PREM 19/2719

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Report of (Lawther) Working Party on Lead

HOME AFFAIRS

MARCH 1980

Referred to	Date	Referred to	Date	Referred to	Date	Referred to	Date
20.3.80		27.7.87					
5.7.86							
17.1.89							
8.2.89							
26.10.82							

PREM 19/2719

TO BE RETAINED AS TOP ENCLOSURE

Cabinet / Cabinet Committee Documents

Reference	Date
E(EA)(81) 8th meeting, Item 2	9/4/1981
E(EA)(81) 20	6/4/1981
E(EA)(81) 5th meeting	9/3/1981
E(EA)(81) 14	4/3/1981
CC(83) 12th meeting, Item 1	14/4/1983
CC(83) 13th meeting, Item 3	21/4/1983
CC(84) 25th meeting, Item 3	28/6/1983

The documents listed above, which were enclosed on this file, have been removed and destroyed. Such documents are the responsibility of the Cabinet Office. When released they are available in the appropriate **CAB** (CABINET OFFICE) CLASSES

Signed B. Walsh Date 9/8/16

PREM Records Team

Published Papers

The following published paper(s) enclosed on this file have been removed and destroyed. Copies may be found elsewhere in The National Archives.

Royal Commission on Environmental Pollution: ninth report:
ISBN 0 10 188520 2

Signed B. Walsh Date 9/8/16

PREM Records Team

CONFIDENTIAL

file PH3

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

8 February 1989

Dear Paul.

LEAD-FREE PETROL

I spoke last night to Sir William Heseltine who confirmed that The Queen has agreed to take part in the launch of the Motability Campaign for Lead-Free Petrol on Monday 13 February. I understand that this will take place in the Royal Mews where The Queen will look at one of the royal motor cars being converted and will also witness the release of the promotional balloons. The Prime Minister will not take part in this but your Minister may well wish to.

The next stage will be to arrange to have a Question put at Prime Minister's Questions in order to provide an opportunity for the House to applaud the initiative. The first choice is to ask Mr. Alf Morris if he will do this. Sir Jeffrey Sterling will be approaching him to see if he is willing.* If not, Sir Hugh Rossi, as Chairman of the Environment Committee, would be a suitable alternative, although this would have less of an all-party flavour. I attach a draft of a suggested Question and Answer on which I would welcome comments.

Could you provide me with a copy of your Department's briefing on lead-free petrol and also check that the new car which is to be delivered to the Prime Minister shortly will indeed run on lead-free petrol.

I am copying this letter to Alex Allan (H.M. Treasury), Stuart Lord (Department of Social Security), Roy Griffins (Department of Transport) and Murdo Maclean (Chief Whip's Office).

Yours sincerely

Andrew Turnbull

ANDREW TURNBULL

Paul Grice, Esq.,
Department of the Environment.

* I have not heard that he is willing. I will talk to Murdo Maclean to get this in hand.

CONFIDENTIAL

to

LEAD-FREE PETROL: DRAFT QUESTION AND ANSWER

Question: Will the Prime Minister join with me in applauding the initiative which Motability are leading to promote the use of ~~lead-free~~ unleaded petrol, not only in the vehicles which it provides for the disabled, but also by car owners everywhere.

Answer: I congratulate Motability, and the companies and organisations working with it, on launching this initiative. I am sure everyone in this House will want to wish it success. This will benefit not only disabled people but, by reducing contamination of lead in the atmosphere, will improve the health of future generations of children. For its part, the Government will be progressively converting its own fleet of cars, as I hope everyone else will.

PM3AII

Mr Ridley
Sterling
Bottomley
CJ
Gph

Prime Minister

We notice timing of any campaign would need to wait on the Budget but the view I minister is: is this now time for Government to take over funding unleading advertising from the private sector?

PRIME MINISTER should Ministers have another go at manufacturers, oil companies + petrol retailers to be more effective than they have so far in getting the message across?

27 January 1989

PUBLICITY CAMPAIGN FOR UNLEADED PETROL

DM 27/1.

1. It seems quite likely that Nigel Lawson will again widen the duty differential between leaded and unleaded petrol in the Budget. Unleaded petrol is now some 11p a gallon cheaper than leaded 4-star.

2. But the effect of this price differential has been very limited. There is still wide-spread ignorance about the low cost (£20 or less) and ease of having older cars converted to take unleaded petrol. Crucially, it is not widely known that following conversion, cars can run on either type of petrol. The fear of being stranded far from an unleaded petrol pump is thus a myth.

3. Proportionately the UK has a larger number of petrol stations selling unleaded than France, Italy or Ireland. We have a clear duty differential. Yet the public response remains disappointing; only 10 per cent of cars on the road in the UK can run on unleaded.

4. There is a growing feeling that the only hope of getting to people is via a Government-funded television campaign immediately after the Budget. This might cost £2-3 million. The Department of Environment could find this.

5. A marked increase in the number of UK cars running on unleaded petrol would turn this into a successful government initiative in favour of the environment. More importantly, it would benefit children's health.

6. Would you favour such a publicity campaign?

Carolyn Sinclair

CAROLYN SINCLAIR

File:
NOT submitted
Miss Sinclair will talk to Mrs Bottomley & follow up Mr Ridley + other relevant initiatives
DM 31/1.

cc BI
LFG

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET LONDON SW1P 3EB
01-276 3000

My ref:

Your ref:

Prime Minister
To be aware. The reference at X c No 10 is to a conversation I had with Sir Jeffrey in which I encouraged this initiative
AT 24/1

Andrew Turnbull Esq
Principal Private Secretary
10 Downing Street
LONDON
SW1

24 January 1989

Dear Andrew

I promised to let you know what transpired at Mrs Bottomley's meeting with Sir Jeffrey Sterling, Chairman of P & O, and Peter Thomas, a Director of P & O about unleaded petrol.

Sir Jeffrey explained that following Mrs Bottomley's letter to the top 100 companies encouraging the use of unleaded petrol he was convinced of the environmental and commercial benefits of changing over to the new fuel. P & O would be setting an example by converting their whole fleet. This may have some difficult consequences in remote areas where unleaded was not yet available but they were willing to live with this.

Sir Jeffrey said that as Chairman of Motability he had widespread contacts and would be recommending the convertion of all of their vehicles to run on unleaded petrol.

P & O want to co-ordinate a major campaign to persuade industry to change to unleaded. His intention was to start a kind of "unleaded club".

Sir Jeffrey drew an analogy with the Great Ormond Street Hospital appeal; nobody could afford not to say yes to them. He said that as he already had a number of influential people signed up to the Motability campaign such as the CBI, the IOD, the Daily Mail, Duke Hussey and Michael Grade, he thought he was in a strong position to persuade them to support him on this. He said the Secretary of State for Transport and No 10 had indicated their support. David English had also said that he would like to help where possible.

X

Sir Jeffrey explained that P & O were prepared to sponsor it and lead the campaign. It was necessary to move rapidly; certainly before the Budget.

Mrs Bottomley said she believed that industry has an important role to play in the move to unleaded petrol. The Minister said she welcomed P & O's interest and suggestion that they would take a lead in further mobilising the captains of industry while we and CLEAR concentrated on co-ordinating the efforts of the various interests.

Sir Jeffrey said that he and his advisors would now consider how best to take the idea forward. Mrs Bottomley said that she would discuss Sir Jeffrey's proposals with colleagues, but in the meanwhile Sir Jeffrey might like to know of our intention to issue a press release on either 26 or 27 January reporting on responses to her letter to the top 100 companies. Sir Jeffrey saw this as an possible opportunity. Mr Weeden of this Department was nominated as the liasion point between DOE and P & O.

I will keep you informed of developments. Copies of this letter go to PS/Secretary of State for Transport and PS/Mr Bottomley.

DWIGHT DEMORAIS
Private Secretary

Note
Phoned Mrs Bottomley's office & (Nicola) and told her of this. Mrs Bottomley has written to top 100 companies urging switching. She agreed to push timescale
AT 17/1

PRIME MINISTER

LEAD-FREE PETROL

This is to give you advance warning of a proposal which Jeffrey Sterling is working on. He has perceived that the move to lead-free petrol is something which is in the interest of society as a whole (I have established that there are no adverse greenhouse effects), but which it is not in anyone's interest to take the lead. If usage of lead-free petrol is to take off it is necessary to get a number of people to move together. He believes he can do this by arranging for a number of large companies, including his own, to announce at the same time that they will be converting their company car fleets to lead-free operation and buying the lead-free variants of new cars. He has also persuaded the Council of Motability to adopt a lead-free policy for the Motability fleet of cars which numbers around 100,000. There is no action for you at present though I suspect this will lead to an invitation to you to associate yourself in some way, e.g. attendance at a launch, with this development.

AT

(ANDREW TURNBULL)

17 January 1989

DCAART

SECRETARY OF STATE FOR THE ENVIRONMENT

2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

My ref:

Your ref:

27 July 1983

Dear Willie,

I am writing to let you know that we propose to give two written answers tomorrow on issues that may raise some press comment.

The first is on the Government response to the Royal Commission on Environmental Pollution's Ninth Report on Environmental Lead - on all matters other than lead in petrol on which of course the Government has already responded. I attach a copy of our draft press notice. The second is to affirm the Government's policy on the sea-dumping of low-level radioactive waste. At a meeting of Ministers for Employment, Environment and Energy yesterday, it was agreed that in the light of the current difficulties being encountered in this year's sea-dump it was important that the Government's commitment to the use of the sea disposal method should be affirmed. The exact form of the answer has not yet been settled, but it will probably provide a summary of the justification of the Government's policy and confirm that there is a clear national interest in seeing it implemented. Our press office will of course be co-ordinating with yours.

Yours sincerely

Helen Ghosh

Mrs H F Ghosh
Private Secretary

Willie Rickett Esq

DRAFT PRESS NOTICE

PATRICK JENKIN ANNOUNCES NEW INITIATIVES ON LEAD

1. Patrick Jenkin, Secretary of State for the Environment, today announced the Government's response to the Royal Commission on Environmental Pollution's Ninth Report, 'Lead in the Environment'.

2. Among the initiatives announced today are early completion of surveys of water supply zones, consideration of ~~a~~ grant for replacing lead plumbing, a publicity campaign on the hazards of old leaded paint, research on lead in dust, and the setting up of a steering committee to look into changes in environmental lead.

3. In response to a Parliamentary Question from.....
Mr Jenkin said:

"The Government's response will be published in printed form in a few weeks' time; but I have today placed a final draft in the Library of the House.

"The Royal Commission on Environmental Pollution's Ninth Report on lead provides an authoritative, up-to-date and objective review of the situation in this country; a comprehensive overview of the current state of knowledge; and - most important - a sound and rational basis for decision-making.

"The report acknowledges the importance of the steps already taken by the Government to reduce exposure to lead from food, water, petrol, old paint and industrial emissions. But because the use and distribution of lead are widespread and because there appears to be no assured safety threshold, the report recommends a line of maximum prudence in reducing exposure to lead still further. The Government fully endorse this general objective.

"The Government have already announced their decision that lead should be eliminated from petrol as soon as possible. The aim is to achieve the Royal Commission's target date of 1990 for the introduction of unleaded petrol throughout the European Community and, if possible, improve upon it. Negotiations with other members of the EC are already under way.

"The Government regard action on other sources of lead as equally important; and our response details what action is planned or already in hand on each. Among the new initiatives announced today are:

- the setting of early target dates for the completion of lead surveys of water supply zones and the main programme of remedial treatment;
- a further investigation of the ~~need for a specific~~ arrangements grant ~~scheme~~ for the replacement of lead plumbing;
- a major publicity campaign on the hazards of old leaded paint;
- support for research into the significance of lead in dust for children;
- establishment of a steering committee, with representatives from local government to co-ordinate and evaluate a programme to monitor changes in environmental lead.

"There can be no complacency about lead pollution, however low average UK body-lead levels are, and however uncertain the possible effects might be. The Government's response to the Royal Commission's Ninth Report illustrates our determination to safeguard the public and the environment to the best of our ability."

NOTE TO EDITORS

1. The report of the DHSS working party on lead, chaired by Professor P J Lawther, was published in 1980 ('Lead and Health').

2. Tom King, then Minister for Local Government and Environmental Services, announced the Government's response to the Lawther Report on 11 May 1981, in a statement to the House of Commons. Measures included:

- a reduction of the maximum permitted lead content of petrol from the present limit of 0.40 grammes per litre to 0.15 grammes per litre by the end of 1985;

- plans to give information and advice to local authorities on lead generally and old paint-work in houses and buildings specifically;

- an intention to make plumbing alterations eligible for home improvement grant where high levels of lead occurred in drinking water;

- reviewing the implications of the use of lead solder in food cans;

- Government agreement on the Lawther report recommendation of an air quality standard for lead of 2 microgrammes per cubic metre (a standard now adopted in an EC Directive).

3. The Royal Commission on Environmental Pollution's Ninth Report, 'Lead in the Environment', was published on 18 April 1983 (Cmnd 8852). The Royal Commission concluded that although adverse effects from low levels of lead on health - particularly children's intelligence and behaviour - had not been convincingly established, exposure to lead should be reduced wherever possible as a matter of prudence. They recommended a tightening up on all sources of environmental lead.

4. As Secretary of State for the Environment, Mr Tom King announced in a statement to the House of Commons on 18 April 1983 (Official Report, col 21-22) that the Government had accepted the Royal Commission's recommendation to eliminate lead from petrol completely, and undertook to initiate discussions with the UK oil and motor industries and with our EC partners on a feasible timetable. The full response announced today - copy attached - reports on progress to date on that issue and sets out how the Government proposes to tackle the Commission's recommendations on other important sources of environmental lead.

PRIME MINISTER

Statement on Environmental Lead

The Opposition tried with little success to paint Mr. King's statement as an inadequate response to the RECP Report.

Gerald Kaufman went out of his way to congratulate the Royal Commission and to welcome its Report, in contrast to what he described as the Government's U-turn. He said that the RCEP did not give a blanket endorsement of the Government's 2-stage approach. Denis Howell had recommended a move to lead-free petrol for new vehicles two years ago, and the Government's response had been that this would lead to a much slower improvement than the approach they were then adopting. Even now, the Government was taking a leisurely approach: no timetable had been set for the consultations with EC partners. He gave an assurance that a Labour Government would implement the RCEP's recommendations, and that it would inform the Commission that it would implement these recommendations by a certain date if agreement had not been reached within the Community.

The theme of most Opposition Members' Questions was that the Government's approach gave a veto to its Community partners and that the Government should set a deadline by which agreement must be reached. The other theme of Questions was that the Royal Commission's Report vindicated the CLEAR campaign and that the Government should not have waited two years before announcing its decision to move to unleaded petrol.

Leslie Spriggs and Robert Adley both made an impassioned plea for the introduction of lead filters on car exhausts.

Mr. King said that the Labour campaign document "New Hope for Britain" set no deadline for the introduction of lead-free petrol. The Government recognised the need for urgent action, but it was in the interests of our motor car

/industry,

industry, and of environmental protection, to persuade our European partners to follow our lead. The Royal Commission Report showed that the 2-stage approach adopted by the Government was the most effective way of reducing lead pollution in the shortest possible time. It would be fatuous to tell our European partners that we did not care if they did not agree with our approach, and that we would go it alone in such circumstances: that would hardly strengthen our negotiating hand. The Royal Commission said that it might be possible to introduce lead-free low octane petrol for new vehicles by 1990; he hoped that it would be possible to introduce it earlier. He reminded the House that the reduction of the lead content of petrol from 0.4 g/l to 0.15 g/l by 1985, which would apply to every vehicle, would make the greatest contribution to reducing lead pollution. This new step would make a smaller contribution since it only applied to new vehicles. (It took ten years for unleaded petrol to capture 50 per cent of the petrol market in the US). He pointed out that the introduction of lead filters would simply lead to the problem of disposing of used filters.

18 April, 1983

Lead in the Environment

3.31 pm

The Secretary of State for the Environment (Mr. Tom King): With permission, Mr. Speaker, I should like to make a statement about lead in the environment. The Royal Commission on environmental pollution has today published its report on this subject, and copies are available in the Vote Office.

In 1981 the Royal Commission decided that it would be timely to review the whole field of environmental pollution. It invited a wide range of organisations and individuals to give their views on the types of pollution which they perceived to pose the greatest threat to the environment and to comment on the Royal Commission's own provisional choice of topics for study. Environmental contamination by heavy metals was among those topics, and the response to the Royal Commission's invitation showed that the specific problem of lead was an issue of major and continuing concern to the public and the scientific community.

The Royal Commission therefore decided to complete and publish separately the results of its study of lead as soon as possible, and to report on the other matters later this year. The Government welcomed this decision, since we felt that the Royal Commission's independence and authority would be most valuable in clarifying the issues surrounding this complicated and difficult subject. I am most grateful to the chairman, Professor Southwood, and his colleagues in the Royal Commission for the prompt, thorough and comprehensive manner in which they have conducted their present study.

In its report, before discussing a range of particular problems and possible measures to deal with them, the Royal Commission reviewed the sources of lead in the environment, the pathways by which it enters living systems, and its effect on man and animals. It stresses that there is still uncertainty about the effects on individuals of the low levels of lead typical in the United Kingdom. It notes that features of lead poisoning occasionally occur at blood-lead levels of about 50 microgrammes per 100 millilitres of blood; and that

"at present the average blood-lead concentration of the United Kingdom population is about one-quarter of that level."

It continues:

"We are not aware of any other toxin which is so widely distributed in human and animal populations and which is also universally present at levels that exceed even one-tenth of that at which clinical signs and symptoms may occur."

It concludes:

"It would be prudent to take steps to increase the safety margin for the population as a whole."

The Royal Commission's report contains a number of recommendations covering all the sources of exposure to lead, including water, paint, food and drink. It commends the action already taken by the Government under the programme that I announced to the House two years ago. It now recommends further action in certain areas. For example, early completion of our programme for treating naturally acidic drinking water to reduce its lead solvency and extension of the grants we offer for lead plumbing replacement; a progressive reduction in the lead level of new household paint; more publicity about the hazards of old leaded paint and how to avoid them; and a tightening up on emissions from lead processing works. We shall bring forward an early response to those recommendations.

There is, however, one recommendation which the Royal Commission believes should be the subject of immediate action by tge Government and on which an early announcement is desirable. This relates to future policy on levels of lead in petrol. I announced two years ago that we would require the compulsory reduction of the maximum permitted level of petrol lead from 0·4 to 0·15 grammes per litre by the end of 1985. This action, applying to every vehicle, was the most effective way of achieving the largest possible reduction in the shortest possible time. The Royal Commission strongly endorses this decision; and it now recommends that it should be regarded as an intermediate stage in the phasing out of lead additives altogether, with the requirement that from an early date all new vehicles should be required to use 92 octane lead-free petrol. The Royal Commission estimates that the cost of this change would be small in relation to the likely gains in fuel efficiency over the next few years.

The Royal Commission believes that the motor manufacturing industry would have no insuperable difficulty in making the transition. But it recognises that the car industry which supplies our market is organised on a European basis; and Community directive 78/611 lays down 0·15 grammes per litre as the minimum lead content that member states may stipulate in their own legislation. The change which the Royal Commission proposes requires Community agreement, and it recommends that we initiate negotiations immediately with our European partners.

I can now tell the House that the Government accept the Royal Commission's recommendations on lead in petrol. My hon. Friend the Under-Secretary of State will be writing to our opposite numbers in the Community immediately to set out the United Kingdom's position, with a view to opening formal negotiations as soon as possible. We shall also, of course, discuss with the United Kingdom oil and motor industries a timetable for the introduction of unleaded petrol.

Typical blood-lead levels in the United Kingdom are low and dropping. Substantial research efforts have so far shown no conclusive evidence that these typical levels have adverse effects on the health of children or adults. But it is, and has been throughout, the Government's policy to increase the safety margin wherever possible, and while lead in petrol is not the largest contributor to the average body burden, it is the largest that is controllable on a national basis.

Our acceptance of these recommendations of the Royal Commission, following the previous decision to reduce lead in petrol for all vehicles to 0·15 grammes per litre from 1985, represents the best possible route to achieve the earliest and most substantial reduction in petrol lead coupled with its eventual elimination.

Mr. Gerald Kaufman (Manchester, Ardwick): Her Majesty's Opposition welcome the report and congratulate the Royal Commission on it. I thank the commission for sending me an advance copy of the report so that I had a little time to study it.

We welcome the report as a significant milestone in the campaign against lead in the environment. We accept its recommendations, including the valuable recommendations of home improvement and repair grants for the removal of lead from plumbing and the reduction of lead in paint.

[Mr. Gerald Kaufman]

We note with interest the Government's U-turn on the removal of lead from petrol—*[Interruption.]* Far from giving a blanket endorsement of the Government's decision two years ago to reduce the lead content from 0·40 grammes per litre to 0·15, the Royal Commission draws attention to the increased costs to the relevant industries of that policy as distinct from a decision to eliminate lead from petrol outright. In paragraph 7.85 it states that

"companies are likely to take the view that the transitional stage is likely to be too long (or the prospect of European agreement on unleaded petrol too uncertain) to justify postponement or modification of the investment already planned."

When, two years ago, my right hon. Friend the Member for Birminghan, Small Heath (Mr. Howell) recommended an immediate policy of removing lead from petrol, the Secretary of State said that our policy would result in a slower improvement in lead pollution. Will the right hon. Gentleman now say that the adopton by him of what we recommended two years ago will lead to a slower improvement?

The Secretary of State said:

"On the evidence available to me, it would be 25 years before we achieved the position that I have recommended." —[*Official Report*, 11 May 1981; Vol. 4, c. 485.]

Will the Secretary of State say whether it will still take 25 years—or possibly 23 now—to adopt the policy that we recommended two years ago?

The Government's reaction even now is far too leisurely. If the Government have accepted this important report, it simply will not do to say that the action they will now take is that the Under-Secretary will write to his opposite numbers in the Community. The Secretary of Stste should himself initiate talks with the Community right away.

The Minister did not mention a date for implementation. What is his timetable? What date does he have in mind? The next Labour Government will implement this report. *[Interruption.]* Yes, we shall set a date for its implementation and enter into talks with the EC, because we accept fully the statement in paragraph 7.132 that it would be right for the United Kingdom to give a lead to the rest of Europe in phasing out the use of lead in petrol. Therefore we shall inform the EC that that will be our policy and that whatever the state of the negotiations at the time we set for the elimination of lead from petrol, we shall implement it on that date. The Government have wasted two years. The next Labour Governmnent will make sure that no time is wasted on an issue that is vital to the nation's health.

Mr. King: I am grateful for the right hon. Gentleman's basic welcome to the statement. I was intrigued by his comments about setting a date. I noticed in a rather strange document called "The New Hope for Britain" a statement about the elimination of lead, but carefully omitting any reference to a date by which a Labour Government would seek to achieve it.

