February 27, 1974

Mr. Jim Gill
Projects Director
Labour Council of Metropolitan Toronto
15 Gervais Drive
Toronto, Canada

Dear Mr. Gill:

I have not had an opportunity, up to the present, to read or to comment on the brief which you sent to me with your communication of February 19. As a consequence of this fact, I can send you a copy of the material which I prepared some time ago for publication on the same subject, without any suggestion of creating thereby a controversy on this subject. Since I have had a long experience in this field, what I propose has the virtue of having been employed successfully for many years. I can say of it, in relation to the difficulties of putting it into effect is that it has worked admirably in eliminating lead poisoning from the most hazardous of the lead-using industries.

I shall be able, I trust (I have developed cataracts in both eyes, and I am not as rapid and facile as I should be), to examine and to comment fairly and fully on the proposal which you have sent me. All I can say, at this time, with any degree of fitness, is that lead poisoning can be, and should be, eliminated entirely from present day industry, and if your proposal tends only to limit the severity of lead poisoning in industry without preventing it totally, it is not good enough and I shall so indicate. We have temporized quite long enough with this problem.

Cordially yours,

Robert A. Kehoe, M.D.
Professor Emeritus of
Occupational Medicine

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LABOUR COUNCIL OF METROPOLITAN TORONTO
Affiliated with
CANADIAN LABOUR CONGRESS
President
D. R. MONTGOMERY
15 GERVAIS DR. - TEL. 429-3668
TORONTO (DON MILLS)
Secretary
HUGH BUCHANAN

February 19, 1974.

Dr. R.A. Kehoe
Kettering Laboratories
University of Cinncinnatti
Cinncinnatti, Ohio

Dear Dr. Kehoe:

The Labour Council of Metropolitan Toronto together with a number of community groups and interested individuals have prepared a draft brief on controlling lead pollution in Toronto, an acute problem both to employees and residents living in communitites adjacent to certain plants.

In view of your concern and expertise in this area we will be extremely grateful for your comments regarding the attached sections of our brief.

We hope to present it to the Ontario Government in early March and will appreciate greatly your assistance in this respect.

Thanking you in advance, I am,

Yours sincerely,

Jim Gill

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Jim Gill,
Projects Director.

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(12)

STANDARDS FOR CONTROL OF POLLUTANTS

I ENVIRONMENT

The average dietary lead intake of an adult has been estimated at about 300 mcg/day.(1) Six hundred micrograms is the level generally considered safe for adults. Sixty is the level for infants.(2)

More than 90% of the lead in the air comes from leaded gasoline.(1) The large particles, after leaving the exhaust, settle quickly to the ground while the very small particles remain suspended in the air and we breathe them.(3)(4) The body absorbs 30% or more of the inhaled lead.(5) The fallout on the ground contaminates not only the dirt and dust, but gets washed off into our water supplies. It can even contaminate food supplies.(6) The adult body absorbs about 10% of the ingested lead.(5) Studies of infants and children indicate that absorption is about 50% (7)(8) and retention is greater than in adults.(7)

Because of the cumulative effect of exposure to lead it is imperative to set standards that err on the side of safety when looking at environment. As our unavoidable intake from normal sources already approaches the level at which accumulation begins to accrue, any additional burden in soil, house dust, paint, water in lead plumbing, lead in glazed crockery, candles etc., may cause the safe level to be exceeded.

Lead is widely recognized by public health authorities as one of the most dangerous elements to which man is exposed. The ill effects of lead in man are established facts.(9) Toxic effects include colic, anemia, convulsions, irritability, blindness, muscular incoordination, sterility, stillbirths, mental retardation, miscarriage;(10) heart problems, enlarged hearts and cardiac murmurs, electrocardiograph abnormalities, weakness, tiredness;(11) cerebrovascular catastrophics, increased incidence of hypertension, disturbances in personality, intelligence, and learning.(12)

The onset of the disease is insidious and the symptoms nondescript. Fatigue, pallor, onerexia, and irritability may be followed by abdominal pain, vomiting and motor unsteadiness. Headaches and drowsiness presage the more severe signs of encephalopathy: convulsions, stupor and coma.

