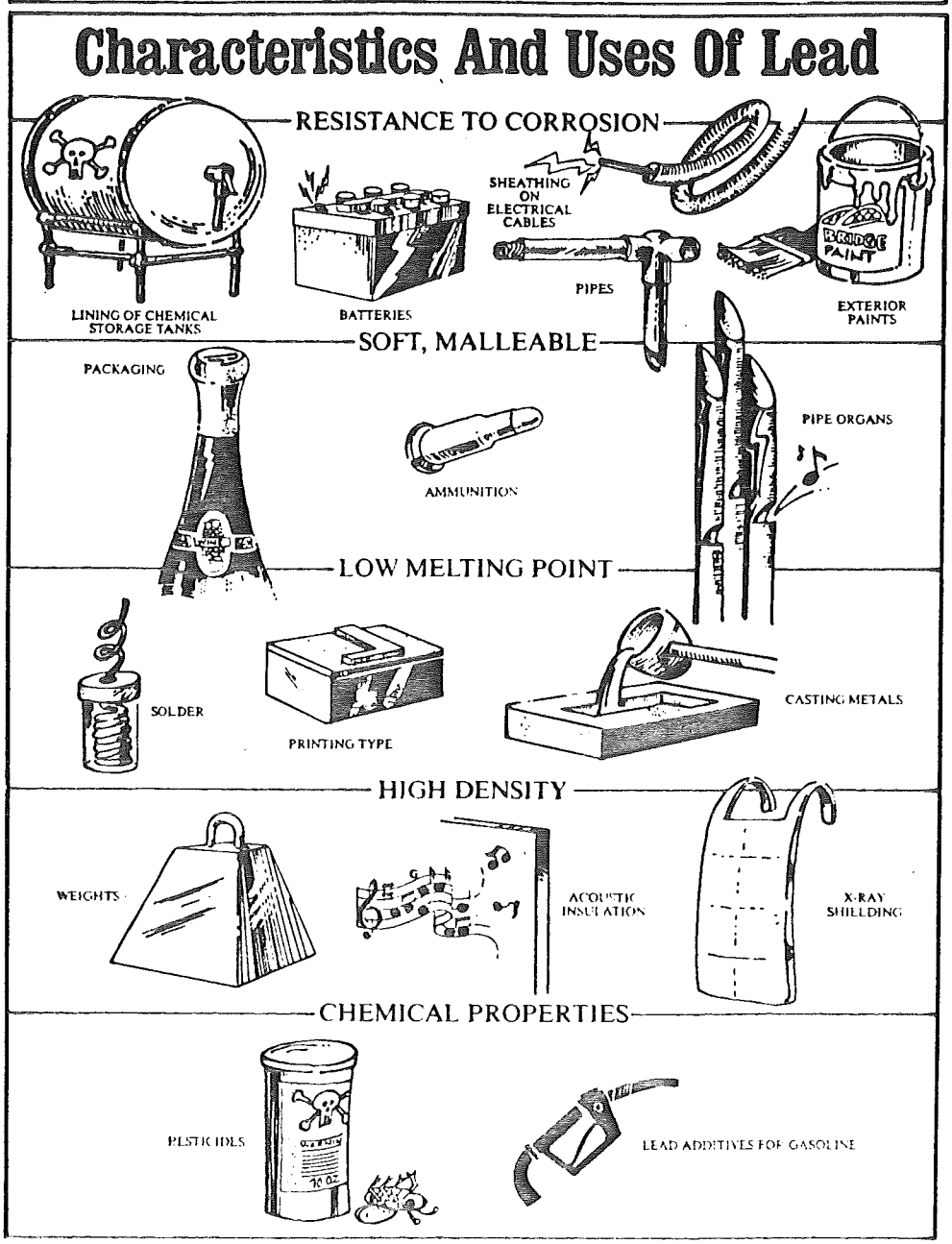
Sources of Lead

The primary source of environmental lead contamination is leaded gasoline. In "hot spot" areas of lead contamination, like Toronto's South Riverdale and Niagara neighbourhoods, children are additionally exposed to these already high levels of lead in the environment as a result of secondary lead smelting operations. In addition, against this large background level resulting from historical and ongoing emissions of lead from gasoline a wide variety of other sources exist such as lead industries, peeling leaded paint, lead soldered food cans and to a lesser extent lead soldered plumbing, lead pipes, ceramic dishes, etc. Figure 5 illustrates the characteristics and many ways that people have used lead.