Obviously we must enter into urgent discussions with our European colleagues on the matter, and I hope that the discussions can be brought to an early conclusion because it is important, not least for the motor industry, that this change is achieved on a Europe-wide basis. At this stage it is not possible to predict when it will be possible to achieve that, but we shall certainly enter into the discussions in good faith and with a proper sense of urgency.

The right hon. Gentleman said he would have an opportunity to study the report. I draw his attention to the graph in chapter 7, from which he will understand that as a result of taking the course of making the announcement that I made two years ago, followed by my announcement today, after we have achieved a reduction for all vehicles to the lower lead level in 1985, we shall then seek at an early date to introduce compulsory lead-free petrol, 92 octane, for all new vehicles. That combination is the most effective way of reducing lead levels by the most substantial amount in the shortest time. Any hon. Member who wishes to challenge that will find that proposition endorsed by the Royal Commission in its report. Therefore, I make no apologies. The right hon. Member for Birmingham, Small Heath (Mr. Howell) said in responding to my previous statement that we would get the worst of both worlds. The Royal Commission has kindly confirmed that we will get the best of both worlds.

Mr. Kaufman: The right hon. Gentleman is deliberately distorting what the Royal Commission says —[HON. MEMBERS: "Oh!"] and hon. Members will have an opportunity to judge that when they read the report, which he and I have had the opportunity to do, but which few hon. Members have had the chance to do.

The right hon. Gentleman says that he will seek to eliminate lead from petrol. Will he now give a categoric assurance that, if he remains in office, he will eliminate lead from petrol regardless of the outcome of any discussions with the EC? If not, he is not giving any commitment, and that is why I repeat the commitment from these Benches that we shall do it, whatever the outcome of those negotiations.

Mr. King: It is enormously in the interests of Britain and its car industry that this change should be achieved —as his hon. Friend the Member for Coventry, North-West (Mr. Robinson), who knows something about the industry, knows well—in partnership and harmonisation with other members of the Community. The most fatuous way in which to enter into negotiations with out partners in Europe, when we have the clear intention of seeking this change, would be to start off by saying that we do not mind even if they do not agree.

Mr. Nigel Forman (Carshalton): This is a further timely instalment in the Government's excellent policy for dealing with the problem of lead in the environment. Is my right hon. Friend aware that it would make no sense to proceed other than with the agreement of our Community partners? Will he therefore give that the highest and most urgent priority, because that is the correct policy by which to bring great health benefits to the children of this country?

Mr. King: I am grateful to my hon. Friend for those comments, and I know that he will be interested to see in chapter 7.55 how the curve in the figures demonstrates the valuable and early benefits that will result from the reduction of lead to 0·15 by 1986 and the way in which that reinforces the Government's arguments about this change in course. That is the approach that we have taken, and I am proud that we are able to make this further announcement today.

Mr. A. J. Beith (Berwick-upon-Tweed): We warmly welcome the statement and the decision contained in it. Does the right hon. Gentleman agree that the motor industry needs to know whether he is aiming at two years or 20 years, that it needs an idea of the date for which he is aiming? Will he say how quickly he thinks the Community can reasonably reach such a decision? We believe that it should be quickly.

Mr. King: The evidence given to the Royal Commission by the industry indicated 1992. The Royal Commission felt that that was a pessimistic estimate of what was possible. Its assessment was that it should be 1990 at the latest. I hope to see it achieved at an earlier date and it is the intention of the Government, in consultation with our partners and colleagues in Europe, and with the industries in this country, to seek to achieve an earlier date.

Mr. Leslie Spriggs (St. Helens): Is the Minister aware that rather than wait one or two years, or more, for a change in the policy of the motor car industry to the filtering of lead from petrol, filter manufacturers such as the Associated Octel Co. Ltd. and others, are manufacturing filters that provide for the atmosphere to be completely free of lead?

Mr. King: That matter is dealt with in the report. The Royal Commission challenges whether the filters remain effective over their life. As it is recognised that lead is a neurotoxin of considerable potency, it does not seem to make sense to introduce lead into the environment only to take it out again and then be left with the problem of the disposal of many highly polluted filters.

Mr. John Wheeler (Paddington): The Royal Commission's report and principal recommendations will be a source of great pleasure to my constituents, and still more will be his ready acceptance of those recommendations. What improvements does he expect will arise for the environment in the inner cities as a result of adopting those recommendations?

Mr. King: I am pleased to say that in my earlier statement we made the most important announcement, which was a reduction from 0·4 to 0·15, which will reduce to about one third the emission of lead from all motor cars in the constituency of my hon. Friend, and all other constituencies, with effect from the end of 1985. That is the logical further development, which will then progressively further reduce the figure closer to zero.

Mr. Clinton Davis (Hackney, Central): Does the Minister agree that the case that has been argued by the organisation CLEAR has now been fully vindicated and that his statement, which will be welcomed by most right hon. and hon. Members, is in marked contrast to the rather feeble approach that was announced two years ago? Does he recognise that there will be demonstrable concern, which he has so far failed to indicate, over any veto that might be encouraged by any member of the EC in answer to the application that this Government are proposing to make to the EC and that that will be viewed with the greatest possible concern by millions of people in this country and particularly by those living in inner city areas, where pollution is most rife?

Mr. King: With respect, I do not believe that the hon. Gentleman begins to understand our approach to this matter. He does not seem to be aware that the announcement that I made two years ago, far from being feeble, led to the biggest reduction of lead in petrol, which will start at the end of 1985. This further reduction will improve the position by reducing the amount to zero.

I shall not comment further on any possible obstruction in Europe. That is not the spirit in which we enter negotiations. I hope that we shall achieve a satisfactory outcome. Some hon. Members may have noticed the press report three days ago which said that the German motor industry was petitioning its Government to go lead-free. I expect our proposals to receive a good response from other members of the European Community.

Mr. John Cartwright (Woolwich, East): Does the Secretary of State accept that the psychological impact of the acceptance of lead-free petrol is much greater than the reduction of the quantity of lead in petrol? On that ground alone his statement will be much welcomed, particularly by teachers and parents in inner cities who have been increasingly worried about the problem of lead in petrol. In his negotiations with our European partners, will he underline the fact that the requirement for lead-free petrol for new vehicles in the United States since the middle 1970s shows the need for the European car market to change as rapidly as possible?

Mr. King: There are good commercial reasons why many motor manufacturers, which are already manufacturing for the United States market and export, are required to manufacture cars that conform to these requirements. There have been misleading aspects in some of the campaigns that have been conducted, but the most valuable change will be the requirement for all motor cars to run on a much lower level of lead with effect from the end of 1985. The hon. Gentleman may take particular satisfaction, as I do, from the statement, but the requirement applies to new cars and will take some time to come in. It took ten years following the introduction of unleaded petrol in the United States before the consumption of unleaded petrol had reached half the total consumption.

Mr. David Atkinson (Bournemouth, East): Is my right hon. Friend aware that his statement will be welcomed warmly by my constituents, not least by the parents of St. James's school, Pokesdown, outside which the highest lead pollution in the atmosphere in the country has been established? They will be mightily relieved by his statement. My right hon. Friend suggested that he should negotiate with the European Community. Would it not be better to negotiate with the Council of Europe, so that some kind of European convention could be established for the 21 Western European states?

Mr. King: I join the right hon. Member for Manchester, Ardwick (Mr. Kaufman) in the tribute that he paid to the Royal Commission. The report will have a profound effect in Europe. The Royal Commission is highly respected and the quality of its reports is outstanding. I expect the report to have a significant effect on the debate that will now take place. If we succeed, and Community car manufacturers have to produce cars that run on lead-free petrol, it will mean effectively that the car manufacturing world will go that way.

Mr. Bob Cryer (Keighley): What inducement will the Minister provide for local authorities to remove lead paint from schools? This is a problem for many authorities, particularly those with a large number of Victorian

[Mr. Bob Cryer]

schools, many of which have been painted over many years with leaded paint. Secondly, will he give an assurance that the Government will be prepared to take action independently of the EC to get rid of lead from petrol entirely, as our experience is not happy when trying to obtain EC standards for dangerous materials? We have negotiated for four years to increase safety standards in the use of asbestos, which is arguably at least as dangerous as lead, and to this day we have reached no agreement on that.

Mr. King: Without commenting on the last part of the hon. Gentleman's question, he will recognise that we are dealing with major car manufacturers which are seeking to sell not just in their home markets but in other countries of the Community, and therefore a degree of conformity is likely to be rather easier to achieve. I endorse the perfectly proper importance that the hon. Gentleman attaches to lead paint and the problems of old lead paint. We have done what we can to help local authorities and we shall consider the report's recommendations to see what further action we can take.

Mr. T. H. H. Skeet (Bedford): Will the Secretary of State bear in mind that more crude oil will have to be run to maintain octane ratings? Is he aware of section 2 of the directive 78/611, which says that levels below 0·15 g per litre should not be established? As the Community has 10 members, it will take a considerable time to get some of the people who do not want to take lead out of petrol to remove it.

Mr. King: From my previous contacts with my hon. Friend, I know that will be one of the hon. Members who will gain most from this report and will be most interested to read it. I believe he will find that some of the assumptions that were readily accepted previously, for example, the cost in crude oil terms, might be differently interpreted. He may find that the cost is rather less than might have been anticipated. We seek to change the directive that he quotes correctly. I have found, when negotiating in the Council of Environment Ministers, that other Environment Ministers are subject to the same concerns and interests as we are and will see the benefit of making the change, for many of the reasons that we feel are important.

Mr. Alfred Dubs (Battersea, South): Is not the Secretary of State being a little inconsistent in accepting the Royal Commission's conclusions? It recommends that the United Kingdom should give a lead to the rest of Europe, while the Minister is saying that we should act only in line with the rest of Europe. Which is it to be?

Mr. King: If that is a serious question, I should have thought that the hon. Gentleman could solve it. We shall give a lead to the Community by encouraging it to act in line.

Mr. Eldon Griffiths (Bury St. Edmunds): Will repair grants be adjusted to cover the cost of Plumbosolvent pipe replacements on the reduction from 0·4 to 0·15? Will my right hon. Friend try to ensure that an improvement is made throughout the OECD countries, and not just in the EC, at the same time? As someone who for four years was chairman of the clean air council within his Department, I congratulate my right hon. Friend on having overcome the resistance of the oil and car industries, which I failed to do and which my successor on the Labour Benches utterly ignored.

Mr. King: I know the efforts that my hon. friend made in this respect. One of the interesting things about the statement, and which hon. Members may notice from the report, is that attitudes have changed markedly even within the past two years. The view now is that there is not the same capital investment price to pay on extra refining capacity. The United States, Japan and Australia are already going this way. The Community is the one great trading entity that has yet to move in this direction. I think that this will establish the pattern effectively for the OECD. I believe that my announcement and the actions that we propose to take will give a lead to the Community in a way which I think the Community will be willing to follow.

Mr. Geoffrey Robinson (Coventry, North-West): The Minister is right when he speaks about a 10-year transition period in the United States. During the 10 years that I was asssociated with the industry, the issue was always being debated. Will he reassure the House that he takes this matter seriously, that he will give a lead to Europe, that he will say that we will proceed on our own if we have to, and that he will try to better the dates that he mentioned?

Mr. King: I am grateful to the hon. Gentleman. The House will be aware that he is familiar with the motor industry. Anyone who thinks that the industry has been sitting back utterly oblivious of the trends and developments taking place in other parts of the world is wrong. Many developments are taking place and many companies have anticipated possible moves in this direction. It has all tended to change the position from what it was a few years ago. I am optimistic that we can reach a sensible and early agreement with Europe.

Mr. Sydney Chapman (Chipping Barnet): I warmly welcome my right hon. Friend's statement. Is he aware that many of us are gratified because it shows that the Government have kept an open mind on the serious issue of lead in petrol and that while they would have been justified to rest on the statement two years ago in the light of the Lawther report, they have sifted new evidence and come to the right conclusion now. The Royal Commission is to be congratulated. May I suggest to my right hon. Friend that 1 January 1988 might not be too soon for lead-free petrol?

Mr. King: My hon. Friend can have lead-free petrol much earlier than that, if he wants it. The problem is much more on the car industry side.

Mr. Chapman: Yes, of course.

Mr. King: That is obviously the point that my hon. Friend had in mind. I am grateful to him for his remarks. The Royal Commission has done us a great service by the quality of its report. The most satisfactory aspect is that after the loud shouts and cries by various lobbyists, it has balanced the arguments and produced a cogent and well-thought out analysis of the problem. I appreciate that few hon. Members have had the opportunity to read the report, but when they do they will find it most interesting and well-argued.

Mr. Willian Hamilton (Fife, Central): Is the Secretary of State aware that there is overwhelming evidence that

with the present lead levels of petrol children's IQs are being seriously affected and that large numbers of people who realise that will be disappointed at the over-complacency of his statement? Does he agree that there are no technical reasons—there is much informed opinion to agree with this—why lead should not be removed from petrol within the next three years?

Mr. King: I am grateful to the hon. Gentleman, as he has helped to emphasise the point I was making. His opening remarks were absolute rubbish. To say that there is conclusive evidence about the affect of lead on children's IQs is absolute rubbish. The most recent authoritative studies in that respect in some ways show the opposite. It is precisely because such exaggerated statements are often based on fairly small analyses and studies that the Royal Commission report, in taking a balanced and informed view, is so valuable. To refer to my statement as over-complacent is a travesty of the facts. We have come to the House quickly in response to the publication of the report and announced immediate acceptance of that recommendation. How the hon. Gentleman can describe that as complacent completely defeats me.

Mr. Robert Adley (Christchurch and Lymington): Is my right hon. Friend aware that, on the basis of figures that have been given to me by the Department of Transport within the past month, I have learnt that the main beneficiaries of lead-free petrol will be the oil companies, which will sell £475 million worth more petrol for people to go the same number of miles as they do at the moment? Following the question that was asked by the hon. Member for St. Helens (Mr. Spriggs) about filters, is my right hon. Friend aware that the filter programme could be introduced five years earlier than the petrol programme and that filters take not only lead out of the atmosphere but many other nasty environmental pollutants as well? Will my right hon. Friend please look at the figures that I have had from the Department of Transport and at least conduct an open-minded examination of filters before finally making up his mind?

Mr. King: I invite my hon. Friend, as I invited the hon. Member for St. Helens (Mr. Spriggs), to study the comments on filters in the Royal Commission's report. My hon. Friend said that it was possible to implement the filter programme five years earlier than the alternative approach. That is rather strange. The Royal Commission said that it would take seven years at the most. I have said that I hope we can do better than that. Therefore, it is unlikely that the filters could be available five years earlier. The Royal Commission examined filters seriously. As my hon. Friend will appreciate, the question of filters ties in with the problem of pollution of the environment. What one does with the polluted lead filters afterwards could add to the problems. However, I shall leave the Royal Commission to argue its case to my hon. Friend.

Mr. Nigel Spearing (Newham, South): Will the Secretary of State confirm that there is no constraint at the refineries on the production of proper octane petrol that is lead free as from now? With regard to EEC regulation 78/611, will the right hon. Gentleman confirm that it is now illegal to sell lead-free petrol in this country because of the minimum amounts that are laid down in that regulation? Would it not be proper for people to be given the choice to have lead-free petrol if they wish and if their car engines can take it? Could that not be negotiated soon if necessary?

Mr. King: It is possible to sell petrol with a lead content lower than 0·15. However, under the directive it is not open to countries to require that petrol be sold below the minimum level of 0·15.

Mr. Harry Greenway (Ealing, North): I welcome the report on behalf of all parents and teachers, particularly those who live near busy roads such as the A40 in my constituency. Is my right hon. Friend aware that in various parts of the world a voluntary start has been made towards having unleaded petrol, that petrol companies have been prepared to make it available at petrol stations, that some people have been prepared to buy cars that are suitably adapted and that companies are making them on a voluntary basis? Will he look into that and encourage that trend?

Mr. King: That would be possible now. However, it would be on a voluntary basis. A commercial judgment would have to be made by the oil companies on whether the market would justify it. It is possible, authough I do not want to prejudge the discussions that we shall have. However, it would not be a uniform start. It is almost impossible to conceive that it would be. I think that there will be a progressive development.

Several Hon. Members *rose*—

Mr. Speaker: Order. I propose to call the three hon. Members who have been rising in their places, but who have not yet been called.

Mr. Donald Anderson (Swansea, East): Is not the Secretary of State saying that the pace of the implementation of the policy that he has announced today could be determined by the pace of the slowest member of the Community? Therefore, would it not be true to say that if there is not reasonable progress after a certain time we shall consider other possibilities, including unilateral action?

Mr. King: I intend that we shall go into the negotiations to achieve a satisfactory outcome at the earliest possible time.

Mr. Eric Deakins (Waltham Forest): Will the Secretary of State confirm that in seeking unanimity he lays himself open to the prospect of a veto by one or more of the other Community members?

Mr. King: The hon. Gentleman must reflect on whether there are countries in Europe that are wedded to the idea of maintaining as much lead in petrol as possible. I have not come across such a country. I hope that there will be a satisfactory outcome to the negotiations.

Mr. D. N. Campbell-Savours (Workington): Do the Government intend to phase in duty concessions on the price of lead-free petrol? Does the Secretary of State intend to move on another front, which is the sale and distribution of items such as figurines and toys made of lead, which can be sold if coated with non-toxic paint or other substances, but which are injurious to children? Will he move quickly on that front?

Mr. King: I shall consider the latter point. The third recommendation in the report is that the Government should ensure that at no time does leaded petrol have a

[Mr. King]

price advantage over unleaded petrol. That has been so in the United States, and has caused some switching by peole deliberately trying to get a lower price, and therefore using the wrong fuel. That recommendation will be considered during the discussions that take place.

Visits to Constituencies

Mr. Geoffrey Robinson (Coventry, North-West): On a point of order, Mr. Speaker. I wish to seek your guidance on a matter of parliamentary etiquette. In the early part of last week I, and I imagine other west midlands Members on both sides of the House, received a letter from the Chancellor of the Exchequer saying that he was to visit the west midlands. I inquired by letter about his itinerary and received a copy of it. Coventry was not mentioned in that itinerary, nor was the Jaguar factory there. However, I regret to say that I learned on Friday that the Chancellor of the Exchequer had visited the factory and was received by members of the local newspaper, the *Birmingham Post*, Central television and local radio. Does that invidious situation constitute a breach of parliamentary etiquette?

Mr. Speaker: I always like to encourage people to maintain the conventions that make our life bearable. If there has been a slip-up, I have no doubt that the Department will look into it. I think that it is desirable and in the interests of us all that we tell each other if we are going into each other's constituencies.

BILL PRESENTED

Coroners' Juries

Mr. Christopher Price, supported by Mr. Andrew F. Bennett, Mr. George Cunningham and Mr. Ivan Lawrence, presented a Bill to make fresh provision with respect to the qualifications of persons eligible to serve on coroner's juries; to provide criminal penalties for evasion of service on a coroner's jury; to amend section 26 of the Coroners (Amendment) Act 1926; and for connected purposes: And the same was read the First time; and ordered to be read a Second time upon Friday 22 April and to be printed. [Bill 130.]

STATUTORY INSTRUMENTS, &c.

Mr. Speaker: With the permission of the House, I shall put together the Questions on the three motions.

Ordered.

That the Customs Duties (ECSC) (Quota and Other Reliefs) (Amendment) Order 1983 (S.I., 1983, No. 501) be referred to a Standing Committee on Statutory Instruments, &c.

That the Education (Mandatory Awards) (Amendment) (No. 2) Regulations 1983 (S.I., 1983, No. 477) be referred to a Standing Committee on Statutory Instruments, &c.

That the Heather and Grass Burning (England and Wales) Regulations 1983 (S.I., 1983, No. 425) be referred to a Standing Committee on Statutory Instruments, &c.—*[Mr. Goodlad.]*

CONFIDENTIAL

cc LOK
BI

2 MARSHAM STREET
LONDON SW1P 3EB

01-212 3434

My ref:

Your ref:

18th April 1983

Dear Tim.

STATEMENT ON ENVIRONMENTAL LEAD

I attach a final version of the statement which my Secretary of State proposes to make this afternoon on environmental lead. He will follow the statement with a press conference.

I am copying this to the Private Secretaries to all Members of the Cabinet, the Chief Whip, Sir Robert Armstrong, and the Chief Press Secretary at No 10.

Yours sincerely
Helen Ghosh.

MRS H F GHOSH
Private Secretary

Tim Flesher Esq - No 10

ENVIRONMENTAL LEAD STATEMENT - 18 April 1983

With permission, Mr Speaker, I would like to make a statement about lead in the environment. The Royal Commission on Environmental Pollution have today published their report on this subject, and copies are available in the Vote Office.

In 1981 the Royal Commission decided that it would be timely to review the whole field of environmental pollution. They invited a wide range of organisations and individuals to give their views on the types of pollution which they perceived to pose the greatest threat to the environment and to comment on the Royal Commission's own provisional choice of topics for study. Environmental contamination by heavy metals was among those topics, and the response to the Royal Commission's invitation showed that the specific problem of lead was an issue of major and continuing concern to the public and the scientific community.

The Royal Commission therefore decided to complete and publish separately the results of their study of lead as soon as possible, and to report on the other matters later this year. The Government welcomed this decision, since we felt that the Royal Commission's independence and authority would be most valuable in clarifying the issues surrounding this complicated and difficult subject.

I am most grateful to the Chairman, Professor Southwood, and his colleagues in the Royal Commission for the prompt, thorough and comprehensive manner in which they have conducted their present study.

In their report, before discussing a range of particular problems and possible measures to deal with them, the Royal Commission reviewed the sources of lead in the environment, the pathways by which it enters living systems, and its effect on man and animals. They stress that there is still uncertainty about the effects on individuals of the low levels of lead typical in the United Kingdom. They note that features of lead poisoning occasionally occur at blood-lead levels of about 50 microgrammes per 100 millilitres of blood; and that

> "at present the average blood-lead concentration of the UK population is about one-quarter of that level."

They continue:

"We are not aware of any other toxin which is so widely distributed in human and animal populations and which is also universally present at levels that exceed even one-tenth of that at which clinical signs and symptons may occur."

They conclude:

"It would be prudent to take steps to increase the safety margin for the population as a whole."

The Royal Commission's report contains a number of recommendations covering all the sources of exposure to lead, including water, paint, and food and drink.

They commend the action already taken by this Government under the programme that I announced to the House two years ago. They now recommend further action in certain areas. For example:

early completion of our programme for treating naturally acidic drinking water to reduce its lead solvency and extension of the grants we offer for lead plumbing replacement;

a progressive reduction in the lead level of new household paint;

more publicity about the hazards of old leaded paint and how to avoid them;

and a tightening up on emissions from lead processing works.

We shall bring forward an early response to these recommendations.

There is however one recommendation which the Royal Commission believe should be the subject of immediate action by the Government and on which an early announcement is desirable. This relates to future policy on levels of lead in petrol. I announced two years ago that we would require the compulsory reduction of the maximum permitted level of petrol lead from 0.4 to 0.15 grammes per litre by the end of 1985. This action, applying to every vehicle, was the most effective way of achieving the largest possible reduction in the shortest possible time. The Royal Commission strongly endorse this decision; and they now recommend that it should be regarded as an intermediate stage in the phasing out of lead additives altogether, with the requirement that from an early date all new vehicles should be required to use 92-octane lead-free petrol.