In its early stages there is little to separate the symptoms from those of other less serious diseases of childhood. Undoubtedly, many children with milder symptoms of intoxication do not see a physician, and many who do are incorrectly diagnosed.(13)

This is a preventable illness. Progress to a toxic level may be gradual and an early identification program leads to early treatment and possible prevention.(14) Such programs have been established in many North American cities, i.e. Chicago, Baltimore, Boston, New York, Atlanta, etc.

In order to prevent the onset of this illness standards for air, dust and soil have been primarily based upon three human health considerations. No consideration has been given to effects on such things as animals or plants, although inclusion of such information might allow a more stringent standard based upon criteria of more sensitively responding living tissue.(15) Data on laboratory analysis in the canine species indicates that this may be an early indicator of environmental hazards to small children.(16)

1. Total Body Burden for High Risk Populations

Body burden is the amount of a pollutant in the body which produces, or is capable of producing, damage or interference with functions of the body. Blood lead level concentration is a variable which is used to characterize lead body burden.(15)

We have already commented on the non-specific signs of lead toxicity and this has made it very difficult to establish a blood lead level at which one can say "lead poisoning" exists. Until the mid 1920's the human disease was always defined in terms of a definite symptomatology. Since that time the development of bio-chemistry and physiology has enabled us to indicate the disease at an early stage.

Children with levels as low as 45-50 micrograms exposed over a long period of time have exhibited clinical lead poisoning.(17) Sub-clinical effects of lead have been reported at levels as low as 20 mcg/100 ml blood.(18) Although these changes are biochemical they are an indication of damage to the body chemistry. There are so many instances in which subtle disturbances have eventually proven to be dangerous, i.e. thalidomide, radiation, asbestosis, that it would be prudent if standards accommodated any unforseeen long-term effects.

For a child, 40 mag/100 ml of whole blood is considered to be the level above which toxicity and undue body burden occur.(19) However, for a child with anemia, the clinical effect of 40 mcg/100 ml may well be equivalent to that at a higher blood level in a child with normal blood.(19) The observed summer increase of lead levels in children suggests that a child with blood concentrations on the borderline in winter may well get worse with seasonal change.(20a)(20b)(20c) Children who become acutely ill may mobilize large amounts of lead from bones into the blood stream, with a resulting sharp rise in blood lead concentrations.(15)

2. Earliest Adverse Metabolic Effects

In defining a health related standard it is important to consider sub-clinical effects as well as clinical disease. The interference of lead with heme protein synthesis is such a sub-clinical effect. Aminolevulinic acid dehydrase (ALAD) is an important enzyme in heme protein symthesis. It has been found that impaired ALAD activity

in red blood cells is the earliest evidence of an adverse metabolic effect to environmental exposure to increasing concentrations of lead. (21)(22) There appears to be no blood lead level threshold below which inhibition of ALAD does not take place.(22) In addition, ALAD's substrate (ALA) is excreted in urine when ALAD is inhibited. This effect is initially observable at blood lead levels of 27-35 mcg/100 ml and exhibits an increasing exponential relationship above 40 mcg/100 ml.(21) This "signifies inhibition of ALAD that is physiologically significant in vivo".(5) This action must be viewed as undesirable in that it does represent an interference with the availability of an essential metabolite required for normal body function, which in some circumstances might prove deleterious.(1)

Given the analogy of diabetes where disease is recognized when glucose spills into the urine, even in the absence of symptoms, it is not unreasonable to consider the condition of ALA in the urine as pre-disease, or at least as a factor which increases body stress.(9)

Thus the designation of 40 mcg/100 ml as a threshold level below which no biologic damage is assumed to occur deserves re-examination. A single blood level is a static measurement of a number of dynamic forces: intake, excretion, and sequestration in tissue. It ignores differences in susceptibility of the host to lead.(13) For instance, it is well known that sickle cell anemia and cystinuria are exacerbated by lead. Blood level is an imperfect index of exposure and damage to the organism; damage can occur at levels below those accepted as safe.(13)