The Biggest Troublemaker: Lead in Gasoline

In addition to the recent scientific evidence and concensus on the hazards of low-level lead exposure, the United States Environmental Protection Agency undertook in 1985 an exhaustive economic analysis which was then subject to rigorous peer review.[5] The analysis revealed that the U.S. would save billions of dollars in children's health care and remedial education costs, automobile maintenance costs and savings in the form of improved fuel economy, if lead in gasoline was dramatically reduced. The study formed the basis for the reduction in the U.S. regulation for lead in gasoline to a level

Figure 5



Some of the most interesting physical and chemical properties of lead and examples of the way people have used these characteristics in a variety of products.

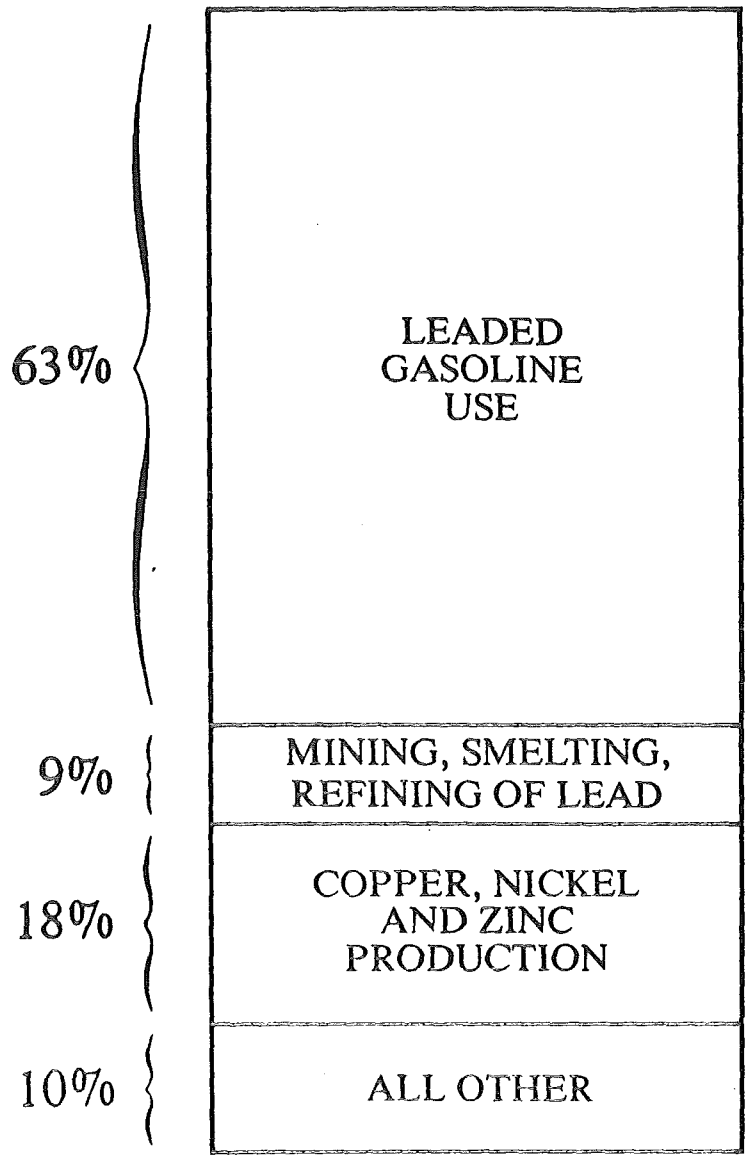
Source: ***B. Wallace and K. Cooper, Lead, People, and the Environment, Niagara Neighbourhood Association, Toronto, Ontario, 1985.***