The Royal Commission estimate that the cost of this change would be small in relation to the likely gains in fuel efficiency over the next few years.

The Royal Commission believe that the motor manufacturing industry would have no insuperable difficulty in making the transition. But they recognise that the car industry which supplies our market is organised on a European basis; and Community Directive 78/611 lays down 0.15 grammes per litre as the minimum lead content that member state may stipulate in their own legislation. The change which the Royal Commission propose requires Community agreement, and they recommend that we initiate negotiations immediately with our European partners.

I can now tell the House that the Government accept the Royal Commission's recommendations on lead in petrol. My Hon Friend the Under Secretary of State will be writing to our opposite numbers in the Community to set out the United Kingdom's position, with a view to opening formal negotiations as soon as possible. We shall also, of course, discuss with the United Kingdom oil and motor industries a timetable for the introduction of unleaded petrol.

Mr Speaker, typical lead levels in the United Kingdom are low and dropping. Substantial research efforts have so far shown no conclusive evidence that these typical levels have adverse effects onthe health of children or adults. But it is, and has been throughout, the Government's policy to increase the safety margin wherever possible, and while lead in petrol is not the largest contributor to the average body burden it is the largest that is controllable on a national basis.

Our acceptance of these recommendations of the Royal Commission, following the previous decision to reduce lead in petrol for all vehicles to 0.15 grammes per litre from 1985, represents the best possible route to achieve the earliest and most substantial reduction in petrol lead coupled with its eventual elimination.

CONFIDENTIAL

PM.

Prime Minister

Oral statement on Monday.
Agree, subject to colleagues' views!

MLS 15/4

2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

My ref:

Your ref:

15 April 1983

Dear David

LEAD

I attach a revised copy of a statement which my Secretary of State proposes to make on Monday 18 April. I understand the view now is that it would be appropriate to make this orally.

My Secretary of State will follow the statement with a press conference.

I am copying this to Tim Flesher at No 10, to the Private Secretaries to all Members of Cabinet, the Chief Whip, and Sir Robert Armstrong, and the Chief Press Secretary at No 10.

Yours

D A EDMONDS
Private Secretary

David Heyhoe Esq

STATEMENT BY SECRETARY OF STATE FOR THE ENVIRONMENT

ENVIRONMENTAL LEAD

With permission, Mr Speaker, I would like to make a statement about lead in the environment, following the publication earlier today of the Ninth report of the Royal Commission on Environmental Pollution on Lead in the Environment. My statement covers the main issues, but I shall, of course, need time to consider in more detail this major and comprehensive report. I am most grateful to the Chairman, Professor Southwood, and the Commission for the prompt way in which this thorough review has been conducted.

The Royal Commission recognise that there is still uncertainty about the effects on individuals of the low levels of lead typical in the UK. Their assessment is that the level above which there may be a real danger to health is about 50 micrograms per 100 millilitres of blood.

They note that:

> At present the average blood lead concentration of the UK population is about one quarter of that at which features of lead poisoning may occasionally occur."

They continue:

> "We are not aware of any other toxin which is so widely distributed in human and animal populations and which is also universally present at levels that exceed even one tenth of that at which clinical signs and symptoms may occur."

They conclude:

> "It would be prudent to take steps to increase the safety margin for the population as a whole."

The Commission's report contains many recommendations covering lead in water, paint, food and drink, and other sources of exposure.

P// The report, of course, also deals with lead in petrol, which contributes about 20% of the average person's intake of lead. It should be noted that substantial research efforts have so far shown no conclusive evidence that typical UK lead levels have adverse effects on the health of children or adults. The House will recall that 2 years ago I announced a package of measures dealing with the problems of lead. The most important announcement I made then was that we would require the compulsory reduction of the maximum permitted level of petrol lead from 0.4 to 0.15 grammes per litre by the end of 1985. This action, applying to every motor

car, was the most effective way of achieving the largest possible reduction in the shortest possible time. I also announced action to reduce exposure from each of the other main sources of lead exposure.

The Royal Commission commend the action already taken by this Government. They now recommend further action in certain areas - for instance, early completion of our programme for treating naturally acidic drinking water to reduce its lead-solvency and extension of the grants we offer for lead plumbing replacement; a progressive reduction in the lead level of new household paint; more publicity about the hazards of old leaded paint and how to avoid them; and a tightening-up on emissions from lead processing works.

We shall bring forward an early response to these recommendations.

As for lead in petrol, the Commission recommend that we can now go even further than the much reduced level already determined. They now estimate that the cost of moving on to totally lead-free petrol will be small in relation to the most up-to-date calculations of the likely gains in fuel efficiency over the next few years. They believe that the motor manufacturing industry would have no insuperable difficulty in making the transition given a clear remit. But the car industry which supplies our market is organised on a European basis; and EC Directive 78/611 lays down 0.15 grammes per litre as the minimum lead content that member states may stipulate in their own legislation. The Commission recommend that we open negotiations with our European colleagues for a concerted and early European move to lead-free petrol.

The Government has made clear its belief that it is a matter of prudence to seek to reduce exposure to lead from whatever source. We accept the conclusion of the Royal Commission that a European move to lead-free petrol is a logical extension of our present policies. The policies I announced 2 years ago will produce a massive reduction in lead emissions, on the fastest possible time-table. The proposals I am announcing today will be discussed immediately with the oil and motor industries and we shall open negotiations with our European colleagues as soon as possible. It is the second stage of a policy ~~and~~ that will mean that all new cars will have zero lead emissions from the earliest possible date.

IN CONFIDENCE

Royal Commission
on Environmental Pollution
Church House
Great Smith Street
London SW1P 3BL

Direct line 01-212 5600
Switchboard 01-212 3434

Your reference

Our reference RC/92/2

F E R Butler Esq
Principal Private Secretary
to the Prime Minister
10 Downing Street
LONDON
SW1

15 April 1983

P.a. WM 15/4

Dear Butler

NINTH REPORT OF THE ROYAL COMMISSION - "LEAD IN THE ENVIRONMENT"

Further to my letter of 5 April I now enclose an advance copy of the Commission's Report, which is to be published at 2.30 p.m. on Monday 18 April.

I am sending copies of this letter and of the Report to the recipients of my previous letter, to MacLean (Chief Whip's Office), Lyon (NIO), Joan Dunn (DoE) and Spence (CPRS).

Yours sincerely

Tom Radice

T E RADICE
Secretary to the Commission

IN CONFIDENCE

Home Affairs & Lambeth working party to lead : MARCH 80

CONFIDENTIAL

WL 18/4

DEPARTMENT OF INDUSTRY
ASHDOWN HOUSE
123 VICTORIA STREET
LONDON SW1E 6RB
TELEPHONE DIRECT LINE 01-212 5902
SWITCHBOARD 01-212 7676

From the Minister of State
Norman Lamont MP

The Rt Hon Tom King MP
Secretary of State
Department of the Environment
2 Marsham St
London SW1

15 April 1983

Dear Tom

ENVIRONMENTAL LEAD: RESPONSE TO ROYAL COMMISSION

Thank you for copying to us your minute of 13 April to the Prime Minister. I am replying in Patrick Jenkin's absence abroad.

We have three comments to make on your draft statement. First, as I mentioned to you on Thursday, we would wish the statement to reflect the need for the UK motor industry to be given time to adjust its production in the event of a move to lead-free petrol. I confirm, therefore, that we would like to see "given adequate time to do so" added to the end of the sentence on page 2 beginning "But they reckon that the cost ...". Also in that sentence, I would like "insurmountable" inserted between "no" and "difficulty".

Third, although your draft statement says that the Commission "recommend that we open negotiations with our Community Partners for a concerted European move to lead-free petrol", the only recommendation referring to EC negotiations (No 27) says merely that we should seek to secure the removal of the minimum level for lead in petrol set by the Directive. This would mean that individual Member States could set a maximum permitted level of lead in petrol of between 0 and .4 grammes per litre, with the effect that if we were to decide to go lead-free, we could well find ourselves doing so alone and this, of course, would be unacceptable to us. Unless the recommendation for concerted action appears in the body of the report therefore (and from a very cursory glance at the copy I have just received, this seems not to be the case) it seems to me that your references to the RCEP recommending a concerted European move to lead-free petrol need to be deleted and the relevant section of the statement redrafted to indicate our willingness to move only in step with our European partners.

I am copying this letter to the recipients of yours.

Yours ever
Norman

NORMAN LAMONT

Home Affairs: March 80
Environmental Lead

WM 15/4

SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
MILLBANK LONDON SW1P 4QJ
01 211 6402

D A Edmonds Esq
Private Secretary to the
Secretary of State for the Environment
2 Marsham Street
LONDON SW1

15 April 1983

Dear David,

ENVIRONMENTAL LEAD: RESPONSE TO THE ROYAL COMMISSION

My Secretary of State has seen a copy of the minute of 13 April from your Secretary of State to the Prime Minister. Mr Lawson is generally content with what Mr King proposes, but has a few comments on the text of the draft Parliamentary statement attached to Mr King's minute.

They all arise on the second page of the draft:

i. Mr Lawson thinks it very important to make clear that the Royal Commission are in favour of a move to 92 octane unleaded petrol, and not 97 octane. He therefore suggests that explicit reference should be made to 92 octane lead-free petrol in line 5;

ii. he also suggests deleting from line 23 the words "from whatever source" which he belives go further than the decisions which the Government has in fact taken, give an unnecessary hostage to fortune, and are in any case superfluous to the point at issue which concerns the prudence of reducing lead in petrol;

iii. he thinks that it would be helpful to add, after "lead-free" in line 26, the words "on a Community wide basis" to bring this paragraph more closely into line with the Commission's recommendation which it summarises;

iv. he would like to see the words "from the earliest achievable date", which might be misinterpreted, deleted from lines 26-27. He recognises that Mr King will wish to say something about timing and therefore suggests that the description of the Commission's recommendation in lines 10-12 be expanded to include their date of about 1990;

v. finally, there is of course a typing error at the end of line 27 which I think should read something like "....second stage of this policy. The 2 steps....".

I am copying this letter to the private secretaries to members of the Cabinet, Murdo Maclead and Richard Hatfield.

Yours ever,

J D WEST
Private Secretary

Home Affs
Mar 83 [illegible]
Working Party
on Coal

CONFIDENTIAL

Prime Minister

13 April 1983

ENVIRONMENTAL LEAD: RESPONSE TO ROYAL COMMISSION

As you know, the Royal Commission on Environmental Pollution is to publish a major report on Environmental Lead on Monday 18 April. Your Private Secretary asked mine to let you have advice on the conclusionsof the RCEP, and on the Government's response. The Chairman of the Commission, Professor Southwood gave the Departmental Ministers mainly concerned a preview of the contents of the report yesterday.

The Commission have clearly dealt with this complex subject in great depth; technically their report promises to be well up to standard; and I doubt whether the rationale behind their findings will be seriously disputed either at home or abroad (where the Commission is held in particularly high esteem.)

The Commission argue that the 1:4 ratio between typical UK blood-levels (10-15 microgrammes per 100 millilitres) and a reasonable view of the threshold-to-danger level (50 mg/100ml) is too low: for non-radioactive pollutants the rule-of-thumb ratio which governs whether corrective action should be taken is 1:10. While they commend us for the action we have taken to reduce exposure to lead from all sources so far, they recommend that we should go further wherever this is practicable.

A summary of the report's recommendations is at Annex A. Some of them - for example, numbers 7, 8 and 12 on water and new paint - may need legislation and could give rise to extra public expenditure. We can give them measured, though prompt, consideration and respond in due course.

But the recommendations on petrol-lead (numbers 26-29) will attract immediate attention. The Commission reckon that the cost of folowing up our 1985 reduction in the maximum permitted level of petrol-lead from 0.4 to 0.15 grammes per litre by going lead-free for new vehicles from, say, 1990 would be negligible - especially when set against the expected gains in fuel economy over the next few years. Annex B shows that if, for example, we secure a 20% improvement in fuel economy over the decade from 1985 (a pretty pessimistic assumption, I understand), we shall save 4.5m tonnes of oil per annum; of which going lead-free would cost us only 0.53m tonnes. Although they were concerned about this 2 years ago, both the oil and the motor industries now seem sanguine about moving on to lead-free petrol - in concert with Europe, where there is a growing movement in the same direction: the Germans in particular have recently announced that they would like to move to lead-free petrol progressively but quickly.

In a short discussion after Professor Southwood has left us yesterday, colleagues generally agreed with me that there would be considerable political value in an immediate announcement of our readiness to seek Community agreement on the timing of a move to lead-free petrol. The risk would be small. I do not think that either the oil or the car industry in the UK will oppose us. And I believe that this would be a useful and positive initiative for us in Europe.

Such an announcement would be extremely popular both with our own backbenchers and with the general public.

I attach at Annex C a first draft of a Parliamentary statement which, subject to your views and those of colleagues I propose to make orally on the day after publication of the Commission's report: ie on 19 April. There is everything to be gained by the Government being seen to respond quickly and positively.

You might consider it helpful to have a discussion about this during Cabinet tomorrow.

I am sending copies of this minute to all members of the Cabinet, Chief Whip and to Sir Robert Armstrong.

Helen Ghosh

TK Private Secretary

(approved by the Secretary of State and signed in his absence).

HOME AFFAIRS
Letter (Lead)
Mar 80

ANNEX A

CHAPTER IX

RECOMMENDATIONS

1. A well designed programme to monitor the body burden of lead in man, to accompany measures designed to reduce further the release of lead to the environment, should be undertaken in consultation with the Medical Research Council and started as soon as possible (Paragraph 4.55).

2. Further long-term studies of persons exposed to lead and lead salts in industry should be undertaken (5.21).

3. Research should continue into the effects of lead at low concentrations, particularly on children (5.24).

4. The Medical Research Council should encourage experimental studies on the effects of low concentrations of lead on the behaviour of animals; particular attention should be paid to experimental design (5.24).

5. The anthropogenic dispersal of lead and man's exposure to it should be reduced further (5.25).

6. The Government should set an early and firm target date for completion of surveys to identify plumbosolvency in water supplied for human consumption and of remedial programmes of water treatment or pipe replacement; a comprehensive report of progress since 1975 should be published (6.9).

7. The criteria for the award of home improvement or repair grants for the replacement of lead plumbing should be reviewed, with the aim of making such grants more widely available. Publicity campaigns should be conducted in areas where pipe replacement is considered necessary, and special attention should be given to property where the incentive for initiating action may be unclear. Financial constraints should not be allowed to hamper the pipe replacement programme (6.6).

8. The adequacy of measures to encourage any necessary replacement of lead plumbing in publicly owned buildings, and in privately owned buildings not eligible for home improvement grants, should be reviewed (6.6).

9. A definitive view should be reached as soon as possible, for public information and discussion, on whether lead solder in modern plumbing systems can contribute significantly to the lead content of drinking water (6.11).

10. The Government, in collaboration with the paint industry, should establish the quantities of lead-based paints currently sold in the UK (6.16).

11. The Government should supplement precautionary labelling of leaded paints by promoting publicity to ensure that users and potential users are aware of the dangers and the alternatives (6.16).

12. The maximum permitted concentration of lead in paint for household use should be progressively reduced to a level comparable to that applied in the USA, and in the meantime all paint containing more lead than this should carry a warning label (6.21).

13. Research on the formulation of paints should be directed towards further reducing the range of applications for which there are grounds, whether technical or financial, for preferring leaded paints (6.21).

14. Research should continue into lowering the amount of lead necessary for satisfactory yellow road paint, and the use of yellow road paint containing the least practicable amount of lead should be mandatory (6.20).

15. Local authorities should review the techniques and equipment available for the detection and measurement of lead in paintwork (6.24).

16. More active steps should be taken to publicise the potential hazards of lead in old paintwork and to ensure that the publicity reaches its target audience, including those for whom English is not the first language (6.27).

17. To reinforce the role of public authorities, manufacturers and retailers in advising the public about the potential hazards of lead paintwork, the Government should conduct an early campaign in the media to underline the message of its information note 'Lead in Paintwork', and there should be periodic reminders to the public to ensure that the lessons are not forgotten (6.28).

18. There should be a continuing effort to gain a better understanding of the various pathways and mechanisms by which food is contaminated with lead (6.34).

19. More data should be obtained on the lead content of alcoholic drinks at the point of consumption (6.35).

20. Priority should also be given to research to assess the relative contributions that different sources and pathways can make to lead in dust (6.38).

21. The Industrial Pollution Inspectorates should consider the scope for reducing the BPM emission limits currently applicable to scheduled lead processes (6.41).

22. Urgent efforts should be made to develop alternatives to lead shot and lead fishing weights (6.45).

23. As soon as these alternatives are available, the Government should legislate to ban any further use of lead shot and fishing weights in circumstances where they are irretrievably dispersed in the environment (6.45).

24. Local authorities should accord a high priority to the monitoring and other work necessary to establish the extent of human exposure to lead in their areas and to reassure the public that any necessary remedial action is being taken without delay (6.47).

25. There should be adequate publicity, drawing attention to the risks associated with exposure to lead, and advising how to avoid or minimise these, to enable people significantly to reduce their own exposure to lead from localised sources (6.48).

26. The reduction of the maximum permitted lead content of petrol to 0.15 g/l should be regarded as an intermediate stage in the phasing out of lead additives altogether (7.55).

27. The Government should initiate negotiations immediately within the European Community to secure the removal of the minimum level for lead in petrol currently set by Directive 78/611/EEC (7.127).

28. The Government should begin urgent discussions with the UK oil and motor industries in order to agree a timetable for the introduction of unleaded petrol, having regard to the time required for essential production changes and the desirability of matching major refinery investment to long-term rather than interim requirements (7.132).

29. The price of unleaded petrol should not exceed that of the highest grade of leaded petrol during the period in which leaded petrol is phased out (7.108).

TABLE 7.6

Estimates of crude oil required for petrol in 1996 at different lead levels and on various assumptions about improved fuel economy
(Millions of tonnes of crude oil, including equivalent energy from other sources; RON values are for average pool octane after addition of lead)

	Overall improvement in fuel economy 1986—1996		
	0%	*20%*	*30%*
Forecast demand for petrol in 1996 on the basis of 96.4 RON[1]	22.5	18.0	15.75
96.4 RON: 0.15 g/l Pb Additional crude oil for refinery fuel[2] (compared with 96.4 RON: 0.4 g/l Pb)	0.43	0.34	0.30
92.4 RON: unleaded (i) Additional crude oil for refinery fuel[3]	0.04	0.04	0.03
(ii) Additional car crude oil consumption due to reduced compression ratios[4] (compared with 96.4 RON: 0.4 g/l Pb)	1.13	0.90	0.79
	1.17	0.94	0.82
Total crude oil required for petrol[5]			
96.4 RON: 0.4 g/l Pb	27.00	21.60	18.90
96.4 RON: 0.15 g/l Pb	27.43	21.94	19.20
92.4 RON: unleaded	28.17	22.54	19.72
Overall increase (decrease) in total crude oil requirement (taking 0.15 g/l as base)			
96.4 RON: 0.4 g/l Pb	(0.43)	(5.83)	(8.53)
96.4 RON: 0.15 g/l Pb	BASE	(5.49)	(8.23)
92.4 RON: unleaded	0.74	(4.89)	(7.71)
Increase (decrease) in total crude oil requirement exclusive of fuel economy element (unleaded compared with 0.15 g/l)			
(i) Additional crude oil for refinery fuel	(0.39)	(0.30)	(0.27)
(ii) Car consumption	1.13	0.90	0.79
(iii) Lead additive manufacture and car maintenance[6]	(0.07)	(0.07)	(0.07)
Net energy benefit forgone	0.67	0.53	0.45

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ANNEX B

ANNEX C

CONFIDENTIAL

DRAFT

STATEMENT

With permission, I would like to make a statement about environmental lead.

The Royal Commission on Environmental Pollution published a major report on this subject yesterday. I am grateful to the Commission for the care and thoroughness which they have devoted to their comprehensive treatment of this complicated subject.

The Commission argue that although there is continuing uncertainty about the effects of lead at the low concentrations which are typical of the UK, the ratio of about 1 to 4 between these concentrations (10-15 microgrammes per 100 millilitres of blood) and the threshold-to-danger level (which the Commission set at 50 µg/100ml) is too low. The rule-of-thumb ratio which governs whether corrective action should be taken on environmental pollutants generally is 1 to 10. While they commend the Government for the action we have already taken to reduce exposure to lead from all sources, they recommend that we should go further wherever this is practicable.

Some of the recommendations in the report - for example, numbers 7, 8 and 12 on water and new paint - may need legislation and could give rise to additional public expenditure. We shall give them prompt consideration and make a further announcement as soon as we can.

The Government think it right to respond immediately, however, on the recommendations on petrol-lead (numbers 26-29). The Commission fully support the Government's decision in 1981 to

give priority to reducing the maximum permitted level of petrol-lead from 0.4 to 0.15 grammes per litre as the only way of securing a massive and early reduction in lead emissions from this source. (This takes effect at the end of 1985). But they reckon that the cost of moving on subsequently to lead-free petrol would be small in relation to today's estimate of the likely gains in fuel efficiency over the next few years; and that the motor manufacturing industry would have no difficulty in making the transition. The Commission appreciates that European car production is so closely integrated that the United Kingdom cannot "go it alone". So they recommend taht we open negotiations with our Community partners for a concerted European move to lead-free petrol, as a logical extension of our present policy.

The Government accept this recommendation and will be opening negotiations with European colleagues forthwith.

Mr Speaker, it is important to see this in perspective. Even now petrol contributes only 20% or so to the average person's total intake of lead in the UK; and following the change in 1985 this contribution will be down to less than 7%. It is important to stress that the substantial research efforts show that there is still no evidence that the levels of lead exposure which are typical in the UK have any adverse effects on the health of adults or children. Nevertheless, the Government decided as a matter of prudence to seek to reduce exposure to lead from whatever source. That is why I announced in 1981 that we would require from December 1985 that all petrol should have to have the lower lead content.

The proposal now to move to lead-free for all new cars from the earliest achieveable date marks the second stage of this policy which taken together will achieve the largest reduction possible and in the most effective way.

PRIME MINISTER

ENVIRONMENTAL LEAD

Attached is a minute from the Secretary of State for the Environment which

(i) summarises the Report of the Royal Commission on Environmental Pollution on environmental lead which is to be published on Monday; and

(ii) proposes a Government response in the form of a draft statement at Flag A which he proposes to make on Tuesday.

The principal feature of the statement is the commitment to open negotiations with our Community partners for a concerted move to lead-free petrol by 1990. (Although the statement does not mention a date the Report does). I understand that none of the principal Departments involved is in any doubt that this is the right direction, but Mr. Howell and Mr. Lawson may want to have further discussions before announcing what is, after all, a major policy decision. They have, for example, not yet even seen the Report of the Royal Commission, and Mr. Howell wishes to be sure that the assumption in Mr. King's minute that the oil and motor industries are happy with such an announcement is justified.