3. Human Exposure

(i) Ambient Air

The mean values of lead determined in urban areas of Ontario are in the range of 0.4 to 2.4 mcg/m^3 with values in Metropolitan Toronto slightly higher at 1.1 to 2.4 mcg/m^3. The median Provincial value is 0.9 mcg/m^3.(23)

It is well to note that the mean value of lead blood levels for groups of males subdivided by occupation and activity has been found to be as high as 38 mcg/100 ml, with corresponding annual average air concentrations of 1-3 mcg/m^3.(24)(25) Concentrations of lead in blood of children exposed to air with a lead content of about 1 to 3 mcg/m^3 varied from 15 to 40 mcg/100 ml.(26)

Blood level concentrations from epidemiologic studies of various general and occupational groups have been compared with estimated ambient air exposure to lead. The data suggest that blood lead levels increase as air concentration increases, particularly above 2 mcg/m^3.(27) The proposed standards recognize this relationship, and the prediction that further increases in atmospheric lead will result in higher blood lead levels in the population.

The Ontario standards are contained in Regulation 15 of the Revised Regulations of Ontario, 1970, dated September, 1972. Under "Standards for Emitted Contaminants" the following is listed:

20 micrograms per cubic meter averaged over 30 minutes

and under "Criteria for Desirable Ambient Air Quality":

15 micrograms per cubic meter averaged over 24 hours
10 micrograms per cubic meter averaged over 30 days

The 30 minute and 24 hour standards are not based on any human health criteria. The initial standard was a simple 1/10th function of the occupational standard for lead workers and the air quality criteria were statistically based functions of the 30 minute standard.(25)

It is desirable to set a standard that will ensure a low exposure over a longer period of time to more adequately reflect human exposure and hazard.

In recognition of the hazards of airborne lead,

THE METROPOLITAN TORONTO LABOUR COUNCIL RECOMMENDS AN AMBIENT AIR QUALITY STANDARD OF 1.5 mcg/m3 BASED ON A 24-HOUR AVERAGE SAMPLE THAT IS APPLIED AT ANY GIVEN TIME AND AT ANY GIVEN POINT SOURCE.

(ii) Dustfall

Mean values of lead in dustfall in areas remote from lead sources are of the order of 0.2 $mg/m^2/30$ days.( ) In addition, a further 1 $mg/m^2/30$ days is added in precipitation.( ) Mean values of lead in dustfall are in the range of 7-35 $mg/m^2/30$ days in Metropolitan Toronto.(23) Particulate size from automobile exhaust is primarily in the submicron range, approximately 80%. However, the majority of particulate fallout from secondary refineries is above seven microns with approximately 70% above one micron. Both these sources contribute to the total dustfall in the environment. Levels of 200 $mg/m^2/30$ days have been recorded to double the blood lead content in adults.(28) There is no Ontario standard for lead in dustfall. The Ministry of the Environment has recommended 100 $mg/m^2/30$ days as a possible suitable standard.(23)

In recognition of the contribution of dustfall to elevated soil levels,

THE METROPOLITAN TORONTO LABOUR COUNCIL RECOMMENDS A DUSTFALL LEVEL OF 35 $mg/m^2/30$ DAYS SAMPLE THAT IS APPLIED AT ANY GIVEN TIME AND AT ANY GIVEN POINT.

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(iii) Soil

There is no Ontario standard for lead in soil, but the upper limits of normal for areas in Metro away from major industrial lead sources is in the area of 200 parts per million (p.p.m.).(29) Data indicates that pica, lead intoxication through ingestion, can be attributed to lead in soil (30) and in an area where past contamination from a now almost defunct mining and smelting industry has elevated extensive surface concentrate of lead, blood lead levels of 40 to 60 mcg/100 ml have been found in 10 to 15% of the population.(31)

In recognition of the hazard of lead in soil,

> THE METROPOLITAN TORONTO LABOUR COUNCIL RECOMMENDS A LEAD IN SOIL STANDARD OF 300 p.p.m. IN ANY INCH OF SOIL AT ANY GIVEN POINT ACCESSIBLE TO THE PUBLIC.

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STANDARDS FOR CONTROL OF POLLUTANTS

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