that is 10 times lower than what is allowed in Canada. An equally swift and dramatic drop in the level of lead allowed in Canadian gasoline is justified because, as Figure 6 indicates, gasoline lead contributes to the majority of environmental lead contamination and, most importantly, average blood-lead levels in Canadian children are the same and may be even slightly higher than in U.S. children. It is also noteworthy to add that the U.S. standard for leaded gasoline is all the lead that any car built to use leaded gasoline requires to function properly; the excess corrodes the engine and exhaust system, unnecessarily increasing maintenance costs and reducing fuel economy.

Effects on Blood Pressure

In addition to the health concerns about the effects of low-level lead exposure on children there is a growing body of evidence showing that even lower levels of lead exposure (in the range of 5 to 10 ug/dl) are contributing to higher incidences of heart disease and hypertension in adult males. Once again, the United State Environmental Protection Agency has quantified the costs associated with these health problems and has discovered that upwards of 40 billion dollars can be saved in the U.S. over a five year period if lead exposure in these adult males was reduced.[6]

Figure 6



Sources Of Environmental Lead Contamination

Approximate percentages that different lead sources contribute to current environmental lead contamination in Canada.

Source: *Adapted from Royal Society of Canada, Commission on Lead in the Environment, "Lead in Gasoline: A Review of the Canadian Policy Issue," 1985, p. 6.*

Updating the Regulations

The solutions to the current widespread environmental lead contamination problem exist on two levels. First, the easiest and most effective means of reducing lead contamination is to reduce the level of lead in Canadian gasoline to the level currently allowed in the U.S. as soon as possible. A period of two years is more than adequate for the relevant industries to accommodate this drop. In addition, Canada should also reduce the amount of lead allowed in paint from the level of 5,000 parts per million (ppm) to the U.S. level of 600 ppm. Regulations for the amount of lead allowed in food are also based on out-dated and incorrect information and should be revised downward.[7] In smelter neighbourhoods, provincial regulations on the amount of lead allowed in dustfall are also urgently needed. It is interesting to note that even though the U.S. has a regulation for lead in gasoline that is 90% lower than what is allowed in Canada, the U.S. is still moving aggressively at the federal and state level to get lead out of other sources such as in drinking water and in older homes with peeling paint.

Lifestyle Changes

In addition to needed regulatory changes many things can be done on a personal level to reduce lead exposure. Such changes are desirable because lead contamination is a pervasive problem. Even with swift regulatory action, lead is a persistent pollutant that will stay in our environment for many years to come.