Mr. King wants to raise this at Cabinet, presumably under Parliamentary Affairs. Given that nobody disagrees about the principle, it might be best to discourage lengthy discussion in Cabinet and refer the detail to a meeting of Ministers. I understand that this is what Mr. Gregson advises.

13 April 1983

file

da

10 DOWNING STREET

From the Private Secretary

8 April 1983

You will have seen a copy of the letter of 5 April to Robin Butler from the Secretary to the Royal Commission on Environmental Pollution, in which he explains that the 9th Report of the Commission on "Lead in the Environment" will be published on 18 April.

The Prime Minister has commented that the Government's response to this Report will need careful handling. I should be grateful for your advice on what conclusions the Commission have reached, and what line your Ministers will be taking in response to the publication of the Report.

I am copying this to Tony Rawsthorne (Home Office).

W. F. S. RICKETT

David Edmonds, Esq.,
Department of the Environment.

dg

(2)

Royal Commission
on Environmental Pollution
Church House
Great Smith Street
London SW1P 3BL

Direct line 01-212
Switchboard 01-212 3434

Your reference

Our reference RC/63/4

Prime Minister

A.J.C. 6/4

F E R Butler Esq
Principal Private Secretary
to the Prime Minister
10 Downing Street
LONDON
SW1

5 April 1983

I'll need
careful handling

Dear Butler

You may wish to inform the Prime Minister that the Ninth Report of the Royal Commission, 'Lead in the Environment', will be sent to the Home Secretary at the end of this week for submission to Her Majesty the Queen. It is envisaged that publication will take place on Monday 18 April.

The Chairman, Professor Southwood, will be informing the Secretary of State for the Environment and other Ministers principally involved of the Commission's main conclusions and recommendations at a meeting next week.

I am copying this letter to Halliday (Home Office), Hatfield (Cabinet Office), Heyhoe (Lord President's Office), Kerr (Treasury), Edmonds (Environment), Bird (Transport), Spencer (Industry), West (Energy), Clark (DHSS), Lowson (MAFF), Rhodes (Trade), Fall (FCO), Russell (Scottish Office) and Peat (Welsh Office).

Yours sincerely

T E Radice

T E RADICE
Secretary to the Commission

CLEAR

The Campaign for Lead-free Air

2 Northdown Street, London N1 9BG
Telephone 01-278 9686

October 26, 1982

EUROPEAN CAMPAIGN ON LEAD-FREE PETROL

For the first time ever the European Environmental Movement (organised by the European Environmental Bureau in Brussels) and the European Consumer Movement (organised by the European Bureau of Consumer Organisations in Brussels) are to combine on a Europe-wide campaign. The subject will be lead-free petrol.

I believe all Members of Parliament concerned with public health protection will wish to support this major European initiative.

I also enclose:

1 A clipping from the Daily Mail, October 15, accurately summing-up the present industrial position - that both oil companies and car manufacturers are able to meet the CLEAR objective of lead-free petrol within five years at a reasonable cost.

2 A photocopy of an article I recently wrote for The Guardian demonstrating the latest position in the United States of America.

As you will know, the support for lead-free petrol is now universal in this country. We urge you to advise Ministers that they should now take the necessary steps.

Yours faithfully,

DES WILSON

Enclosures

Supporting organisations:
The Conservation Society, CAUP, Friends of the Earth,
Health Visitors' Association, Transport 2000,
The Association of Community Health Councils for England and Wales,
Association of Neighbourhood Councils

Motoring

Totting on the brink of chaos

by Michael Kemp

COURTS are in confusion over a change in penalties for driving offences that begins on November 1.

Amazingly, with only 16 days to go before the new Penalty Points system replaces endorsements and totting-up, magistrates have not been told of the change.

Thousands of drivers expecting a better deal from the courts could be in for a shock.

Some could be disqualified—against the spirit of the Penalty Points law. Others could escape disqualification because magistrates will not understand the new system.

Lighter

The Magistrates Association says: 'There are going to be difficulties. Officially we have not been told of the change and it will be the New Year before we are able to make suggestions to magistrates throughout the country.

'Normally we would expect to [illegible] suggestions in advance.'

Under the points system, speeding—the commonest driving offence and a sore point with motorists under totting-up—will carry a lighter penalty.

At present three endorsements in three years means automatic disqualification for six months. Endorsements are active for three years and on your licence for four years.

Under the new system you will have to accrue 12 points in three years to face automatic disqualification. But since speeding will be a three-points offence, a driver will need four convictions before disqualification.

[illegible] ved his punishment [illegible] licence will be wiped clean.

Problems could arise in courts that have a policy of disqualifying speeding drivers for a month as a short, sharp punishment.

Magistrates will still have the power to do this, but after a month the driver's three points would be wiped away. He would be better off than having the points on his licence for three years.

Advice

As a result, courts might be inclined to disqualify drivers for a longer period, perhaps three or four months.

If you are due to appear in court after November 1 and fear confusion between old and new systems, you should seek legal advice.

Colt cruiser

NEW from Colt of Japan is the Tredia, a medium 4-door saloon with four options, 1·4, 1·6 and automatic, plus a turbo model. Manual transmission has two high ratios for economy cruising. Price: £5,500 to £7,500 including tax. The Tredia front-wheel-drive 1·6 engine also powers a sleek new liftback named Cordia — from £6,650 to £7,750.

Waiting for a lead on lead

OIL companies are ready to take the lead out of petrol and car-makers would co-operate by producing new engines. All that's needed is a Government directive—not forthcoming at the moment.

The oil men could bring in 92-octane unleaded petrol in a few months, but motor firms would need five years to change their engines and it would add £80 to the cost of a car.

Lead-free 92-octane petrol would be up to 1p a gallon dearer at today's prices, with five per cent. less fuel economy. Unleaded 97-Octane petrol which doesn't need new engines, would put up pump prices by 2½p a gallon.

So the way ahead seems obvious — 97-octane petrol, which Japanese cars are already designed to run on.

How an American move to take the fuss out of lead backfired

The United States has just stepped up its limits on lead in petrol, even though the White House seems to have had other ideas. Des Wilson reports

THOSE environmentalists embattled with obstinate ministers over pollution from lead in petrol have received a substantial morale boost from news of an emphatic defeat for the Reagan administration in the United States on the same issue.

As part of a programme to relieve his industrial friends of restrictive regulations, President Reagan appointed an environmental hard-liner, Ann Gorsuch, as administrator of the Environmental Protection Agency, who promised oil refiners and the lead industry that she would, "drastically revise or abolish" the restrictions on lead in petrol for pre-1975 cars (since that date, all cars have been manufactured to run on lead-free petrol).

Instead, the EPA has ended up with fresh regulations to increase limits on lead in petrol and has been so determined about their enforcement that it withstood three weeks of pressure from the White House to reconsider. Not only has the EPA administrator been humiliated, but the petroleum and lead industries have seen their attempts to endanger public health by behind-the-scenes manipulation explode in their faces.

Hearings revealed that the administrator and her staff had private conferences with the petroleum and lead industries on 32 separate occasions between May 1981 and March 1982 without ever meeting environmentalists or up-dating information on the health effects of lead. On one occasion the administrator was said to have implied that if a company wanted to break the regulations, she would not enforce them. A subpoenaed document written by a petroleum company attorney on December 11 last year summed up what the administrator was saying to companies:

"She (Ann Gorsuch) noted that EPA's lead phase-down regulations would probably be revised and perhaps even abolished during the course of the up-coming rule-making in accordance with Vice-President Bush's expressed intentions ... We all thanked her and then left. Larry Morgan, however, remained behind with Gorsuch momentarily. When he came out he told us that the administrator had explained to him that she couldn't actually tell us to go out and break the law, but that she hoped that we had gotten the message."

By then, however, environmentalists had also "gotten the message" and tipped off the media. The influential syndicated columnist, Jack Anderson, represented an almost unanimous media viewpoint: "Incredibly the Reagan administration appears willing to risk the health of hundreds of thousands of anonymous preschoolers, just so the oil companies can make a few bucks."

Belatedly, the Environmental Protection Agency started to act the role its name implies, and called in the evidence on sources of lead pollution, and on the health hazard involved. In a remarkable document filed in the Federal Register, the EPA has now reviewed all the evidence it received and stated: "The majority of the comments emphatically rejected the proposition that lead was no longer a public health problem."

Of 64 comments from the professional health community and academia, 60 opposed any loosening of the lead standards, and many suggested that tighter controls would be desirable. Thirty-two comments were received from local and state administrations, "all of these supporting retention of the current standards to protect their citizens' health."

It stated: "Most of the commentators pointed to previous studies, as well as their own experience, to demonstrate that lead has an adverse effect on people at very low doses and that the more the problem is studied the lower the 'acceptable level' of lead becomes."

It concluded that "protection of public health and welfare demands that all reasonable steps be taken to eliminate lead from the environment."

The EPS's Rule Document will be invaluable to anti-lead campaigners in Britain.

First, it is the definitive answer to the claims by the petroleum industry in this country, and by some ministers, that the Americans control lead in petrol not because it is a threat to health, but because it is inconsistent with the use of catalytic converters to control other emissions. Undoubtedly this was one of the factors involved, but the document lists all the steps taken to control lead in petrol in the United States and the reasons for them, and makes it clear beyond doubt that there was "a basic health rationale" for the regulations as far back as 1973.

Second, it represents an authoritative review of the evidence on sources of lead pollution, emphasising the importance of dirt and dust as a primary pathway of lead to children, and concluding that its past findings that petrol lead is a major contributor to lead in dirt or dust stand up to subsequent studies.

Third, it looks at recent scientific evidence on the question of health risk, and concludes: "There are insufficient health grounds upon which a relaxation of the phase-down programme can be based. The rationale for the original decision by EPA to regulate the use of lead in petrol has been re-examined and no new information has been submitted which would warrant a shift in the original rationale to control lead in petrol."

The importance of these findings as far as I am concerned is not that they reaffirm what CLEAR and others have been saying in Britain, not that they have the authority of the Environmental Protection Agency, but that they have been reached at the end of a process *that was intended to support the opposite conclusion.* There is no possibility of anybody suggesting that the Environmental Protection Agency on this issue set out to take a "soft line" or to put emotive pressure before the facts. The brief was to free the petroleum and lead industries, not control them further.

Two questions arise in the British context.

First, if a United States administration unsympathetic to the environmental point of view nevertheless decided on the medical and scientific evidence to strengthen the regulations, does that not make even more untenable the position of obstinate British ministers who claim they have done enough?

Second, do we need an institution like the Environmental Protection Agency in this country? In the United States, the system has been seen to work. In Britain, at the moment, our system clearly has not.

Des Wilson is Chairman of CLEAR, the Campaign for Lead-free Air.

MG

Home Affairs!

CONFIDENTIAL

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET LONDON SW1P 3EB
01-212 3434

My ref:

Your ref:

17 June 1982

Note/ I have told Mr Shaw's office to despatch this letter on the Prime Minister's behalf.

WR 21/6

Dear Mr. Ricketts,

We spoke recently over the telephone about the attached correspondence from Mr Ernie Roberts about lead in petrol.

As I explained, Mr Shaw considers that it would be advisable for him, rather than the Prime Minister to answer Mr Roberts' letter. Mr Shaw is anxious that the Prime Minister should not be too closely associated with the current controversy over lead, partly because of the opposition which Mr Des Wilson and the CLEAR campaign are heaping upon advocates of the Government policy and partly because, should any change in the policy become inevitable, it would be better if the Prime Minister had not been too committed to it. You will recall that Mr Shaw answered the formal letter of 11 February from Mr Wilson to the Prime Minister.

Yours sincerely,

William Chapman.

W E CHAPMAN
Private Secretary

Willie Ricketts Esq

Prime Minister

Mr Roberts asked you to intervene in the lead in petrol saga and enclosed a recent news release from the offices of CLEAR. Are you happy for Giles Shaw to reply on your behalf as at A? Or would you like me to adapt it for your signature?

Yes

WR 15/6

CONFIDENTIAL

H/PSO/13982/82

DRAFT REPLY: MR SHAW TO ERNIE ROBERTS ESQ MP

The Prime Minister has asked me to thank you for your letter of 19 May about the latest news release from CLEAR, and to reply.

You will have noted Kenneth Clarke's reply to Neville Trotter's recent Written Question about the health effects of lead. I attach a copy for ease of reference. To my mind the Reply neatly encapsulates all that needs to be said in response to the CLEAR news release; and I see no reason to change our present policy of prudently reducing people's exposure to lead wherever this is practicable without incurring disproportionate costs.

The trouble with the CLEAR release is that it misleads through a selectivity which I can only assume is deliberate. For instance:

a. on their claim about 'accumulating evidence' that lead in petrol is leading to serious risk of mental disadvantage in children, I do not under-value the need for concern for the health and well-being of children; but the available evidence is by no means as conclusive as CLEAR suggest. Drs Yule and Lansdown, who have been researching the relationship between blood-lead concentrations, intelligence and attainment in school-age children, have said themselves that their work at Greenwich must be treated with caution in view of the "crude" measure of social class they used, a factor which is known to have important effects on IQ and the other aspects of their study;

b. in a part of their evidence to the Royal Commission not quoted by CLEAR, the BMA said that "it is by no means certain that lead is the direct cause of the reported deficits in cognitive and behavioural functioning. Further research is necessary". And both the BMA evidence and the Yule study were concerned with the possible effects of lead in the body irrespective of source, so that it is stretching the facts, to say the least, to claim these remarks as evidence for adverse effects from lead in petrol; and

ANNEX A

Petrol (Lead Content)

Mr. Trotter asked the Secretary of State for Social Services if he has reviewed the health risks associated with lead in petrol; and if he has studied the views of the British Medical Association and those expressed at the CLEAR symposium on such risks.

Mr. Kenneth Clarke: I have now had an opportunity to study the British Medical Association's evidence to the Royal Commission on Environmental Pollution. It is a balanced document reaching similar conclusions to those reached a year ago by the Government following publication of the report of the DHSS working party on lead and health, chaired by Professor Patrick Lawther. I welcome it as reinforcing the Government's view of the need for a series of measures based on the recommendations of that report. We announced a programme in May last year and nothing in this report reduces our confidence in the desirability of that programme.

I understand that in the course of a careful summing up of the recent CLEAR symposium, Professor Michael Rutter, who was a member of the working party, expressed the personal view that it would be prudent to remove lead entirely from petrol. He, however, acknowledged the uncertainty of the medical evidence on the effects of very low levels of lead in the body. We have all along taken the view that, although the evidence is uncertain, action is necessary to reduce people's exposure to lead derived from petrol. We have sought the quickest and most practicable means of doing this. It is our aim to reduce the limit from 0·4g per litre to 0·15g per litre by the end of 1985. This will reduce by about two-thirds lead emissions from cars some 10 years earlier than any other practicable method—including going lead free.

The BMA report makes it plain that petrol is only one of a number of sources of lead in the environment, and I understand that Professor Rutter stressed this. The Government agree on the importance of these other sources, including lead contaminated food and tap water, industrial emissions, lead-based paint, and special exposure such as employment in a trade using lead and we are taking steps to reduce lead in the environment along the lines announced a year ago.

Falkland Islands (Requisitional Vessels)

Mr. John Townend asked the Minister for Trade if he will make a statement on compensation payable to the crews of trawlers requisitioned for the Falkland operation.

Mr. Sproat [*pursuant to the reply*, 26 April 1982, c. *177*]: I am glad to say that it has been agreed that payments to seamen covered by National Maritime Board agreements and to trawlermen who have been put ashore as a result of the charter or requisition of ships to support the Falklands task force shall be a proper claim which the Government will meet. This agreement is for three months in the first instance, and subject to review thereafter.

CC 16.

From: ERNIE ROBERTS, M.P.

Ref. E.43

HOUSE OF COMMONS
LONDON SW1A 0AA

01- 219 4609
01- 219 3000
01- 249 8069 (Hackney)

19th May, 1982

R 20/5

The Rt. Hon. Margaret Thatcher M.P.,
Prime Minister,
10 Downing Street,
London - SW1

Dear Prime Minister,

Lead in Petrol

I have asked you Parliamentary Questions on this subject, on the 22nd February, No. W24, and 24th March, No. W26, and I am now enclosing further evidence of the serious threat to damage of the brains of young children by the continuation of this poisoning, and the dangerous effect it has generally on the public exposed to lead emitted into the atmosphere through motor vehicles exhaust.

I would ask you to take urgent action in this matter.

Yours sincerely,

Ernie Roberts

CLEAR

The Campaign for Lead-free Air

2 Northdown Street, London N1 9BG
Telephone 01-278 9686

NEWS RELEASE

14th May 1982

URGENT

Naturally the attention of the nation is focused on the international crisis. However, some issues need to remain in the forefront of our attention. One is the accumulating evidence that our children are at serious risk of mental disadvantage caused by the addition of lead to petrol.

There have been some major new developments and we draw them to your attention:

1 The British Medical Association

The British Medical Association, premier voice for the medical profession, stated last week that:

> "Taking into account all the available evidence it would appear that the elimination of lead from petrol would reduce considerably the concentration of lead in the atmosphere. This in turn would produce a reduction in the burden of lead absorbed by individuals. For those individuals already exposed to higher than average concentrations of atmospheric lead, the body burden might be reduced by as much as one third."

It also stated:

> "On the basis of the evidence which it has received the BMA considers that lead is capable of causing harm at levels of exposure previously considered safe.....it therefore recommends that steps be taken to reduce the amount of lead in the environment by progressive measures to protect those at risk."

It also stated:

> "Associations have been demonstrated between impairment of mental functioning and lead levels below the range previously considered harmful.

Supporting organisations:
The Conservation Society, CALP, Friends of the Earth,
Health Visitors' Association, Transport 2000,
The Association of Community Health Councils for England and Wales,
Association of Neighbourhood Councils

At first there was some doubt about the validity of these studies but it is now generally accepted that the association is real and it should not therefore be disregarded."

2 Professor Michael Rutter

Professor Michael Rutter was a leading member of the Lawther Committee. At the conclusion of a three-day international symposium on low level lead exposure, he summarised all the evidence and came to the conclusion .....

"On the hypothesis that low level lead exposure leads to psychological impairment.....the implication is that it would be both safer in practice and scientifically more appropriate, to act as if the hypothesis were true, rather than continue to act as if it were not true".

He added:

"The risk seems to be substantially more than a trivial one and at least in some individuals, the effects are likely to be of practical importance in causing impairment of functioning. The implication is that we now know enough to warrant taking such public health actions as are likely to reduce lead pollution in the environment, provided such actions do not have other hazards, and provided they are not prohibitively expensive. The removal of lead from petrol would seem to be one of those worthwhile and safe public health actions. The evidence suggests that the removal of lead from petrol would have a quite substantial effect on reducing lead pollution and the costs are quite modest by any reasonable standard..... In my view, the reduction of lead in petrol to an intermediate level is an unacceptable compromise without clear advantages and with definite disadvantages.....The reduction of lead in the environment should make some worthwhile difference to some children and that ought to constitute a quite sufficient justification for action now."

Professor Rutter is one of the world's leading child psychiatrists.

3 Research with London children

At the international symposium in London, Dr. William Yule et al described further results of research with 166 London school children and concluded that their results broadly replicated the findings of Needleman et al. in the United States (1979) in that they indicated a dose-response relationship between increased lead levels and an increased

liklihood that teachers would record deviant behaviour. They also demonstrated that hyperactivity was found to be significantly related to children's blood lead levels.

This followed their earlier findings of an IQ deficit of 7 points in children with blood lead levels above 12ug/dl - in other words, an IQ deficit at nearly a third of the DHSS safety level.

4 Ministers'position contradicted four times

Ministers continue to claim that lead in petrol is a relatively minor contributor to body lead burdens, about 10-20%.

Yet, both the BMA, and Professor Rutter, acknowledge that this is now an inaccuarate assumption.

Research from the United States of America involving a vast number of people across the country as a whole showed that blood lead levels fell by 36.7% in the first four years of the phasing out of lead in petrol.

Research from the Turin area of Italy based on an isotope study shows that petrol's contribution to body lead levels was a minimum of 30%.

5 Public demands action

There is now overwhelming support for action. Over 200 Members of Parliament have signed CLEAR's objectives. An opinion poll showed that 9 out of 10 people wanted lead in petrol banned. Nearly all the nation's leading newspapers have called for a ban on lead in petrol.

It is imperative that action now be taken.

DES WILSON
Chairman CLEAR
The Campaign for Lead-free Air

JH 506

WH 18/5 Hone

DEPARTMENT OF INDUSTRY
ASHDOWN HOUSE
123 VICTORIA STREET
LONDON SW1E 6RB
TELEPHONE DIRECT LINE 01-212 3301
SWITCHBOARD 01-212 7676

Secretary of State for Industry

17 May 1982

Rt Hon Tom King MP
Minister for Local Government and
Environmental Services
Department of Environment
2 Marsham Street
London SW1

Dear Tom,

Thank you for your letter of 5 May.

2 I was glad to see that you had no objection to my proposal that my officials should consult the motor industry. This is now in hand.

3 As I said in myletter of 23 April we need to be sure of our ground in standing firm on the main decisions we have reached. It seems to me that the extent to which our present policy is defensible politically does depend in good measure on the evidence that we can produce - and in our confidence in that evidence - of the penalties that would be incurred in going beyond the decisions of last year. To the extent that this involves the interests of the motor industry, I have thought it right to seek an up-to-date assessment from the manufacturers to establish whether the position has changed substantially in the period since the work of the Working Party on Lead in Petrol. Obviously until this review is completed I could not be committed to any decisions which depended to a significant extent on an assessment of those interests. But I realise that this is only one aspect of the issue, and I would be content to be represented at a preliminary informal discussion, as you suggest.

4 I hope to have the results of my officials' review in about a month's time; depending on the course of the preliminary discussion we could if necessary then meet again to take stock of the overall position.

5 I am sending copies of this letter to the Prime Minister, David Howell, Nigel Lawson and Norman Fowler.

Yours ever

Patrick

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

MINISTER FOR LOCAL GOVERNMENT AND ENVIRONMENTAL SERVICES

Prime Minister 4

5 May 1982

GM 5/5

MG

Dear Patrick

LEAD IN PETROL

Thank you for your letter of 23 April.

Let me say at once that I do not see a unilateral UK move to lead-free (high-octane) petrol as a feasible course of action. I entirely agree with you that the most that we could sensibly do would be to move to a position of advocating lead-free as the right long-term policy for Europe.

My office is already in touch with yours (and the others concerned) about fixing up the meeting I suggested in my letter of 30 March. Your suggestion that we should postpone this until your officials have been able to talk to the motor industry seems to me to be based on a misunderstanding of my intentions in suggesting the meeting. I do not see such a meeting as being aimed at arriving at firm decisions on policy. Rather, I wanted to exchange views informally with colleagues on how far our present policy is politically defensible over the next two years.

I have no objection to your officially discussing the position with the motor industry - no doubt they will keep my officials and David Howell's in touch with those discussions. I hope, however, that you will agree that what we should be looking at with the motor industry is the long-term picture; and that we should not spend too much time on the sort of difficulties referred to in paragraph 6 of the note attached to your letter which relate to engine designs which may in any case be obsolete by the mid-1990's.

However, I see no reason why the sort of Ministerial discussion that I have in mind should wait until these discussions with the motor industry have taken place. I hope therefore that you will agree to join in, or be represented at, the meeting that is being arranged.

I am copying this to the Prime Minister, David Howell, Nigel Lawson and Norman Fowler.

Yours

TOM KING

01-211 6402

Rt Hon Tom King MP
Minister for Local Government &
Environmental Services
Department of the Environment
2 Marsham Street
London SW1P 3EB

23 April 1982

LEAD IN PETROL

Thank you for copying to me your letter to David Howell of 30 March. I have also seen David's reply of 7 April, with which I generally agree. I would be happy for Hamish Gray to join in a meeting with the oil and motor industries but, like David, I very much doubt whether we should rush into this.

The oil industry's position is, I think, pretty well known to all the Departments concerned: the industry will implement the lead reduction already decided by the end of 1985 (but cannot do it more quickly). They would have no difficulty thereafter in producing a lead free low octane fuel, provided they were not also required to market a leaded low octane fuel as well. There are signs that they are thinking of making a public declaration on these lines, but my officials have indicated that we should prefer them not to move until the UK motor industry have been able to reassess their position. Meanwhile, we should keep stressing the point that the decision we have already taken represents by far the quickest way of reducing substantially the volume of lead emitted into the air by motor vehicles: as you know, lead free petrol now, or in the future, is simply not an option for the vast bulk of cars which will be on UK roads into the 1990s.

However, it seems to me that we might usefully strengthen our position against what is essentially the emotional - rather than scientific - approach of CLEAR if we were able soon to make further announcements of more positive action on some other aspects of the lead problem such as plumbosolvent water, lead works, and lead solder in food cans and, in so doing, to ram home the point that these are now the real priorities.

I am copying this letter to the recipients of yours.

Yours ever
Nigel

NIGEL LAWSON

HOME AFFAIRS

JU208

DEPARTMENT OF INDUSTRY
ASHDOWN HOUSE
123 VICTORIA STREET
LONDON SW1E 6RB
TELEPHONE DIRECT LINE 01-212 3301
SWITCHBOARD 01-212 7676

Secretary of State for Industry

23 April 1982

Prime Minister 2
WR
27/4

Rt Hon Tom King MP
Minister for Local Government
and Environmental Services
Department of the Environment
2 Marsham Street
London SW1P 3EB

Dear Tom,

Thank you for sending me a copy of your letter of 30 March to David Howell.

2 I should say, at once, that on present knowledge, I do not see a need to move beyond the 0.15 grams per litre limit we have already announced. Any further move would be very costly in national terms; we should therefore need to be fully persuaded that there were genuine and major national benefits to set against those costs, benefits which at the moment, I believe, are simply not demonstrable. If in spite of this we were to be persuaded that a further move beyond 0.15 was at some stage desirable, we must evidently only consider doing so in conjunction with the rest of the Community. The most we could therefore do would be then to move to a position of advocating lead free petrol throughout Europe.

3 At the same time, I am well aware of the domestic pressure which is building up on this issue, and I entirely agree that we must be confident of our ground in standing firm on the main decisions we have reached. Therefore, although I am doubtful whether the CLEAR campaign raises any significant doubts about our policy, I agree that it might be as well for us to discuss the position further.

4 Before we do so, however, we must ensure that we have the best available view of the effects of any further moves on (i) national energy consumption and other direct costs, and (ii) the UK motor industry's competitive position, as well as the constraints on timing imposed by the oil and motor industries' need for adjustment. With this in mind I am asking my Department to undertake, with the co-operation of the motor industry, a rapid but thorough review of the arguments from the point of view of motor vehicle manufacture, design and usage. I attach a note by officials setting out more detailed thoughts on the areas

which I propose the review should consider.

5 Until I have been able to consider and present to colleagues the results of the review, which I hope to do quickly, it would be premature to hold wider collective Ministerial meetings with the oil or motor industries - though obviously Nigel Lawson may wish to run over the oil industry arguments as we shall the motor industry's. Thereafter I should be happy to join with colleagues in a discussion of these issues with the industry, though I imagine we should wish to do so amongst ourselves in the first instance.

6 There is of course a risk that the existence, or even content, of discussions with the motor industry may leak. I have therefore thought it right to give you advance warning of my proposed review, but unless I hear from you or colleagues within a week to the contrary, I propose to set the review in hand. Any leak would be simply met by confirmation that we were properly keeping ourselves informed on the implications of a matter of wide public concern.

7 I am sending a copy of this letter to the Prime Minister, and to David Howell, Nigel Lawson and Norman Fowler.

Yours ever

Patrick

JU209

ANNEX

NOTE BY OFFICIALS

Proposed review of Motor Industry Interest in Lead in Petrol

1 The study would review several areas where the Government have seen significant disadvantages in moving further or faster in reducing lead in petrol. Some of the main areas are outlined below.

2 Reduction in the lead levels in petrol results in increased primary fuel usage by the vehicle fleet: in the past it has been estimated that the move from 0.4g/litre to 0.15g/litre will increase motor transport's crude oil demand by 2½% - a significant disbenefit from the energy conservation point of view. A move to lead-free petrol is thought likely to increase usage by a further 2½% due to the increased petrol consumption to be expected from the lower compression ratio and hence more inefficient engines.

3 Perhaps more important than the immediate increase in fuel-consumption on existing technology is what a move to lead-free (and therefore low octane) petrol might do to fuel efficiency in the longer term. It is generally believed that the fuel efficiency of the petrol-engined car might be capable of 50% improvement by the end of the century. While much of this is forecast as coming from developments outside the engine itself, in body materials, transmission design, tyres and so on, engine efficiency is seen as contributing a large part. In the current state of knowledge, practically all of this improvement in engine efficiency is expected to be dependent on a move to high compression engines, which on present technology require the availability of high octane fuel of at least around 97 RON. At the present state of the art it is seen as impracticable or prohibitively expensive to provide lead-free petrol at high enough octanes to support high compression engines. So much of this anticipated improvement may be lost.

4 It cannot be certain that these looked-for improvements will appear, or that alternative routes for their attainment might not be found if high octane (i.e leaded) fuels were in fact outlawed. But it seems probable that moving to lead-free petrol could have serious drawbacks in terms of the usage of natural energy resources.

5 The above energy conservation aspect of changed petrol lead levels stands apart from any special problems for the UK motor industry; it is equally of interest to the Department of Energy, both generally and because part of the loss is bound up with the refining process itself.

6 As for the UK motor industry, any further moves beyond 0.15g/litre would require new cars to be equipped with engines capable of running on unleaded and lower octane fuel, at lower compression ratios. Much would depend on the timescale,but there is some evidence that compared with their competitors UK manufacturers' current generation of engines would not generally be cheaply developed in this direction. This is an unfortunate result of the choice of cylinder head material: cast iron heads, widely adopted in present UK engines (including the Metro) require considerably more modification to accommodate the changed valve seatings required in the absence of lead additives than do the alloy heads adopted by many European and Japanese manufacturers. One aspect of the proposed study would be to consider how important this relative difficulty is, and what order of additional unit costs would be involved in modifying engine designs in this direction.

7 As to Octel's work on lead filters, it is recognised that filters cannot totally remove lead emissions from cars. Nonetheless, their use might offer worthwhile further reductions without the energy consumption penalties mentioned above, and without requiring the substantial engine redesign implied by low octane unleaded petrol. The Department would not at this stage wish to rule out the possibility that they could have a role to play, and it would be looked at closely in the study.

WR 26/4

Home Affairs

EF

DEPARTMENT OF HEALTH & SOCIAL SECURITY

Alexander Fleming House, Elephant & Castle, London SE1 6BY

Telephone 01-407 5522

From the Secretary of State for Social Services

The Rt Hon Tom King MP
Minister of State for Local Government
and Environmental Services
Department of the Environment
2 Marsham Street
London SW1

7 April 1982

Dear Tom.

Thank you for copying to me your letter of 30 March to David Howell, about lead in petrol.

As you say, the line you are proposing does not involve any change in our stance on the significance of the health evidence, but we shall of course need to keep the position carefully under review as new evidence becomes available. I should be glad in the meantime if you would keep me in touch with developments.

I am copying this letter to recipients of yours.

Yours ever
NORMAN FOWLER

DEPARTMENT OF TRANSPORT
2 MARSHAM STREET LONDON SW1P 3EB

The Rt Hon Tom King MP
Minister for Local Government and
Environmental Services
Department of the Environment
2 Marsham Street
LONDON SW1P 3EB

7 April 1982

Dear Tom

Thank you for your letter of 30 March about lead in petrol.

I very much agree with you that having reached our decision last year to move to low lead petrol (0.15 grams per litre) as quickly as we practicably can, it would be quite wrong to put it in doubt. The CLEAR campaign has not produced any new objective evidence. Nor, judging from the relative paucity of letters from constituents, has the campaign so far generated any substantial pressure for change from ordinary people. I sense also that the media have been taking in recent weeks a more objective view, and that the message is getting over that our policy of going to low lead petrol will bring a big reduction in exposure, leaving this source of lead as a small contributor to people's total intake.

That latter point seems to me a very strong ground of defence, resting as it does on the physical evidence about relative contributions from different sources rather than the medical evidence about the effects of lead on intelligence. As your recent letter to Des Wilson pointed out, even with present petrol lead contributes only up to 20% of people's intake. With the low lead petrol we shall be using from 1985 that percentage is likely to be halved.

In these circumstances I think it would be wrong to shift the basis of our policy towards lead free petrol as a long term objective. This objective could only really make sense on one of two assumptions:

a. that engine technology, or availability of crude oil, changes against all expectation so as to radically reduce the costs of a lead free policy, or

b. that new medical evidence leads us to adopt a far harder, and more expensive, policy towards lead from all sources (including water, food and products such as paint).

With regard to engine technology you have asked whether a chance is at all likely that would make the production of engines capable of running on lead free petrol attractive to British manufacturers. Recent letters from Ford and British Leyland are categorical that major capital investment would be involved, and that any such changes ought to be agreed on a European basis - a point you made in your letter to Des Wilson. We could seek confirmation of this at a meeting with motor manufacturers, though this would need careful handling to avoid giving them the impression that we were contemplating a change of policy (and, in the event of a leak, giving CLEAR the impression that they have us on the run). But whatever the relative abilities of manufacturers to respond to a change, the technical advice is clear that by going to a lead free low compression engine, such as produced by Honda, cars would use about 6% more fuel than with an equivalent high compression engine running on low leaded fuel (0.15 grams per litre).

Apart from this immediate loss there would be dangers of sacrificing greater savings and possible advantages to UK manufacturers later on. It is Ford's view that "lean-burn" engines, which require high-octane fuel, offer one of the best hopes of securing improved fuel-economy in the future.

To stand firm on our present policy does not preclude a change if circumstances were to emerge such as are outlined in paragraph 4(b) above, demanding a much tougher policy on all sources of lead in the environment. The exhaust filters being developed by Associated Octel are one technical possibility, that might prove attractive. Precise figures for performance and cost will not be available until the company has done more development work which we can evaluate (and we would also have to study disposal problems). Their work so far will doubtless be reported and assessed by the Royal Commission. But although it seems that filters could achieve a further halving of lead exhaust emissions, they will never be 100% efficient. If we were now to change the basis of our policy to going lead free as an ultimate objective, exhaust filters would make no sense. We would effectively be telling Associated Octel to abandon their development programme. And we might regret this if evidence accumulated to support the more modest reduction that could be achieved by exhaust filters.

I have not commented on your question about the timing of the move to low lead petrol as Nigel Lawson will be closer to oil industry thinking on this than I am.

I am of course ready to take part in any discussion about this, but you will have gathered from this letter that I do not see any case for a change in the basis of our policy at the present time. The right course seems to me that we keep to our current line at least until, say in six months' time, we have a clearer idea of what evidence the Royal Commission have received, and the ground which they will cover with their report.

I am sending copies of this letter to those who received copies of yours.

Yours ever

David

DAVID HOWELL

3P

CONFIDENTIAL

2.

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

MINISTER FOR LOCAL GOVERNMENT AND ENVIRONMENTAL SERVICES

30 March 1982

Prime Minister

MAP 31/3

Dear David

LEAD IN PETROL

I should be grateful for an opportunity to discuss with you our response to the continuing campaign on lead in petrol.

As you know, Giles Shaw and I have been robustly defending the policy that we adopted last year - and I know that you and other colleagues have been doing the same in your respective fields. You will have received a copy of the response which Giles Shaw has sent to CLEAR's letter to the Prime Minister.

I have no doubt that the decision that we took last year was absolutely right. But I am equally sure that we must not be seen to be complacent about this issue, especially as there is room for doubt, and the health and intelligence of children are involved. Moreover, we must keep under review the validity of the technical and economic assumptions on which our decision was based.

The issue has come up a number of times during Prime Minister's questions, and I am sure that this political interest will continue, especially as the leaders of the Opposition parties have all been quoted as supporting the CLEAR campaign. We know that CLEAR have other "revelations" planned, with a major international seminar in May; and it seems almost certain that we shall be faced with pressure for a Debate before too long.

I enclose a note paragraphs 7 - 12 of which draw attention to some points in our position which, it seems to me, could be open to challenge. I personally should like to meet representatives of the oil and motor industries - together, of course, with appropriate colleagues - in order to get a first-hand account of the factual background as they see it.

I am copying this to Patrick Jenkin and Nigel Lawson, and it might be helpful if they could join us in any discussion. A copy goes also to Norman Fowler - though he will note that I am not suggesting that we should in any way change our stance on the significance of the health evidence - and I am also sending a copy to the Prime Minister.

Yours

TOM KING

The Rt Hon David Howell MP

CONFIDENTIAL

LEAD IN PETROL

1. In August 1981 the Government decided, as part of the response to the Lawther Report, to reduce the maximum permitted lead content of petrol from 0.40 grams per litre (g/l) to 0.15 g/l. Regulations have now been made bringing the new limit into force on 31 December 1985.

2. The basis of this decision was that moving to low-lead (but still high-octane) petrol represented the quickest way of achieving a major reduction in petrol-lead emissions. Ministers rejected the idea of moving straight to a lead-free policy, on the ground that this was an undertain alternative because its implementation would require major changes in engine design, and negotiation in Europe.

3. It was recognised that the move to 0.15 g/l would not be the end of the story, and that there would be continuing pressure from some interest groups for lead-free. However, the report by officials on which the decision was based noted that it should be possible to maintain the 0.15 g/l policy for 10 years. This would enable the oil companies to recover the investment required to implement the policy.

4. Expectations about continuing pressure for lead-free have been fulfilled. Indeed, the pace has hotted up with the establishment of a new, well-funded, pressure group - CLEAR - directed by Mr Des Wilson. They are arguing that the Government should <u>both</u> bring in a requirement for 0.15 g/l petrol for use in existing vehicles (with implementation before 1985), <u>and</u> require lead-free for vehicles marketed after 1985.

5. There has been no significant change in the factual background since the decision on lead in petrol was taken. In particular, the health evidence remains equivocal; and it will be some time before the major study sponsored by the MRC produces results. The Government's response to the CLEAR campaign has been a robust defence of present policy - trying to keep the record straight on the health evidence; pointing out the importance of action on other sources of lead; and explaining why 0.15 g/l is environmentally the best option for action on petrol-lead (with the caveat that policy would need to be reviewed if substantive new evidence on the health effects required this).

6. There appears to be no case for a major review of policy. But there are some aspects of current policy where there is a need to check the robustness of our case and, perhaps, to modify our position.

Timing of the move to 0.15

7. The date of 31 December 1985 was considered the earliest practicable for the effective date of the new Regulations. Two questions arise:

a. the oil companies have now had time to assess the detailed implications of moving to 0.15. Is there a possibility of achieving an earlier date?

b. even if the statutory date remains the same, will it be possible for at least some companies to start marketing 0.15 petrol earlier?

Lead exhaust filters

8. Associated Octel have tried to revive interest in the use of exhaust filters. How seriously can we take their claims about the efficiency of their current designs, their lifetime, and their costs? Would this be a worthwhile approach to going beyond 0.15 g/l without moving to lead-free?

Lead-free and engine design

9. Current policy is based on the premise that lead-free petrol would require major changes in engine design which would take a long time to introduce. How robust is this argument? Has BL's ability to produce engines capable of running on lead-free been affected by their link-up with Honda? Is there a possibility of the Government's position being undermined by an announcement by one of the car manufacturers?

Lead-free as a long-term objective

10. Even if it remains the case that lead-free could require major design changes, lead-free (low-octane) petrol is a feasible long-term objective. The earlier report by officials noted that, from the health and environmental point of view, the best course would be to cease adding lead to petrol; and this would be in line with the Government's general policy of reducing human exposure to lead

wherever practicable. Even if the strict health case remains unproven, there are general arguments in favour of lead-free, given the potential risks and the fact that the safety margin between current exposure (as measured by blood-lead) and levels at which action is called for is much narrower for lead than for most other pollutants.

11. The Royal Commission on Environmental Pollution have just begun a study of some aspects of the environmental lead problem, including the technical aspects of a further reduction in (or elimination of) lead in petrol. In Europe, discussion on the need and scope for, and the consequences of, a reduction in polluting exhaust emissions from cars (including lead) are taking place in a Commission working group, which is expected to report in mid-1983. Provided that a lead-free policy was developed in this context - taking account of energy, industrial and economic implications and also of policy on other vehicle emissions - it would not seem to be in any way incompatible with the decision taken by Ministers last year.

12. Is there a case for modifying the UK line in the European discussions, and for arguing for lead-free as the basis for policy, provided that there is a reasonably long timescale which ensures that economic and industrial considerations are given full weight? This might be pursued by an early statement in favour of giving full consideration to lead-free, to be followed up by the submission of a paper when the results of the Royal Commission study are available (probably by the end of 1982).

MFJ
H offices

cf

12 February 1982

Thank you for your letter of 11 February, about the Chief Medical Officer's wish to send a letter to the "Times" on lead in petrol for publication tomorrow.

The Prime Minister has now seen the text. Despite her general reservations about direct intervention in controversy in the press, she believes that Sir Henry's draft is an excellent one and is quite happy for him to go ahead.

I am sending copies of this letter to David Edmonds (Department of the Environment) and David Wright (Cabinet Office), and to Bernard Ingham here.

I understand that Monday is now the preferred date.

MAP

Brendan O'Gorman
Department of Health and Social Security

BR

DEPARTMENT OF HEALTH & SOCIAL SECURITY

Alexander Fleming House, Elephant & Castle, London SE1 6BY

Telephone 01-407 5522

From the Secretary of State for Social Services

11 February 1982

Dear Mike,

LEAD IN PETROL : "TIMES" ARTICES

I enclose a copy of the letter which the Chief Medical Officer wants to send to the "Times" for publication on Saturday.

As I explained, he has been prompted to do this because three members of the Lawther working party have indicated that they will write if he does not. The Chief Medical Officer is concerned that these letters would create more problems than they would solve, as they are likely to raise issues other than lead in petrol, e.g. the idea of a panel to investigate the levels of lead in the environment.

My Secretary of State has seen and has agreed the letter.

yours ever

Brendan O'Gorman

SECOND DRAFT

DRAFT LETTER FROM CMO TO THE EDITOR OF THE TIMES

Your issue of 8 February printed a letter which I sent to the Permanent Secretary at the Department for Education and Science and other official colleagues in March 1981. Some of the subsequent comment in your columns and elsewhere has misrepresented my position in certain respects, and I would be grateful for the opportunity to make two points.

Firstly, it is erroneous to infer that my advice in any way negated or contradicted that of Professor Lawther's Working Party on "Lead and Health". The contrary is the case. The report was published in March 1980 and after careful consideration of all the evidence then available, the Working Party felt unable to come to clear conclusions concerning the effects of intermediate amounts of lead (ie in the range 35-80 micrograms per decilitre of blood lead) on the intelligence, behaviour and performance of children. It nevertheless recommended that emissions of lead to the air should be reduced. Following the publication of the report results from a later pilot study strongly suggested that there might be deleterious effects on reading, spelling and intelligence associated with even lower blood-lead levels (ie in the range below 35ug/dl). These results were not wholly conclusive because the possible influence of social factors could not be separated from the effects of lead but taken together with the known toxicity of lead at high levels and the conclusion of the Working Party that an effect at intermediate levels could not be excluded they strongly suggested that the margin of safety was too small. It was estimated that

some hundreds of thousands of British children could have blood lead concentrations above 25ug/dl; even though most of these children would be below 35ug/dl and they would have little margin of safety in comparison with margins considered necessary for other toxic substances. I concluded that steps should be taken to reduce the general population exposure to lead.

That conclusion was entirely consistent with the Working Party's advice and in March 1981 I advised the Government accordingly.

Thus the specific advice which I gave was based on the Working Party's fifth recommendation and on further information which became available after the publication of the report. That advice was corrently quoted in the paragraph fourth from last in my letter in these terms: "I have advised my Secretary of State that action should now be taken to reduce markedly the lead content of petrol in use in the United Kingdom". The Minister for Local Government announced to Parliament on 11 May 1981 that this was being done.

Secondly, my letter did not mention in any detail other sources of lead, such as old paint and plumbo-solvent water supplies. These sources had been discussed at length in the Working Party's report and recommendations concerning them had already been agreed between the Government Departments concerned at the time I wrote. It would be unfortunate if over-concentration on the issue of lead in petrol were to distract attention from these other avoidable sources of exposure to lead. In some localities they are probably of greater importance.

H. A Hain

PRIME MINISTER

LEAD POLLUTION

Tom King's statement went over quite well. Discussion was focussed almost exclusively on lead in petrol, with occasional references to the financing of replacement of lead plumbing.

For the Opposition, Denis Howell welcomed what was proposed, but said that the lead in petrol decision was inadequate and would be obsolete before it was implemented. The Government should have given notice now of its intention to go for a complete ban, allowing a reasonable time to prepare for a changeover. He also touched on the delays in announcing the decision, and press reports of the internal Government discussion leading up to the announcement. Mr. King replied that a decision to go straight to a ban on lead in petrol would be more expensive in the short term, and would not in fact produce a more beneficial result than his proposals until 25 years had passed. He had placed a graph in the Vote Office demonstrating this. He emphatically denied press reports that the Government's decision was the result of a deal with the oil companies and car industry involving a commitment not to move to lead-free petrol in the future.