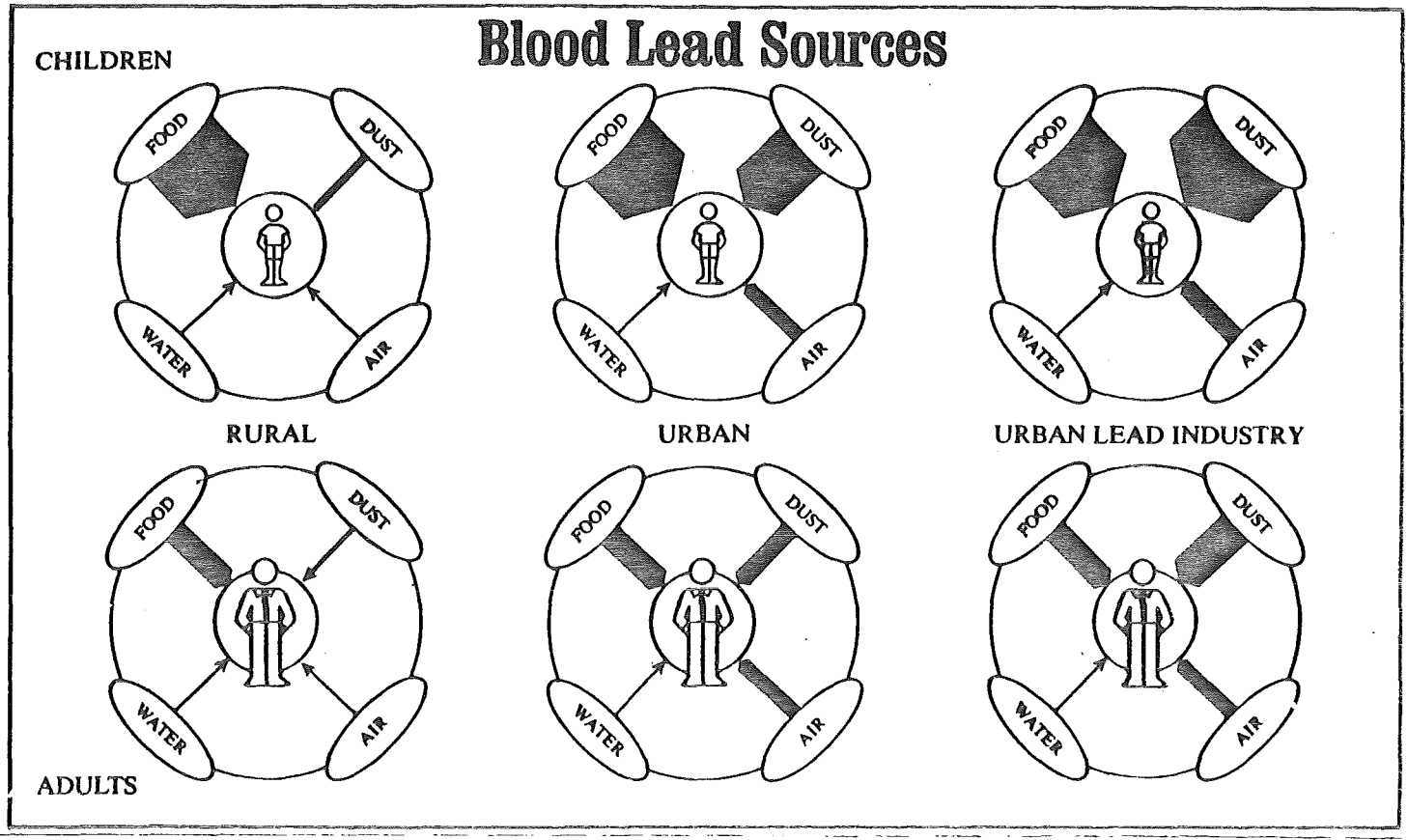
There are many strategies that people can undertake to reduce the risks of lead exposure. These strategies are particularly important for specific subgroups of the population, including children, women of child bearing age, (for the sake of the developing child in utero) renovators and those entrusted with the care of young children.

Blood-Lead Sources

It is important to determine the sources of lead to which we are exposed by breaking them down into categories and seeing where we can avoid exposure. Figure 7 shows the relative contribution to blood-lead levels from the sources of food, dust, air and water for children and adults living in rural and urban areas and near urban lead industries. The contribution from food is constant and the largest source in all categories. The food source is only overshadowed once by the dust category in children living near urban lead industries. By focusing first on the food source of daily lead intake, there are a number of lifestyle changes we can consider. First and foremost, we can avoid lead-soldered cans.