There was some pressure for a move to lead-free petrol from all sides, including Robert McCrindle and Nigel Forman from the Government backbenches. Mr. King held to his explanation. His proposals offered the best run of benefits in the medium term. Jock Bruce-Gardyne alone questioned the cost to public funds and to consumers of the measures now announced, but his view seems to be based on a misunderstanding of the Lawther recommendations.

Ken Marks was one of those who wanted clarification on availability of grants for replacing lead plumbing. When he rose, he was cheered from the Government side, following his defeat of left wing opponents in the Gorton constituency.

/ Alf Dubs

Alf Dubs quoted recent research which suggested that lower levels of lead in petrol were more dangerous to children, because they produced smaller lead-bearing particles which were more easily absorbed from the air. Mr. King undertook to look into this research.

MP

I am also attaching a question-and-answer brief which was offered for your use today

MP 12/v.

11 May 1981

LEAD POLLUTION: DRAFT QUESTIONS AND ANSWERS FOR PM's QUESTION-TIME

Q1 Why not lead-free petrol now?

A1 As my RHF (the Minister for Local Government and Environmental Services) told the House yesterday, it is an illusion to think of introducing lead-free petrol now. Cars in this country cannot run on lead-free petrol; nor could home-produced cars in substantial numbers for another 10 years.

Q2 Was there a deal with the oil industry to put off lead-free petrol?

A2 I am glad to be able to repeat the categorical assurance which my RHF gave the House yesterday. There is no such deal.

Q3 Lead-free petrol in the longer term?

A3 This is a matter for the car industry throughout Europe. It could only be achieved in the longer term through international agreement. If our Community partners want to explore this, we will gladly take part in discussions.

Q4 Extra Government funds for measures to prevent poisoning eg through lead tanks and water pipes?

A4 We need to reduce Government expenditure, not increase it. Remedial measures will have to be funded from present provisions. But I agree that they warrant high priority. My Rt Hon Friends will be holding discussions with the appropriate authorities.

Q5 Was inter-departmental disagreement the reason for all the delay?

A5 Professor Lawther reported about a year ago. Since then there has been extensive discussion to ensure that we got the right decisions. The upshot has been a wide-ranging initiative by the Government as a whole.

Q6 Is the Government concerned about the possibility of lead causing brain damage in children?

A6 We are doing two things in particular to protect children. We are reducing the lead content in emissions from petrol-driven vehicles. And, because the Greenwich study /into the effects of lead on children in the Greenwich area/ was inconclusive, and its authors share this view, we are asking the Medical Research Council to undertake further research into the problem.

Q7 Other Questions

A7 People have known for years about the hazards of lead, and successive Governments have acted to reduce them. Professor Lawther's report showed that there need be no cause for alarm; but we think it right to take an initiative on a number of fronts, and early action on lead in petrol in particular.

Home Affairs.

Lead Pollution

The Minister for Local Government and Environmental Services (Mr. Tom King): With permission, I will make a statement on Government action on environmental pollution by lead.

The Government have now completed their review of policy, in the light of the report by the working party, under the chairmanship of Professor Lawther, set up by the then Secretary of State for Social Services. The Government accept the general conclusion of the report that current policy needs to be tightened in a number of respects, building on what has already been achieved.

The report makes clear the need to improve our knowledge of the effects of lead in our environment, and particularly of possible effects on children's intelligence. Some studies have been completed on this, and more are in hand. The Government have invited the Medical Research Council to commission a major study in this area.

The report emphasises the importance of a comprehensive approach towards tackling the problems of lead pollution. I have placed in the Vote Office a paper outlining the Government's response to the detailed recommendations in the report. In this statement I shall deal with the main points.

First, on the subject of paint, the real problem is not paint currently on sale to the public—most of which is virtually lead-free—but old paintwork in many houses and other buildings. This will be tackled by information and advice to local authorities, and by increased emphasis in health education programmes on ways to counter the hazards. There will be early discussion with the local authority associations on this and on other matters concerning local authorities.

Secondly, with regard to water, high levels of lead can occur in drinking water in some areas. The problem arises only in the minority of households that have both lead-solvent water and lead plumbing. Water authorities have been working to identify the problem areas and are taking steps to tackle the problem at source. This work is being pressed ahead as rapidly as possible. Meanwhile, water authorities, local authorities and area health authorities are being asked to co-operate to provide information and advice to people who may be affected.

In some cases, and particularly where drinking water comes from lead-lined tanks, the only answer is to alter the plumbing. The Government propose that such work should be eligible for home improvement grants. This will be considered in consultation with the local authority associations. My right hon. Friend will be taking corresponding action in Scotland, where there is a particularly severe problem in those areas where lead-lined tanks are common.

Thirdly, in relation to food, new regulations covering the maximum permitted levels of lead in food offered for sale came into force last year. The Food Additives and Contaminants Committee has already been asked to study the implications of the use of lead solder in cans in its study of metals in canned foods.

Finally, on emissions of lead to air, the Lawther report recommends an air quality standard for lead of 2 micrograms per cubic metre. The Government agree that this standard, which is also proposed in a draft European Communities directive, should be adopted.

On the control of industrial emissions, current powers are adequate to allow the proposed standard to be met. But, as the figures quoted by Lawther show, the standard cannot be met in some areas of heavy traffic. Petrol-lead emissions may also result in high levels of lead in dust, and may contribute to lead in food.

The Government have decided that the maximum permitted lead content of petrol should be reduced as far as is possible, without ruling out the continued use of car engines of present design—that is, from the present limit of 0·40 grams per litre to 0·15 grams per litre. This will reduce by about two-thirds lead emissions from cars some 10 years earlier than any other practicable method.

The aim will be to introduce the new limit not later than the end of 1985. The oil industry will need to install substantial new plant in order to produce the new low-lead petrol in sufficient quantities. We shall discuss the practical requirements with the industry. There will in time be some increase in the cost of producing petrol, but we believe that such extra costs are reasonable in relation to the environmental benefits of an early and substantial reduction in lead emissions.

Professor Lawther's report warned of the need to take further effective action to deal with lead pollution. The measures that I have announced today show the Government's acceptance of the importance of his report and our intention to take all necessary steps to reduce the hazards arising from lead in our environment.

Mr. Denis Howell (Birmingham, Small Heath): We welcome the concern of the Government and the steps that have been announced, but is the Minister aware that the Opposition are extremely disappointed on the main issue of principle, namely, lead in petrol? We believe that this is the wrong decision, given the two options before the Government of either reducing the maximum to 0·15 grams per litre or going for lead-free petrol immediately. We believe that the latter decision should have been taken now. Is it not inevitable that the environmental and health considerations and the developing public opinion on the subject will combine to make that part of the Government's decision obsolete well before it is implemented? the Opposition will certainly go for lead-free petrol. We believe that it would have been better to give industry and the motorist the necessary time to adjust to that fundamental decision.

We welcome the Minister's announcements on food, water and paint, but as the Government have cut back resources for the water authorities, can the Minister assure us that the authorities will have the resources to meet the costs, which are likely to be substantial, especially in the older cities? Is it adequate to offer a 50 per cent. grant to people living in the centres of old cities such as Glasgow and those in Lancashire? Should not this cost be undertaken by the whole community? What will be Government's response if large numbers of those citizens say that they cannot afford to replace their lead pipes or tanks?

Why, too, has there been the political delay of 18 months before the Minister's announcement today? The Labour Government reduced the amount of lead in petrol on four occasions. We set up the Watlip inquiry that reported in July 1979, and the Lawther working party which reported in March 1980. It is clear from all the leaks over the past year that there has been a departmental dog-fight within the Government, in which the Treasury has routed the Department of the Environment and the

Mr. Sainsbury: Will my right hon. Friend ensure that national and local media are not reluctant to give due reward to businesses that sponsor the arts? Will he ensure, that the BBC, for example, is not reluctant to mention sponsorship in case it constitutes advertising?

Mr. Channon: That is a good point. It is an important topic which has been raised frequently. I shall discuss the matter with the BBC and others. Great progress has been made, and I hope that we shall make further strides forward.

British Film Industry

25. **Mr. Freud** asked the Secretary of State for Education and Science what encouragement his Department currently is giving to independent British film-makers.

Mr. Channon: Within my sphere of responsibility, support for independent British film producers is provided by the production board of the British Film Institute. I am pleased to say that the grant-in-aid to the institute for 1981-82 includes a substantial increase for this work.

Mr. Freud: Is the Minister aware of the extreme difficulty for the private sector of the film industry in getting its films distributed? Will he see whether he can do something to help?

Mr. Channon: That is more a matter for the Secretary of State for Trade. My responsibilities in the film industry are limited. The Department of Trade deals with the film industry as a commercial industry. My responsibilities are limited to the British Film Institute, but I shall draw my right hon. Friend's attention to what the hon. Gentleman says.

Mr. Cryer: Will the right hon. Gentleman encourage independent film production in this country by making more money available to the BFI? Will he accept that his responsibility is not entirely separate from that of the Department of Trade and encourage his colleagues in that Department to make more money available to the National Film Finance Corporation? Will he also bring pressure to bear on television companies to help independent feature film production here?

Mr. Channon: The matters that the hon. Gentleman raises are partly the responsibility of my right hon. Friend, and I shall mention them to him. The British Film Institute has set a net budget for the production board of about £700,000 this year, which will permit about six low budget feature films and eight low budget experimental films to be made, which is a step forward.

Mr. Faulds: Will the right hon. Gentleman discuss with the Department of Trade, first, the nonsense that films are placed in that Department? Secondly, will he discuss the need to govern British film-making by imposing a levy on the televising of feature films, which would be an easy way to bring funds to the film industry?

Mr. Channon: I shall certainly discuss the first matter, but, unfortunately, so far the allocation of Government responsibilities is not among my duties. The second part of the hon. Gentleman's question is a matter for the Secretary of State for Trade, and I shall discuss it with him.

Public Lending Right

26. **Mr. Moate** asked the Secretary of State for Education and Science what is his estimate of the number of authors who would be eligible to register for public lending right.

Mr. Channon: An estimate of 50,000 eligible authors has been used as the basis for planning but no precise figures are available. The number registering may well be substantially fewer.

Mr. Moate: If my right hon. Friend is in the business of setting up quangos—which I hope he is not—and if he should ever institute a scheme of public lending right, what would be the likely average payment to each author for every £1 million of taxpayers' money expended?

Mr. Channon: I am indeed enthusiastically looking forward to the introduction of public lending right. I know that this is one of the very few issues on which my hon. Friend and I are not in agreement, but the House has decided by a large majority that public lending right should be introduced. I ask my hon. Friend to await the consultative document which will, I hope before too long, be available to the House.

Mr. Faulds: Will the right hon. Gentleman reiterate that this will be introduced before not too long, as there has been a good deal of delay in the Government's intentions on this matter? When will he make a public statement about when the scheme will be introduced and exactly how it will be run?

Mr. Channon: The consultative document will be published before very long and the hon. Gentleman will then be able to see. In fact, we are at the stage of appointing the registrar. I hope that he will be appointed very soon. The prime responsibility for actually getting on with the scheme, once Parliament has approved it, will be his. But there will be no undue delay.

file BK

Home Affairs

10 DOWNING STREET

From the Private Secretary

11 May 1981

Thank you for your further letter of 8 May, about today's statement on lead pollution.

I confirm that the Prime Minister is content.

I am sending copies of this letter to the Private Secretaries to the Secretary of State for Industry, the Secretary of State for Energy, the Secretary of State for Transport, the Chancellor of the Duchy of Lancaster and the Government Chief Whip.

M. A. PATTISON

Martin Brasher, Esq.,
Department of the Environment

AGO

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DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

MINISTER FOR LOCAL GOVERNMENT AND ENVIRONMENTAL SERVICES

cc Press

8 May 1981

Dear Mike, MM 11/5

STATEMENT ON LEAD POLLUTION

You told me that the Prime Minister was content with the line of the draft statement attached to my letter of 5 May.

I now attach the final version of the statement, which Mr King will make on Monday 11 May and which Lord Bellwin hopes to repeat that day in the House of Lords. The statement has been shortened at Mr Pym's request, but it takes account as far as possible of the comments received from other Departments on the two earlier versions.

Copies go to those who received my earlier letters.

Yours Sincerely,

Martin Brasher

MARTIN BRASHER
Private Secretary

Mike Pattison Esq

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REVIEW OF POLICY ON ENVIRONMENTAL LEAD

DRAFT STATEMENT

1. With permission, I will make a statement on Government action on environmental pollution by lead.

2. The Government have now completed their review of policy, in the light of the Report by the working party, under the chairmanship of Professor Lawther, set up by my RHF the Secretary of State for Social Services. The Government accept the general conclusion of the Report that current policy needs to be tightened in a number of respects, building on what has already been achieved.

3. The Report makes clear the need to improve our knowledge of the effects of lead in our environment, and particularly of possible effects on children's intelligence. Some studies have been completed on this, and more are in hand; the Government have invited the Medical Research Council to commission a major study in this area.

4. The Report emphasises the importance of a comprehensive approach towards tackling the problems of lead pollution. I have placed in the Vote Office a paper outlining the Government's response to the detailed recommendations in the Report. In this statement I shall deal with the main points.

5. First, paint. The real problem here is not paint currently on sale to the public - most of which is virtually lead-free - but old paintwork in many houses and other buildings. This will be tackled by information and advice to local authorities, and by increased emphasis in health education programmes on ways to counter the hazards. There will be early discussion with the Local Authority Associations on this and on other matters concerning local authorities.

6. Second, water. High levels of lead can occur in drinking water in some areas. The problem arises only in the minority of households which have both lead-solvent water and lead plumbing. Water authorities have been working to identify the problem areas, and are taking steps to tackle the problem at source. This work is being pressed ahead as rapidly as possible. Meanwhile water authorities, local authorities and area health authorities are being asked to co-operate to provide information and advice to people who may be affected.

7. In some cases, and particularly where drinking water comes from lead-lined tanks, the only answer is to alter the plumbing. The Government propose that such work should be eligible for home improvement grants; this will be considered in consultation with the Local Authority Associations. My RHF will be taking corresponding action in Scotland where there is a particularly severe problem in those areas where lead-lined tanks are common.

8. Third, food. New regulations reducing the maximum permitted levels in food offered for sale came into force last year. The Food Additives and Contaminants Committee have already been asked to study the implications of the use of lead solder in cans in their study of metals in canned foods.

9. Finally, emissions of lead to air. The Lawther Report recommends an air quality standard for lead of 2 micrograms per cubic metre. The Government agree that this standard, which is also proposed in a draft European Communities directive, should be adopted.

10. So far as the control of industrial emissions is concerned, current powers are adequate to allow the proposed standard to be met. But, as the figures quoted by Lawther show, the standard cannot be met in some areas of heavy traffic. Petrol-lead emissions may also result in high levels of lead in dust, and contribute to lead in food.

11. The Government have decided that the maximum permitted lead content of petrol should be reduced as far as is possible, without ruling out the continued use of car engines of present design - that is, from the present limit of 0.40 grams per litre to 0.15 grams per litre. This will reduce by about two-thirds lead emissions from cars some 10 years earlier than any other practicable method.

12. The aim will be to introduce the new limit not later than the end of 1985. The oil industry will need to install substantial new plant in order to produce the new low-lead petrol in sufficient quantities; and we shall discuss the practical requirements with the industry. There will in time be some increase in the cost of producing petrol, but we believe that such extra costs are reasonable in relation to the environmental benefits of an early and substantial reduction in lead emissions.

13. Mr Speaker, Professor Lawther's Report warned of the need to take further effective action to deal with lead pollution. The measures I have announced today show the Government's acceptance of the importance of his report and our intention to take all necessary steps to reduce the hazards arising from lead in our environment.

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DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

MINISTER FOR LOCAL GOVERNMENT AND ENVIRONMENTAL SERVICES

Prime Minister

In April you agreed E(EA)'s proposals for implementing the Lawther report on control of lead pollution. This statement announces these proposals. These will raise petrol pump prices by 5p and increase crude oil consumption by ½%. Mr King will be briefed to deal with these questions. Content? MR 6/5

cc Mr Ingham

5 May 1981

Dear Mike,

STATEMENT ON LEAD POLLUTION

Mr King has considered his colleagues' comments on the draft statement on lead I circulated with my letter of 15 April. I attach a fresh draft designed to reflect as far as possible the points made.

The only point with which Mr King has any difficulty is Mr Howell's wish to include a reference to the possible impact of the Government's action on the pump price of petrol. Mr King will clearly have to be ready to deal with questions that may be asked about petrol prices, and officials are in touch about briefing for questions, but he would prefer not to draw explicit attention to this and to the figure of up to 5p in the statement itself.

I would be grateful to have any comments, in particular on this outstanding point, by Thursday 7 May, so that the statement would be ready to be made on Monday 11 May. I understand from Mr Pym's office that a statement on that day would be acceptable.

I am sending copies to all who had copies of my earlier letter, and to Michael Pownall who will no doubt advise on the desirability of repeating the statement in the House of Lords.

Yours Sincerely,

Martin Brasher

MARTIN BRASHER
Private Secretary

Mike Pattison Esq

REVIEW OF POLICY ON ENVIRONMENTAL LEAD

DRAFT STATEMENT

1. With permission, I will make a statement on Government action on environmental pollution by lead.

2. The Government have now completed their review of policy, in the light of the Report by the working party, under the chairmanship of Professor Lawther, set up by my RHF the Secretary of State for Social Services.

3. The Report emphasises the need for a comprehensive approach. It calls for action to reduce the exposure of the general population to lead, and to pay special attention to groups - such as children - who may be particularly at risk.

4. The Government accept the general conclusion of the Report that current policy has to be tightened in a number of respects, building on what has already been achieved. I shall deal with the main points in this statement; with permission, I will place a paper covering more detailed matters in the Library.

5. The Report makes clear the need to extend our knowledge of the effects of lead in our environment. This is particularly true of the relationship between exposure to lead and children's intelligence. Some studies have been completed on this and more are in hand. The Government have invited the Medical Research Council to consider the form and scope of a major study in this area.

6. The Report emphasises also the importance of monitoring lead pollution. Local authorities are already active in this, and are tackling the problems they identify. There will be early consultations with the Local Authority Associations covering this and all other relevant aspects of the Report's recommendations.

7. It also calls for more advice and information about the dangers of lead. We are therefore asking the appropriate organisations to provide this.

8. I now turn to the main proposals for tackling individual sources of environmental lead.

9. First, paint. The real problem here is not paint currently on sale to the public - most of which is virtually lead-free - but old paintwork in many houses and buildings. Old lead paint can present serious problems. These problems will be tackled by information and advice to local authorities, and by increased emphasis in health education programmes on ways to counter the hazards.

10. Second, water. High levels of lead can occur in drinking water where it is of a kind which tends to dissolve lead from pipes or storage tanks. This problem is also localised: only a minority of households have both lead-solvent water and lead-pipes or tanks. Water authorities have been working to identify the areas which may be affected. They are taking steps aimed at reducing lead in the household supply in those areas, by treating the water to reduce its lead-solvency or by switching to different sources of supply and this work is being pressed ahead as rapidly as possible. Meanwhile water authorities, local authorities and area health authorities are co-operating to provide detailed information and advice locally as necessary in problem areas.

11. In some cases, and particularly where drinking water comes from lead-lined roof tanks, the only answer is to alter the plumbing. The Government therefore propose that such work should be eligible for home improvement grants; the details of arrangements for this will be considered in our consultations with the Local Authority Associations. My Rt Hon Friend will be taking corresponding action in Scotland where there is a particularly severe problem in those areas where lead-lined tanks are common.

12. Third, food. New regulations reducing the maximum permitted levels in food offered for sale came into force last year. The Food Additives and Contaminants Committee have already been asked to study the implications of the use of lead solder in cans in their study of metals in canned foods.

13. Finally, emissions of lead to air - primarily from cars and from industrial emissions. The Lawther report recommends an air quality standard for lead of 2 micrograms per cubic metre. The Government agree that this standard, which is also proposed in a draft European Communities directive, should be adopted.

14. So far as the control of industrial emissions is concerned current powers are adequate to allow the proposed standard to be met. But, as the figures quoted by Lawther show, the standard cannot be met in some areas of heavy traffic. Petrol-lead emissions may also result in high levels of lead in dust, and contribute to lead in food.

15. The Government have decided that the evidence points to the need to make a substantial reduction in emissions of lead from cars as soon as possible.

16. We have concluded that lead in petrol should be reduced to the minimum consistent with continued use of car engines of present design. To attempt to go further would entail long delay while new engines were introduced into service and gradually replaced the existing stock: it would take many years to achieve a substantial reduction in emissions.

17. The minimum lead content compatible with the continued use of most present car engines is 0.15 grams per litre; this level will also allow an air quality standard of 2 micrograms per cubic metre to be met. The Government have therefore decided that the maximum

permitted lead content should be reduced from 0.40 to 0.15 grams per litre. This will achieve a reduction of about two-thirds in lead emissions from cars - and will do so some 10 years earlier than any other practical method.

18. The oil industry will now need to install substantial new plant in order to produce the new low-lead petrol in sufficient quantities. My RHF the Secretary of State for Transport in association with my RHF the Secretary of State for Energy will discuss the practical requirements with them and will in due course make the necessary regulations. The aim will be to achieve introduction of the new limit not later than the end of 1985.

19. Mr Speaker, Professor Lawther's Report warned of the need to take further effective action to deal with lead pollution. The measures I have announced today show the Government's acceptance of the importance of his Report and our intention to take all necessary steps to reduce the hazards arising from lead in our environment.

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SECRETARY OF STATE FOR ENERGY
THAMES HOUSE SOUTH
MILLBANK LONDON SW1P 4QJ
01-211-6402

Martin Brasher Esq
Private Secretary to
The Minister for Local Government
and Environmental Services
Department of the Environment
2 Marsham Street
London SW1P 3EB

27 April 1981

Dear Martin,

Thank you for copying to me your letter to Mike Pattison of 15 April covering a draft policy statement on lead pollution which you enclosed.

Recent press reports suggest that the oil industry is already saying publicly that it would have preferred the Government to decide in favour of lead-free petrol (which would have avoided the need for new refinery investment and the associated petrol price increases). The draft statement already adequately disposes of that option, but Mr Howell believes that to save the Government possible embarrassment the statement should acknowledge the point made in Sir Keith Joseph's minute to the Prime Minister of 13 April that the price of petrol to the motorist will increase by up to 5p a gallon as a consequence of the Government's decision, and go on to say that this is regarded as a reasonable price to pay to secure the health and environmental benefits of low lead petrol. My Secretary of State has also asked me to say that he will wish to be associated with the Secretary of State for Transport in discussions with the oil industry because of his interests in refinery investment, petrol prices and crude oil requirements. I enclose some suggested amendments to the draft statement which reflect these points.

As to timing, Mr Howell notes Mr King's proposals but shares the view expressed by the Chancellor of the Duchy in his minute to the Prime Minister of 15 April that the statement should follow the Committee Stage of that part of the Finance Bill providing for increases in petrol and derv duties, especially in view of the need seen by Mr Howell to acknowledge in the statement the effect on petrol prices of the decision on lead.