Table 1 compares lead levels in some foods in Canada and shows the effect of canning on these levels. (It is noteworthy to point out here that the federal standards for the amount of lead allowed in foods are in the parts per million range. Since

Figure 7



Relative size of the primary environmental sources that contribute to blood lead levels in two-year old children and adults living in rural, urban, and urban lead industry areas.
Source: *Appendix B.*

Table 1

Lead Levels of Some Foods in Canada

Uncanned Food	Lead (ppb)
Most dairy products	20-50
Cheese	240
Beef, pork, lamb, poultry	50-100
Eggs	50
Great Lakes fish	200-600
Cereals, bread, rice, flour	40-80
Potatoes, yams	60-80
Vegetables: leafy, root, tomatoes, beans, peas	30-70
Citrus fruits and juice	30
Apples, apple products	140
Other fruits, berries	20-50
Sugars, sweeteners, candy	50-60
Molasses	410
Chocolate bars	100
Coffee, tea	30
Infant foods:	
Liquid formula	30
Powdered formula	10
Strained meats	30
Strained vegetables	40
Juices, drinks, strained fruits	50
Cereals	90

Effect of Canning on the Above Values

Food Group	Lead Increase
Vegetables: leafy, root, potatoes	2-5 times
Tomatoes	6 times
Fruits	1.2-7 times
Fish	5 times

Sources: *Adapted from Nutrition Foundation, Inc., "Assessment of the Safety of Lead and Lead Salts on Food: A report of the Nutrition Foundation's Expert Advisory Committee," Washington, D.C., The Nutrition Foundation, 1982; and Great Lakes fish levels from J. O. Nriagu, "Lead Contamination of the Canadian Environment," unpublished report to the Royal Society of Canada's Commission on Lead in The Environment, 1985.*

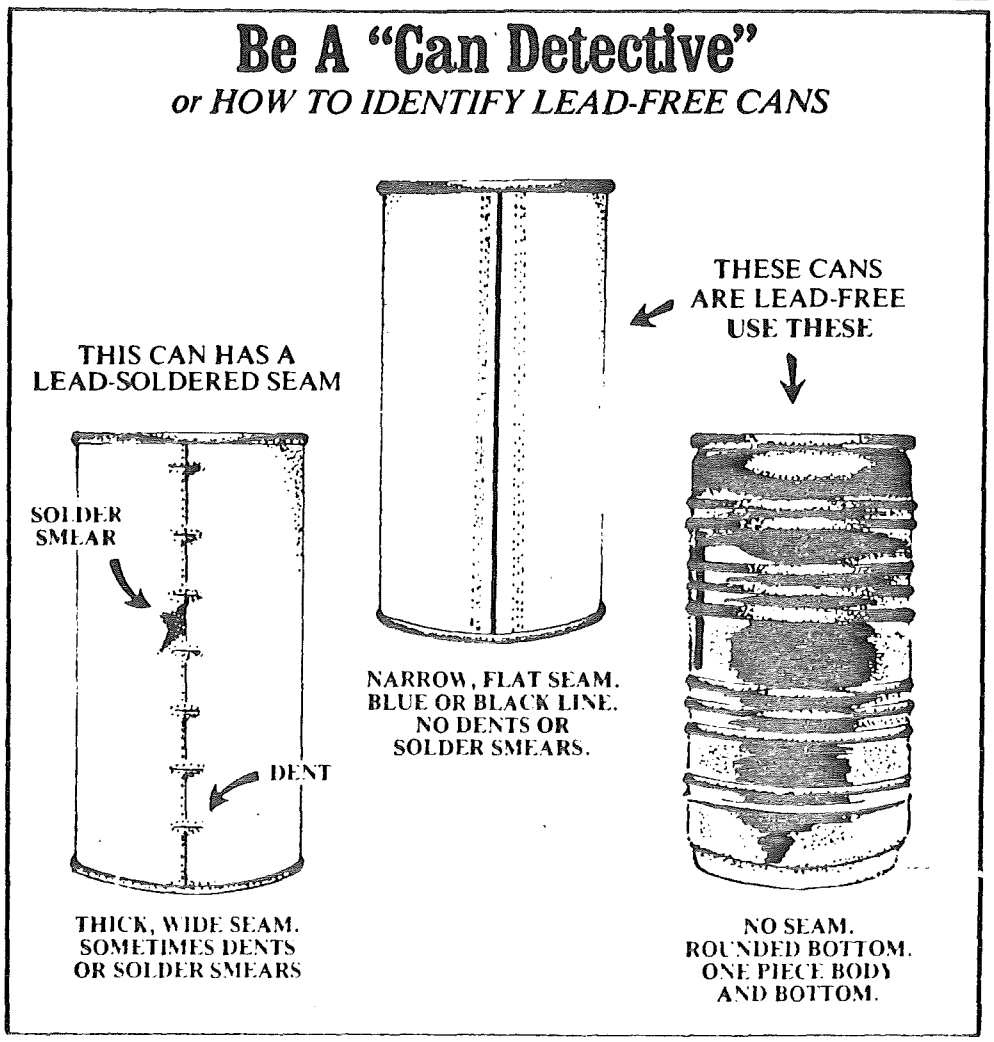
the actual level of lead in foods is in the parts per billion range and since food is the primary source of daily intake in an already seriously lead-burdened population, assurances that federal regulations for the lead content of food are being met are quite meaningless.)

Canning can increase the lead content of foods by 2 to 7 times or more. Fortunately, as shown in Figure 8, it is very easy to identify and avoid lead-soldered cans. In addition to avoiding lead-soldered cans, we can all absorb less of the lead taken in on a daily basis if our diet is rich in calcium and iron.

Turning once again to the relative contributions of food, dust, air and water to blood-lead levels, the second set of lifestyle changes that can reduce lead exposure deal with the second largest category; dust. "Dustbusting" changes (detailed in Table 2) include a variety of alternate ways of housecleaning that require slightly more work than regular housekeeping, but are often just different ways of doing the same old (tedious) chores.

Finally, a special situation exists for professional and home renovators. Table 3 details safety precautions for soldering and removing old leaded paint.

Figure 8



Step 1. *Is there a side seam or is the can seamless with a rounded bottom?*
If it's seamless with a rounded bottom, it's LEAD FREE.
Step. 2. *If there is a side seam, does it have a thin blue or black line running along the seam?*
If there is a thin blue or black line, it's LEAD FREE.
In addition to these two big clues, the seams on LEAD-FREE cans are usually flatter and narrower than on lead-soldered cans, and they do not have "dents" or solder "smears." See drawings.
Source: *Consumers Union Foundation, "Action Kit: Lead Hazards and Children," Institute for Consumer Policy Research, Mount Vernon, NY, no date.*

Table 2

Dustbusters

- Use a damp mop and damp cloths for cleaning and dusting.
- Sweep only when absolutely necessary and in a careful manner.
- Clean near windows and doors frequently since dust in these areas tends to have a high lead level.
- Use window shades that can be wiped clean and washable curtains.
- Vacuum or wash window screens periodically.
- Vacuum rugs often. Cover them with a sheet when babies play on them. If your vacuum expels dust, don't vacuum when children are around. Flat weave carpets and bare floors collect less dust than shag, pile, or looped rugs.
- Have a professional clean your forced-air heating ducts periodically.
- During the heating season, clean or replace furnace filters every month.
- Try to keep the humidity level between about 35-50%. Drier air encourages dust to fly around and wetter air encourages mould growth
- Brush house pets often. Their coats collect dust and dirt. Groom them outside and keep them out of young children's rooms.
- Clean children's bedrooms or other play areas often. Remove dust catching items or store them in closets or drawers. A covered toy box keeps toys cleaner and makes cleaning easier.
- Cover furniture with washable covers.
- Clean shoes or remove them when you come inside.

Make Dust Control Your Goal

Source: *Adapted from "Dustbusters: Tips for controlling lead exposure through housedust," no date. Used with the permission of the Toronto Department of Public Health. Readers may reproduce this table provided the Toronto Department of Public Health is acknowledged.*

Table 3
Renovators' Guidelines

Soldering

- Provide for ventilation with the air moving away from you and from the rest of the house.
- Wear a dual-filter mask such as the one in Figure 17.
- Clean up any tiny scraps of solder carefully and dispose of in a closed container in the garbage.