I am copying this letter and enclosures to recipients of yours.

Yours ever,

J D WEST
Private Secretary

Encs

REVIEW OF POLICY ON ENVIRONMENTAL LEAD

DRAFT STATEMENT

Para.17

Amend last line to read:-

"emissions in this way."

Paras. 18 and 19

Amend to read as follows:

"18. On the other hand, to make a significant reduction in the lead content of petrol while still meeting current petrol specifications would involve substantial investment in new refinery plant and ongoing extra crude oil costs. These additional costs could increase the price of petrol to the motorist by up to 5p per gallon.

"19. The Government are, however, concerned to achieve a significant reduction in the lead content of petrol at the earliest opportunity. We have therefore decided that the permitted lead content should be reduced from 0.40 to 0.15 gram per litre. This will achieve a reduction of about two-thirds in lead emissions from cars - and, after allowing the necessary investment time for the oil industry, will do so some 10 years earlier than any other practical method. It will also, as I have said, put up the price of petrol, but we believe it is a reasonable price to pay for an early and substantial reduction in lead emissions."

Review of Policy on Environmental Lead

Draft Statement

Para.20

Renumber as para. 21 and insert new para. 20 as follows:

"20. Mr RHF the Secretary of State for Transport in association with my RHF the Secretary of State for Energy will discuss the practical requirements with the oil industry, and will in due course make the necessary regulations. The aim will be to achieve the introduction of the new limit not later than the end of 1985."

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Home
MR
Hall

DEPARTMENT OF HEALTH & SOCIAL SECURITY

Alexander Fleming House, Elephant & Castle, London SE1 6BY

Telephone 01-407 5522

From the Secretary of State for Social Services

M L Brasher Esq
Private Secretary
Department of the Environment
2 Marsham Street
London
SW1P 3EB

27 April 1981

Dear Martin

GOVERNMENT RESPONSE TO LAWTHER REPORT

Thank you for sending us a copy of your letter of 15 April to Mike Pattison at No 10 covering a draft of Mr King's statement. We are generally content with it but would like to suggest the following amendments:-

i. para 5: to read "The Report makes clear the need to extend our knowledge of the effects of lead in our environment. This is particularly true of the relationship between exposure to lead and children's intelligence. Some work is already being done on this and proposals for further work are being considered." The main reasons for the changes are that the Yule Study has not yet been published and the MRC has not yet decided whether to fund a full-scale study;

ii. para 7, second sentence: to read "We are therefore asking the appropriate organisations to provide this".

iii. para 9, last sentence: to read "These problems will be tackled by information and advice to local authorities and by increased emphasis in health education programmes on ways to counter the hazards."

I am sending a copy of this letter to those who received a copy of yours.

Yours ever

Mike

MIKE TULLY

CONFIDENTIAL

PS / Prime Minister

FROM THE MINISTER FOR HOME AFFAIRS AND THE ENVIRONMENT

SCOTTISH OFFICE
NEW ST. ANDREW'S HOUSE
ST. JAMES CENTRE
EDINBURGH EH1 3SX

24 April 1981

Private Secretary to the
Minister for Local Government
and Environmental Services
Department of the Environment
2 Marsham Street
LONDON SW1P 3EB

Your letter of 15 April circulated a draft statement setting out the Government's policy on lead pollution. Our main interest is in the grant scheme to replace lead plumbing and lead lined tanks. Since the same policy is being adopted throughout the UK my Secretary of State is content for a single statement to issue, subject to the small- but from our point of view important - amendments annexed to this letter.

We would not wish to dissent from the slightly later date for the statement proposed by Mr Pym in his minute of 15 April to the Prime Minister, if that is generally agreed.

J D Gallagher
Private Secretary

DRAFT STATEMENT: SCOTTISH OFFICE AMENDMENTS

Para 10, line 4, delete "widespread" and substitute "universal".

Para 10, line 9, delete sentence "This work is being pressed ahead as rapidly as possible.".

[Note. Strathclyde Regional Council in particular have represented to us that work could proceed much more rapidly if only more money could be made available.]

Para 11, line 1, recast first sentence as follows "In some cases, and particularly where drinking water comes from lead lined tanks, the only answer is to alter the plumbing.".

Para 11, add new final sentence "My rt. hon. Friend will be taking corresponding action in Scotland.".

[Note. This slightly vague formula is necessary as our consultations may well include representatives of local health boards as well as local authorities.]

Para 12, delete.

DEPARTMENT OF THE ENVIRONMENT
2 MARSHAM STREET
LONDON SW1P 3EB
01-212 3434

MINISTER FOR LOCAL GOVERNMENT
AND ENVIRONMENTAL SERVICES

NJS

Timing issue for you, I think (see COL of 15/4)

MJP

CONFIDENTIAL

cc Mr Gaffin MJS

15 April 1981

MJP MJP.

Dear Mike,

I spoke to Mr King's office on 23/4. They are intending to postpone their statement, and will circulate a new draft in due course.

MJS
23/4

I understand that the Prime Minister has approved E(EA)'s conclusions on policy on lead pollution. E(EA) agreed that a statement should be made as soon as possible after Easter. Mr King proposes that this should be in the week beginning 27 April - the following week is the week of the local government elections.

I attach a draft of the statement he proposes to make. The draft deals with the main elements of the Government's response to the Lawther report: the intention is to place a note on some of the detailed points in the Library and officials here will be circulating a draft shortly.

The draft statement proposes alternatives on lead in water, depending on whether the Secretary of State for Scotland wishes to make a separate statement on this problem.

I would be grateful for any comments on the draft from those on the attached copy list by Thursday 23 April.

Yours Sincerely,

M.L. Brasher

MARTIN BRASHER
Private Secretary

Mike Pattison Esq

Copies

PS/Secretary of State for Industry
PS/Chief Whip
PS/Chancellor of the Exchequer
PS/Chancellor of the Duchy
PS/Secretary of State for Social Services
PS/Secretary of State for Energy
PS/Secretary of State for Trade
PS/Secretary of State for Transport
PS/Lord Privy Seal
PS/Minister of Agriculture
PS/Secretary of State for Employment
PS/Secretary of State for Scotland
PS/Secretary of State for Wales
PS/Secretary of State for Northern Ireland
PS/Chief Secretary
PS/Sir Robert Armstrong

CONFIDENTIAL

REVIEW OF POLICY ON ENVIRONMENTAL LEAD

DRAFT STATEMENT

1. With permission, I will make a statement on Government action on environmental pollution by lead.

2. The Government have now completed their review of policy, in the light of the Report by the working party, under the chairmanship of Professor Lawther, set up by my RHF the Secretary of State for Social Services.

3. The Report emphasises the need for a comprehensive approach. It calls for action to reduce the exposure of the general population to lead, and to pay special attention to groups - such as children - who may be particularly at risk.

4. The Government accept the general conclusion of the Report that current policy has to be tightened in a number of respects, building on what has already been achieved. I shall deal with the main points in this statement; with permission, I will place a paper covering more detailed matters in the Library.

5. The Report makes clear the need to know more about the effects of lead in our environment. This is particularly true of the relationship between exposure to lead and children's intelligence, as was shown by the pilot study in Greenwich conducted by Dr Yule. The Medical Research Council now propose to fund a full-scale study into this.

6. The Report also makes clear the importance of monitoring lead pollution. Local authorities are already active in this and in tackling the problems they identify. There will be immediate consultations with the Local Authority Associations covering this and all other aspects of the Report's recommendations concerning them.

7. It also calls for more advice and information about the dangers of lead. We have therefore asked the appropriate health advisory bodies to provide this.

8. I now turn to the main proposals for tackling individual sources of environmental lead.

9. First, paint. The real problem here is not paint currently on sale - most of which is already lead-free - but old paintwork in many houses and buildings. Old lead paint can present serious problems. These problems will be tackled by information and advice to local authorities and by increased emphasis on the hazards in health education programmes.

10. Second, water. This problem is also localised. High levels of lead can occur in drinking water where it is of a kind which tends to dissolve lead from pipes or storage tanks. The problem is not widespread: only a minority of households have both lead-solvent water and lead-pipes or tanks. Water authorities have been working to identify the areas which may be affected, and to take steps aimed at reducing lead in the household supply in those areas by treating the water to reduce its lead-solvency or by switching to different sources of supply. This work is being pressed ahead as rapidly as possible. Meanwhile water authorities, local authorities and area health authorities are co-operating to provide detailed information and advice locally as necessary in problem areas.

11. In some cases the only answer is to alter the plumbing. The Government therefore propose that such work should be eligible for home improvement grants; and the details of arrangements for this will be considered in our consultations with the Local Authority Associations.

12. Special problems arise in areas - principally in Scotland - where drinking water comes from lead-lined roof tanks. My RHF the Secretary of State for Scotland is today inviting the local

authorities to meet his officials for urgent talks about this problem/ /making a separate Statement on this problem/.

13. Third, food. New regulations reducing the maximum permitted levels in food offered for sale came into force last year. The Food Additives and Contaminants Committee have already been asked to study the implications of the use of lead solder in cans in their study of metals in canned foods.

14. Finally, emissions of lead to air - primarily from industrial emissions and from cars. The Lawther report recommends an air quality standard for lead of 2 micrograms per cubic metre. The Government agree that this standard, which is also proposed in a draft European Communities directive, should be adopted.

15. So far as industrial emissions are concerned current controls are adequate to enable the proposed standard to be achieved. But, as the figures quoted by Lawther show, the standard cannot be met in areas of heavy traffic. Petrol-lead emissions may also result in high levels of lead in dust and contribute to lead in food.

16. The Government have decided that the evidence points to the need to make a substantial reduction in emissions of lead from cars as soon as possible.

17. The introduction of lead-free petrol would, in time, completely remove an important source of lead pollution. Because lead-free petrol can be used only in cars with engines specially designed to accept it and which would take time to come into general service, it would take many years to achieve a substantial reduction in emissions.

18. While it is important to avoid an unacceptable disruption of the position for private cars and petrol supplies, the Government are concerned to achieve a significant reduction in the lead content of petrol at the earliest opportunity. We have therefore

decided that the permitted lead content should be reduced from 0.40 to 0.15 grams per litre. This will achieve a reduction of about two-thirds in lead emissions from cars - and will do so some 10 years earlier than any other practical method.

19. The oil industry will now need to install substantial new plant in order to produce the new low-lead petrol in sufficient quantities. My RHF the Secretary of State for Transport will discuss the practical requirements with them and will in due course make the necessary regulations. The aim will be to achieve introduction of the new limit not later than the end of 1985.

20. Mr Speaker, Professor Lawther's Report warned of the need to take further effective action to deal with lead pollution. The measures I have announced today show the Government's acceptance of the importance of his Report and our intention to take all necessary steps to reduce the hazards arising from lead in our environment.

Hom Affairs

MAP to see. NBPM
MJS
15/4

cc Miss Lake

PRIME MINISTER

LEAD POLLUTION

I have now seen Keith Joseph's minute to you of 13 April, setting out E(EA)'s conclusions on the action to be taken concerning lead pollution.

I have no comment to make on the broad thrust of this minute. However, I note that it is proposed that Michael Heseltine should make a statement on our policy in this area immediately after the Easter recess. I do not think that such a statement should precede the Committee Stage of that part of the Finance Bill providing for an increase in the duty on petrol and derv, since this would invite a wide ranging debate on the Floor of the House about the issue of lead in petrol, which would delay the progress of the Bill. It is currently the intention that the relevant part of the Finance Bill be taken on 30 April, and I therefore recommend that this statement of policy should be made during the week beginning 4 May.

I am copying this minute to the Secretary of State for Industry and to recipients of his minute of 13 April.

F.P.

15 April 1981

FILE

CONFIDENTIAL

VLE

E(EA)
D/Emp
DOE
SO
WO
D/Tr
D/En
Home

+ Chanc/Duchy/L
Ld Privy Seals Off.
MAFF
DHSS
D/Trans
CWO
CO

14 April 1981

The Prime Minister has seen the Secretary of State for Industry's minute of 13 April, reporting discussion in E(EA) about lead pollution.

She is content that the Secretary of State for the Environment should announce the decisions reached in the Committee. His office will no doubt be in touch again with specific proposals for the timing of the statement.

I am sending copies of this letter to the Private Secretaries to members of E(EA), the Chancellor of the Duchy, the Lord Privy Seal, the Minister of Agriculture, the Secretaries of State for Social Services and Transport, the Chief Whip and Sir Robert Armstrong.

M. A. PATTISON

I. K. C. Ellison, Esq.,
Department of Industry.

CONFIDENTIAL

DSG

JU

cc Mr Ingham.

CONFIDENTIAL

Prime Minister
The week-end press previewed (here E(EA)) decisions. Agree that Mr Heseltine should announce them after Easter (the key issues are in paras 5-7, on petrol cost and oil consumption)

Yes

see enclosed letter MP 13/4

PRIME MINISTER

LEAD POLLUTION

You will remember that a DHSS working party under the chairmanship of Professor Lawther produced a report last year entitled "Lead and Health" which made a number of recommendations for action to combat lead pollution. When the report was published the Government undertook to consider the recommendations with "all practicable speed".

2 E(EA) has now completed consideration of the Lawther recommendations in the light of further work by officials. This work has been conducted against the background of mounting concern about the threat to health from lead and considerable pressure from environmental groups. Public concern is likely to be enhanced when a Medical Research Council report is published shortly reviewing the evidence of the effect of lead on children. This report is likely to focus attention, and alarm, particularly on the question of lead in petrol and the pollution it causes.

3 E(EA) has been able to reach agreement on the policy issues so that, subject to your approval, it should be possible for Michael Heseltine to make a positive and comprehensive public statement of policy immediately after the Easter recess.

/4 ...

4 I wish to draw your attention to the two major decisions we have taken relating to lead in drinking water and lead in petrol. On lead in drinking water, the problem is essentially caused by the continued use in some older houses of lead plumbing and, particularly in Glasgow and Edinburgh, lead-lined storage tanks. We have agreed that the Housing Improvement Grant scheme should be extended to cover the replacement of lead plumbing and lead-lined storage tanks. The cost here may amount to £45 million spread over 10 years but can, we have been assured, be contained within existing housing allocations. In addition we envisage a localised publicity campaign in the areas of risk and, in Scotland, a survey conducted by the Scottish Office to identify the households where the risks are greatest.

5 The problem of lead in petrol presented greater problems. In the end and after careful consideration the Committee agreed, with only the Secretary of State for Energy dissenting, that the right course would be to reduce the level of lead permitted in petrol from the current maximum of 0.4 grams/litre to 0.15 grams/litre as soon as the necessary adjustments can be made at the refineries. The Sub-Committee chose this option because it is the one which has the quickest impact on the problem and can be implemented without the need to re-negotiate the current EC Directive on the subject. The Secretary of State for Energy did not dissent from the objective but told us that the oil industry would prefer to move at once to lead-free petrol in order to avoid the possibility that, having changed their

/arrangements ...

arrangements to move to low-lead petrol, they would then have to take a separate series of actions to move to lead-free petrol if that were to become a new international standard (as it already is in some parts of the United States). The Sub-Committee felt, however, that the difficulty of re-negotiating the EC Directive (the Germans among others are adamantly opposed to further change), the relative slowness of the rate of change of atmospheric pollution of this option as against the low-lead alternative (low lead petrol can be used in existing cars, lead free petrol cannot be so used) and the adverse effects on the motor manufacturing industry (which would have to re-design their car engines) made this an uncertain and unattractive option. There will be a cost, initially to the oil industry but ultimately to the consumer, amounting in the end to perhaps 5p a gallon. There will also be a necessary increase in crude oil consumption if the octane level of low-leaded petrol is to be maintained so that it can be used in existing motor cars. The change-over will take some 5 years to complete and the level of consumption of crude oil will be some ½% higher than it would have been if no change were made.

why?

6 I am minuting you on this subject, not only so that you will know of our decisions but also because the marginal increase in crude oil consumption which is a necessary part of the proposed action on lead in petrol might be held to be out of line with the policy adopted at recent summits of reducing dependence on oil. The Sub-Committee did not think you would see this as

/an ...

as insuperable obstacle but I think it right to consult you before any announcement is made.

7 I am copying this minute to the members of E(EA), the Chancellor of the Duchy, the Lord Privy Seal, the Minister of Agriculture, the Secretaries of State for Social Services and Transport, the Chief Whip and Sir Robert Armstrong.

KJ.

K J

13 April 1981

Department of Industry
123 Victoria Street

2 MARSHAM STREET
LONDON SW1P 3EB

My ref: H/PSO/12539/80

Your ref:

28 MAR 1980

REPORT OF THE (LAWTHER) WORKING PARTY ON LEAD

Thank you for your letter of 20 March with which you enclosed a copy of your proposed foreword to the report from Professor Lawther's working party.

I am writing to confirm the agreement to the foreword and to early publication of the report which Tom King's office gave yours on Friday 21 March. I assume that you will arrange for the House to be told of the publication. In any comments on the report at this stage it will of course be important to refer to the need to consider the resource implications.

As you say, consideration of the report is in hand in the Official Committee EP on which all interested Departments are represented. In view of my overall responsibilities in relation to environmental pollution I accept that I should take the lead in preparing the response to the report, and I will consult colleagues on this. I agree that we should aim to have the response ready well before the summer recess.

I am copying this letter to the recipients of yours.

Yours ever

MICHAEL HESELTINE

The Rt Hon Patrick Jenkin MP

FROM THE PRIVATE SECRETARY

HOUSE OF LORDS,
SW1A 0PW

21st March 1980

Don Brereton Esq.,
Principal Private Secretary to
Secretary of State for Social Services
Department of Health & Social Security
Alexander Fleming House
Elephant & Castle
London SE1 6BY

Dear Don,

REPORT OF (LAWTHER) WORKING PARTY ON LEAD

The Lord Chancellor received a copy of your Secretary of State's letter of 20th March 1980 enclosing a copy of the final text of the Lawther Report on Lead. This letter asked for objections to the text of the Report by last thing that same day. This morning the Lord Chancellor received a copy of the Chief Secretary's letter to your Secretary of State objecting to the last paragraph of the proposed foreword to the Report.

I understand that it is now to late to affect the outcome of this issue, your Secretary of State having accepted the points made by the Chief Secretary. The Secretary of State may, however, be interested in the Lord Chancellor's comment on the Chief Secretary's remarks. He said:

> "I do rather deprecate the watering down of a foreword as anodyne as that proposed by the Secretary of State. Everyone knows that lead water pipes are a potential hazard, and since the foreword contains no promise of early expenditure the Chief Secretary's comment seems to me to be an example of excess of zeal."

I am copying this letter to the Private Secretaries of other members of the Cabinet, to Genie Flanagan in the Department of Transport and David Wright in the Cabinet Office.

Yours sincerely

Ian Maxwell

I.H.MAXWELL

Home Affairs

V
MS

Treasury Chambers, Parliament Street, SW1P 3AG

Rt Hon Patrick Jenkin MP
Secretary of State
Department of Health
and Social Security
Alexander Fleming House
Elephant & Castle
London SE1 8BY

20 March 1980

Dear Patrick,

REPORT OF (LAWTHER) WORKING PARTY ON LEAD

Thank you for sending me a copy of your letter of 20 March to Michael Heseltine.

I have no comment on the procedure which you propose for dealing with the report.

I am however concerned about the terms of the foreword with which you propose to preface the report. Several of the Committee's recommendations are potentially very costly in terms either of public expenditure or of additional impositions upon industry; and we shall need to consider very carefully the implications of carrying any of them out. The third paragraph of your draft foreword recognises these considerations. On the other hand the last paragraph of the draft seems to me to be an undesirable hostage to fortune in that it might be taken to suggest that the government aims to eliminate the danger of lead in the environment; while it is unfortunate that paragraph 4 refers to one of the main areas in which the report may provoke calls for extra public expenditure - the problem of lead water pipes and tanks.

I am afraid therefore that I must ask you to delete the last paragraph of the draft foreword. Might I also suggest that the personal note which you strike in paragraph 4 could be achieved equally well, and without specific reference to lead in water, by replacing it by a sentence on the following lines:

> "It gives me particular pleasure to be able to welcome the report since a distinguished ancestor of mine Robert Christison MD, Professor of Materia Medica in the University of Edinburgh, carried out some pioneering research on lead pollution in the 1830s and 1840s".

I am copying this letter to the Prime Minister, other members of the Cabinet, Norman Fowler and Sir Robert Armstrong.

Yours John Biffen

JOHN BIFFEN

Home Affairs
cc Press office

NBPM

MJS

DHSS

DEPARTMENT OF HEALTH & SOCIAL SECURITY
Alexander Fleming House, Elephant & Castle, London SE1 6BY
Telephone 01-407 5522
From the Secretary of State for Social Services

The Rt Hon Michael Heseltine MP
Secretary of State for the Environment
Department of the Environment
2 Marsham Street
LONDON SW1

20 March 1980

Dear Michael,

REPORT OF (LAWTHER) WORKING PARTY ON LEAD

As you probably know, this Working Party was set up in November 1979 under the aegis of my network of advisory committees on toxicology with the following terms of reference:-

> To review the overall effect on health of environmental lead from all sources and in particular its effect on the health development of children. The Working Party will also assess the contribution lead in petrol makes to the body burden.

Somewhat later than was hoped, the Working Party's report is now virtually complete and I enclose a copy of the final text as it has gone to be printed. - in folder The Working Party's conclusions are in Chapter 8 and their recommendations in Chapter 9.

In view of the time taken by the Working Party and of insistent and growing political, public and media interest in what the report will say, I am arranging for its earliest possible publication. This will be in the last week of March and Professor Lawther will be giving a press conference on the day of publication. We are committed to publication by the end of March by Gerry Vaughan's answer to Brian Mawhinney's question in the House on 29 February.

I propose to preface the report by a foreword, a copy of which is also enclosed. This has been worked up by officials and an earlier draft was approved to my knowledge by Tom King, and possibly other colleagues as well. I should be glad to know by close today if you or any other colleague would object to this final version.

E.R.

The foreword gives no hostages to fortune beyond a recognition of the potential dangers of lead in the environment and the undertaking that HMG will consider the Working Party's report with all practicable speed. It seems to me right that you should be in the lead in preparing HMG's response to the report; but a number of other colleagues are involved as well as myself, in respect both of analysis and advice, and of possible action. I suggest that we should aim for HMG's response to be ready well before the summer recess; and I understand that arrangements are already in hand for consideration of the report to be undertaken in the first place by the official Committee EP, on which both of us as well as other relevant colleagues are represented.

I am copying this letter with enclosures to the Prime Minister, other Cabinet colleagues, Norman Fowler and to Sir Robert Armstrong.

Yours ever

Patrick

ENCS

LAWTHER REPORT
DRAFT FOREWORD BY THE SECRETARY OF STATE FOR SOCIAL SERVICES

1. This report by Professor Lawther's Working Party is the latest in a series of reviews of this subject both here and abroad. I believe that it is a valuable and timely addition to international work on environmental exposure to lead. I particularly welcome the breadth of the Working Party's approach, and its attempt to evaluate the significance of all the various ways in which people may be exposed to environmental lead; this provides an essential basis for considering priorities for action. On behalf of HM Government I should therefore like to thank Professor Lawther and the members of his Working Party for producing such an excellent and comprehensive report.