Removing Old Lead Paint

- Remove or cover with plastic any carpets, rugs, upholstered furniture, clothing, cooking utensils, etc.
- Put drop cloths in the working area to catch any paint chips.
- If possible, do only one room at a time, remove furnishings, and close off the room.
- Do not use a power sander since it can create too much lead dust.
- Wear a dual-filter mask (see Figure 17), coveralls, hat, and shoe covers.
- During work, close the windows to prevent lead dust from entering the surrounding environment and keep children, women of childbearing age, pets, and adults with heart or lung conditions away until the clean-up has been completed.
- Do not eat or smoke in the work area.
- Use a heat gun to heat the painted surface; then scrape with a sharp object. With a heat gun, an exhaust ventilation fan (not an air conditioner) is needed.
- At the end of each working session, put the chips in a double plastic bag, close it, and put it into the garbage.
- Vacuum and wet scrub the area with a high phosphate detergent such as Spic and Span. Do not sweep or dry dust.
- Remove your protective clothing and shoe covers in the work area to avoid carrying lead dust into the house.
- Shower and shampoo at the end of each work session.
- Wash your work clothes separately and wipe your footwear off with water and a rag that is washed with the work clothes; or, if you are doing a large job, wear clothing and shoe covers that can be sealed in plastic bags and thrown away.
- Wash your hands thoroughly and rinse out your mouth before eating or smoking.
- Soon after removal of the old paint, repaint the surface. Avoid spray painting if possible; if you paint frequently, wear a mask while brushing or rolling the paint.

Source: ***Adapted from "Safe lead paint removal," Toronto Department of Public Health, no date; and "Getting the lead out," Environmental Action, March/April, 1986, p. 21-22.***

Conclusion

The evidence is overwhelming showing that lead is a serious issue of environmental and public health. The major culprit of current levels of contamination is leaded gasoline. Interestingly enough, the current high level of lead allowed in Canadian leaded gasoline is unnecessary on several counts and relatively easy to change; what is missing is the political will to regulate this change.

The level of environmental lead contamination and average blood-lead levels in Canadian children require both swift regulatory action and a greater awareness in the general population about who is at risk, how and where they are exposed and practical information about how exposure can be avoided.

Author's Note: Graphics and tables used in this paper are reproduced from The Citizen's Guide to Lead: Uncovering a Hidden Health Hazard, by Barbara Wallace and Kathy Cooper, NC Press, Toronto.

ENDNOTES

1. Duncan, C., R.A. Kusiak, J. O'Heany, L.F. Smith, L. Spielberg and J. Smith, 1985. "Blood Lead and Associated Risk Factors in Ontario Children, 1984," Technical Working Group Report, Ontario Ministries of Environment, Health and Labour.

2. Fulton, M. et. al. Lancet, June, 1987.

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4. Dr. Vernon Houk, Director of the Center for Environmental Health, Centers for Disease Control, Atlanta, Georgia, personal communication, October 8, 1987.

5. Schwartz, J., H. Pitcher, R. Levin, B. Ostro and A.L. Nichols, 1985. "Costs and Benefits of Reducing Lead in Gasoline: Final Regulatory Impact Analysis." EPA-230-05-85-006, Office of Policy Analysis, United States Environmental Protection Agency, Washington, D.C., February, 1985, pp. E-1 - E-12.

6. ibid, chapter V and R. Levin, 1986. "Reducing Lead in Drinking Water: A Benefit Analysis." EPA-230-09-86-019, Office of Policy, Planning and Evaluation, United States Environmental Protection Agency, Washington, D.C., December, 1986.

7. Wallace, B. and K. Cooper, op. cit., chapter 13.