2. Since publication in 1974 of the interdepartmental report "Lead in the Environment and its Significance to Man", it has been the policy of successive Governments that people's exposure to lead pollution should be contained and wherever practicable reduced, particularly in those circumstances where people are most exposed to risk. Action has been and is being taken on a range of sources of environmental lead.

3. The Working Party recommends further action in a number of fields. I and my colleagues will consider these recommendations in the light of the evidence assembled by the Working Party and of the practical and economic factors that must be taken into account. We shall undertake this process with all practicable speed.

4. The toxic effects of lead have been known for centuries. A distinguished ancestor of mine, Robert Christison MD, Professor of Materia Medica in the University of Edinburgh in the 1830s and 1840s was demonstrating the harmful effects of drinking water supplied to the great houses of Scotland from natural springs through long runs of lead pipe. Lead colic was the name given to the symptoms of lead poisoning.

5. Today, a hundred and fifty years later, with much more known about the long-term dangers of lead poisoning, it is a sobering thought that we still have much to do before we can be satisfied that we have eliminated the dangers of lead in the environment.

Home Affairs. March 1980
Report of Lead Working
Party on Lead.

TITLE PAGE

DEPARTMENT OF HEALTH AND SOCIAL SECURITY

LEAD AND HEALTH

The Report of a DHSS Working Party on Lead in the Environment

1980

FOREWORD

(To be sent on later)

CONTENTS

NOTE ON TERMS

Kg	Kilogram, one thousand grams
g	Gram
mg	Milligram, one thousandth of a gram
µg	microgram, one millionth of a gram
mg/kg	milligrams per kilogram, equivalent to parts per million
µg/kg	micrograms per kilogram, equivalent to parts per thousand million
l	litre
dl	decilitre, one tenth of a litre or 100 millilitres
ml	millilitre, one thousandth of a litre
m	metre
Km	kilometre, one thousand metres
mm	millimetre, one thousandth of a metre
µm	micron, one millionth of a metre
mol	molecular weight
µ mol	one millionth of the molecular weight
µg/dl	one microgram per decilitre or one microgram per 100 ml
µ mol/l	one millionth of the molecular weight per litre (SI units)
	For lead 1µg/dl is the same as 0.048 µ mol/litre or
	21 µg/dl is approximately equal to 1µ mol/litre
d	day
Cal	Calorie
K Cal	Kilo Calorie, one thousand calories

CHAPTER 1

INTRODUCTION

1. Lead and its compounds are potentially toxic; the element has no known physiological functions; it is widely distributed in nature and as a result of man's activities. The gross effects which it can have on health have been recognised for many years and there are now relatively few cases of frank lead poisoning in this country. However, reports in recent years have suggested that there could be ill effects from exposure to lead in amounts which are too small to cause the classical signs and symptoms of lead poisoning.

2. The Department of Health & Social Security Working Party on Lead was established in November 1978. The terms of reference were "To review the overall effects on health of environmental lead from all sources and, in particular, its effects on the health and development of children and to assess the contribution lead in petrol makes to the body burden". Independent experts actively engaged in the fields of clinical paediatrics, pathology, child psychiatry, psychology, epidemiology and the environmental sciences were appointed. Members of the Working Party are listed in Appendix 1. Owing to the complexity of the problem put to the Working Party scrutiny of a wide range of studies was essential and a bibliography of nearly 3000 publications was compiled. A list of the scientific papers to which special attention was given is shown in Appendix 4 and a copy of the full list of references has been deposited at the British Library.

3. Man has always absorbed some lead from his natural environment, although this contribution is usually small in comparison with that derived from lead liberated by his own activities. Food may contain small amounts of lead from canning processes, contact with glazed containers and deposition from polluted air. Major contributions to the body burden may be made in some areas by lead water pipes and lead-lined storage tanks; lead compounds have been commonly used in paints and primers in the past and the risk to young children who chew old painted surfaces is well known. The production and industrial use of lead may also give rise to much dust and fumes within factories and their immediate environment. All these potential sources of exposure to lead are well known and a variety of measures including regulations have done much to reduce the risks in the UK.

4. Among the many sources of lead, special concern has been voiced about pollution of the air by petrol engines using fuel to which alkyl lead compounds have been added to improve the octane rating. This practice began over 50 years ago and, although the lead content of petrol has been reduced in recent years, the increase in the use of this fuel has led to it becoming the major contributor of lead in the air in this and most other developed countries. Airborne lead may be taken in not only directly by inhalation but also by ingestion, through the contamination of food and dust. It is important however, to consider airborne lead in the context of lead from all sources; its significance can be assessed only when the contributions from food, water, air and the various adventitious sources have been determined.

5. The clinical manifestations of substantial quantities of lead are well known and much work has been published on the toxic effects which amongst adults usually result from occupational exposure. The occurrence of clinical lead poisoning and its sequelae in children, particularly following the ingestion of lead-based paint by those with pica (defined in paragraph 142) is also well documented. It is well known that elevated blood lead concentrations can be seen in children with this habit even in the absence of symptoms.

6. The main question with which we were concerned was the possibility that more subtle adverse effects on health and development may result from the chronic absorption of lead in smaller quantities than those known to give symptoms or signs and hitherto thought to be without effect. During recent years many reports, notably from the USA, have suggested that lead might interfere with mental development or cause behavioural disorders in children. The evidence though suggestive is equivocal and difficult to assess.

7. The report deals in sequence with the several sources of lead in the environment, with the relative importance of each of these to the uptake of lead and with the neuropsychological effects of lead on children. Following a general discussion the report concludes with recommendations for action and research. We have not reported on the extensive literature which we have considered on clinical lead poisoning, or on experimental work in animals and biochemical mechanisms. Such work throws light on the ways in which relatively small amounts of lead might have an effect but it does not determine whether they have effects of medical or social significance. We have therefore

concentrated our attention on the evidence from human populations, which has been widely regarded as critical to this issue.

8. During the course of 1979 the Department of the Environment has co-ordinated a number of blood lead surveys in different areas of the country in fulfilment of an EEC Directive on the Biological Screening of the Population for Lead (CEC 1977). The results of the surveys have extended our knowledge of the distribution of blood lead concentrations among the general adult population and among children who may be exposed to above average concentrations of lead. The provisional results available at the time of completion of the report are reproduced in Appendix 2.

9. We wish to record our indebtedness to many Government Departments for the unflagging help given in the provision of information, to outside experts who gave us special advice on particular issues, and to many others who supplied information and opinions. We would like to express particular gratitude to the Secretariat for its unstinted labour and support, without which we would have been unable to complete this work in little more than a year.

CHAPTER 2

LEAD FROM FOOD

10. The evidence which is available on human exposure to lead indicates that, for the population as a whole, the diet is the most important route of exposure. The majority of the environmental sources of lead contribute directly or indirectly.

Sources of Lead in Food

11. Some of the lead in food comes from the soil as a result of the natural weathering of lead-rich ores and minerals. Some is derived from human activities, in 3 main ways:

a. contamination of canned food by lead solder used in making cans;

b. contamination by lead plumbing systems of tap water used in cooking;

c. contamination of soil, crops and food by lead in air and dust.

The contribution of each of these sources to the intake of lead is discussed in paragraphs 26-31.

Surveys of Lead Intake

12. Estimates of the amount of lead consumed in the diet are difficult to obtain. Dietary habits vary widely; the long-term intake, which determines any effects on health, can only be estimated approximately. There are two ways in which it is practicable to estimate the amount of lead which is consumed. Firstly, lead can be measured in artificial diets made up specially to represent an average national diet (total diet studies). Secondly, it can be measured by analysis of a representative proportion of the food actually consumed by individuals who are selected for study (individual diet studies). Both of these approaches

have been adopted by the Ministry of Agriculture, Fisheries and Food (MAFF).

Total Diet Studies

13. Each year since 1974, MAFF has estimated the average intake of lead by means of a total diet study. These studies are based on information obtained from the National Food Survey and the National Household Expenditure Survey on the average amounts of food purchased by households in this country. An estimate of the average amount of foods which are consumed can be derived from this information by allowing for the food which is bought but not eaten. Colleges of Domestic Science in various parts of the United Kingdom purchase locally the food necessary to make up a standard diet based on these statistics and then prepare and cook the food as appropriate. The concentration of lead in each of various groups of food is analysed so that the average daily intake of lead of the population can be calculated.

14. Since 1974 a total of 113 such diets have been analysed, made up from foods purchased throughout the UK. The calculated intake of lead per head has varied between 55 and 366 µg/day with a mean of 113 µg/day.

15. It is important to note that when diets are analysed many individual food groups contain lead at or below the limit of detection by the method of analysis. In such cases it is assumed that lead is present at the lower limit of detection. The intakes of lead are therefore probably overestimated.

16. Although total diet studies do not take into account variations in dietary habit, it has been found that the concentration of lead in most of the food groups is similar. Consequently a personal preference for any one type of food is not liable to affect exposure to lead substantially. The intake of lead is likely to be more related to the total amount of food consumed.

17. The lead intakes quoted above are averages for the population of the UK as a whole. It is possible to estimate average intakes for sub-groups of the population, such as adult males or children, by adjusting for their average energy requirements compared with the average energy requirements of the total population. The results of such calculations are set out in Table 1 and show an average lead intake of 146 µg/day for adult males and of 70 to 80 µg/day for 2-4 year old children. For this purpose it is assumed that the children consume the same type of diet as adults.

TABLE 1 ENERGY REQUIREMENTS AND CORRESPONDING DIETARY LEAD INTAKES OF ADULT MALES AND CHILDREN

	Energy requirements (Kcal)	Lead intake (µg/day)
UK Average	2200 a	113
Adult male	2850 b	146
Children (2 years)	1350	7c
(3-4 years)	1530	8c

a associated with food consumption of 1.34 kg per day.
b requirement of a 15-17 year old or a moderately active male.

Individual Diet Studies

18. In these studies identical duplicates of all food eaten by the individual whose diet is being studied are set aside after cooking. Milk and both alcoholic and non-alcoholic beverages are excluded. These "duplicate diets" are then blended and analysed for lead. Practical constraints limit the number and duration of these studies but MAFF have analysed duplicate samples of the food intake of adults and young infants for one week in a few such studies in various localities.

19. A total of 195 weekly diets of selected adults have been analysed. The dietary intakes were found to range between 21 and 330 microgrammes per day with an average of 75 microgrammes per day. (MAFF, unpublished data).

Individual diet studies in infants

20. The dietary intake of lead of infants up to 4 months of age has been measured in a recent duplicate diet study. 300 infants were selected at random from the birth registers in each of six towns in England and Wales and their weekly diets analysed. The results for bottle-fed babies are summarised in Table 2. Since infant diets are restricted, these intakes are likely to be representative of the level of exposure of infants up to the age of 6 months or until feeding with solids begins.

TABLE 2 DIETARY LEAD INTAKES OF BOTTLE FED INFANTS -

Intake	Range	Mean
Intake µg per day	6-99	17
Intake µg/ kg bodyweight per day	0.7-30	3

21. The wide range of these results is largely explained by the very different levels of water lead found in the study. The concentrations of lead found in dehydrated infant food ranges from 10-300 µg/kg with a mean level of 150 µg/kg (MAFF, 1975). Since the proportion of liquids to solids in the prepared feed is 8 : 1 the lead present in the solids would provide a large proportion of intake only if lead in tap-water was less than 20 µg/l; it would never be an important source nor could it explain the higher intakes found within this study. The contribution that may be made by lead-containing water to lead intakes in artificially fed infants is dealt with in Chapter 3.

22. In comparison with these findings recent work indicates that the concentrations of lead found in breast milk are about 10% of the blood lead level of the mother (M R Moore, unpublished data). It is unlikely, therefore, that breast-milk contains lead in excess of 3 µg/litre among women in the general population, equivalent to an intake of 0.45 µg/kg body weight per day in infants.

Total Intake of Lead-Conclusions

23. The results of the diet studies give sound estimates of the exposure of individuals or populations at a given time. The analysis of a single diet sample, however, does not necessarily represent long-term intake and the results of the individual diet studies (para 19) probably exaggerate the range of long-term lead intakes.

24. On the basis of the dietary studies carried out so far, it is probable that the great majority of the long-term average dietary intakes of lead of individual adults are within the range 70 to 150 µg/day; they are probably closer to the lower figure for the reasons stated in paragraph 15. These figures will be used in Chapter 6 in estimating the relative contribution of food to the total intake of lead.

Official Guidelines for Dietary Lead

25. The Joint Food and Agriculture World Health Organisation (FAO/WHO) Expert Committee on Food Additives has suggested a provisional tolerable weekly intake of 3.0 mg of lead for adults (FAO/WHO 1972), equivalent to about 430µg/day. This is well above the dietary intakes found in the United Kingdom as described above. The maximum amount of lead in foods offered for sale in the United Kingdom has been subject to control for some time. The Lead in Food Regulations were revised in 1979 and provide a maximum permitted general limit of the lead content in food of 1.0 mg/kg (= 1 ppm). They also impose individual limits on a list of specified foods and limit the lead content of foods specially prepared for young infants to 0.2 mg/kg unless such foods are sold in a dried, dehydrated or concentrated form, in which case the specified limit is 1.0mg/kg

These regulations specify the maximum quantity of lead that an individual food may contain but the amount normally found is considerably lower. Thus the limits do not reflect the normal dietary intake.

The Contribution of Individual Sources of Lead to Dietary Intake

26. Canned Food

Solder used in the manufacture of cans is the only recognised source of contamination of food by lead during processing. Data on the production of canned food in the UK, adjusted for imports and exports, allow an estimate to be made of the average consumption per head of individual types of canned food. Most canned food, excluding beverages, which is sold in the UK is confined to a few products; these account for annual sales of 1.3 million tonnes. From a knowledge of the mean lead levels in these products, it is calculated that they contribute approximately 15% of the total daily dietary intake of lead. A wide range of other canned food (0.3 million tonnes) is sold but there are insufficient data on lead content to give a more accurate assessment of intake from this source. In general canned beverages are not an important source of lead and the available information suggests that the average concentrations of lead in such products are less than 20 µg/kg (MAFF, 1975).

27. A recent total diet study (MAFF, unpublished) compared the amount of lead in diets containing an average proportion of canned food with that in equivalent diets containing only non-canned food. The study indicated that the use of canned food is likely to contribute about 15% to the total dietary intake of lead. This estimate agrees with that quoted in paragraph 26.

28. The maximum concentration of lead which is permitted in prepared foods specifically intended for babies or young children is 200 µg/kg. (Lead in Food Regulations, 1979). This regulation has meant that manufacturers have had to use pure tin solder for canning infant foods. As a result no more lead is found in these foods than that which is present in the raw materials from which they are made.

Cooking water

29. The contribution to lead in food which is made by any lead in the tap water used in cooking has been studied by MAFF (Unpublished). Samples of hard and soft water containing different amounts of lead were obtained by leaving the waters in contact with lead piping for a long time and then diluting them with distilled water . Most water for cooking is used in the preparation of green and root vegetables; each of these foods was therefore cooked in the different samples of water and the concentrations of lead in the cooked food was measured. From a knowledge of the intake of lead from other foods in the average diet (paragraph 13) the contribution made to lead in food by cooking with water at different concentrations of lead were calculated. The results are shown in Table 3.

30. Column 7 of Table 3 shows the proportion of lead in food which would come from water containing different amounts of lead. The proportion is likely to be more than 15% when lead in water exceeds 100 µg/l, whereas it would be only about 3% with concentrations about the relatively common value of 20 µg/l. People who eat large amounts of cooked vegetables or other foods made up with or cooked in water, could have higher intakes from this source. No account is taken here of the effect of lead in water on the intake from beverages made in the home (which are considered in Chapter 3).

The contribution of lead in air and dust

31. Some part of the lead in food is derived from car exhaust emissions, the use of fossil fuels, lead smelting, etc. (See Chapter 4). Airborne lead from these sources may be deposited directly on food and crops; it may permanently contaminate soil and be taken up by plants (although on the basis of existing information this effect is likely to be small) or it may contaminate dust which may then be blown onto food and crops. In particular, fruit and vegetables grown near busy roads and smelters are liable to be contaminated by airborne lead. However, the majority of these

TABLE 3 CONTRIBUTION OF LEAD IN COOKING WATER TO TOTAL INTAKE OF LEAD FROM FOOD

Type of Water	Lead in Water µg/l	Daily Intake of Lead From Food µg/day				Lead from Cooking Water as a % of Total
		Vegetables	Other Food	Total	From Cooking Water	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hard	520	130	64	194	107	55
	265	74		138	51	37
	135	46		110	23	21
	0*	23		87	0	0
Soft	250	67	64	131	52	40
	105	28		92	13	14
	55	23		87	8	9
	0*	15		79	0	0

NOTES
* Below limit of detection (distilled water).
COL. 3. Lead from root and green vegetables cooked in each sample of water.
COL. 4. Lead from other foods (as determined by the 1978 total diet study).
COL. 5. Col. 3 + Col. 4.
COL. 6. Col. 3 less amount of lead in vegetables cooked in distilled water (23 and 15 µg/d).
COL. 7. Col. 6 as a % of Col. 5.

foods have a short growing season and are not heavily contaminated. In the case of leafy vegetables much of the deposited lead will be removed during preparation, washing and cooking, especially if the outer leaves are discarded. Crops grown near sources of airborne lead generally make only a small contribution to the diet and thus to the intake of lead.

Other Sources

32. The use of sewage sludge as fertiliser may also result in some contamination of crops by lead. Lead enters the sewers from industry, domestic discharges, or in run-off from roads. Lead arsenate has been a traditionally favoured insecticide but its use, for orchard fruits, is now extremely limited. No other agricultural or food processing activities involving a lead hazard have come to our attention.

CHAPTER 3

LEAD FROM TAP WATER

33. Lead is rarely present in mains water. It is sometimes present in tap water, since it is liberated by certain types of "plumbosolvent" water from any lead in domestic plumbing or the pipes which connect it to the mains.

34. The contribution of tap water to the total intake of lead depends on:

a. The amount of lead in tap water;

b. the amount of water consumed;

c. transfers of lead between food and water during cooking.

Amounts of Lead in Tap Water in Great Britain

35. Information on the concentrations of lead in water at the tap in Great Britain is available from the report "Lead in Drinking Water - A Survey in Great Britain 1975-1976" (DOE, 1977). This elaborate and carefully designed survey was based on a random sample of more than 3,000 households and allowed statistically reliable estimates to be made of the number of households with different concentrations of lead in single samples of water at a given time in England, Scotland and Wales (but not in smaller geographical units). Two types of sample of water were taken from each household, both without preliminary flushing; one was a first draw sample and the other was taken at casual times in the day (daytime sample). The main results are given in Table 4 and are for daytime samples only since relatively little first draw water is consumed (Water Research Centre, in preparation). Concentrations in first draw samples were higher.

TABLE 4 : LEAD IN TAP WATER IN GREAT BRITAIN

Lead concentration in daytime sample (µg/l)	Percentage of Households			
	ENGLAND	SCOTLAND	WALES	TOTAL
0 - 9	66.0	46.4	70.5	64.5
10 - 50	26.2	19.2	20.7	25.3
51 - 100	5.2	13.4	6.5	6.0
101 - 300	2.2	16.0	1.5	3.4
301 and above	0.4	5.0	0.8	0.9
Total	100.0	100.0	100.0	100.0

36. The report showed that, at the time of the survey, most households in Great Britain had little lead in their tap water but 10.3% had more than 50 µg/l in a single, unflushed, daytime sample and 4.3% had more than 100 µg/l. A few very high concentrations were recorded with one value greater than 1700 µg/l. The table shows that, on the basis of this recent evidence, high concentrations of lead in water are much more common in Scotland than in England or Wales.

37. These figures may overestimate the proportion of people exposed to relatively high concentrations of lead in water for two reasons. Firstly, a substantial proportion of people run some water to waste or for other purposes before drawing it for consumption and the lead content is generally lower after flushing (Water Research Centre, unpublished ; Thomas et al, 1979.) Secondly, local surveys have shown that there is marked variation in the concentration of lead in tap water within any household. Results based on single samples may therefore overestimate the proportion which would have high concentrations, if the value for each household were an average based on several samples. (On the other hand, such results

underestimate the proportion of households with high concentrations of lead in water at some time.) A person's intake of lead over a period tends to reflect average concentrations and it is not possible to estimate intake, accurately, on the basis of single samples of tap water.

38. The amount of lead in a sample of tap water is primarily determined by the chemical characteristics of the water and the length of the lead piping through which it has run. Although it is widely known that soft, acid waters dissolve lead, the national survey showed that some harder waters also do so, although to a lesser extent. The factors which determine whether a hard water is plumbosolvent are at present not fully understood. Particularly high concentrations of lead are often found in places where the drinking water supply is drawn from the down pipe, in a lead plumbed house, especially if the roof tank is lead lined; this arrangement is common in Scotland, where at the same time soft acid waters predominate.

39. The concentration of lead in water is also influenced by the length of time the water has stood in the pipes. It also varies according to how far and how quickly the tap is turned and appears to be greater with the increase of temperature in summer (Water Research Centre, unpublished). The concentration of lead can rise within hours when water stands in the pipes but flushing may achieve a substantial reduction in the lead content of water intended for consumption. Thomas et al (1979) showed that up to an eight-fold reduction can be achieved by flushing. Their results relate to exceptionally high initial concentrations but serve to suggest that, in many situations, otherwise unsuitable tap water might be made satisfactory by flushing; this will not be so where lead lined roof tanks are used. Water drawn from the hot tap may have a high lead content and is undesirable for cooking or to fill a kettle. This is true even in houses without lead plumbing since hot water is liable to leach lead from solder in copper tanks or piping.

Proposed Limit for Lead in Tap Water

40. An EEC Directive on the "Quality of Water for Human Consumption" has been agreed, subject to some points of detail, and is expected to specify a maximum of 50 µg/l for lead in water in non-lead plumbed houses. It is also expected to state that, where lead pipes are present, the lead content should not exceed 50 µg/l in a sample taken after flushing but to require that,"if a sample is taken directly or after flushing and the lead content either frequently or to an appreciable extent exceeds 100 µg/l, suitable measures must be taken to reduce exposure to lead on the part of the consumer".

41. The requirement concerning households with lead pipes may be regarded as specifying that it is the average from several samples of water as it is consumed in any household which should not exceed 100 µg/l; in that case some individual values may be above 100 µg/l simply because of the variability of water lead in any household.

42. The Directive is expected to allow 5 years for compliance, with a longer period in exceptional cases, provided that an action programme and a timetable for compliance are accepted by the European Commission.

Action in Great Britain to Reduce Lead in Tap Water

43. Much has already been done by the British water industry. Surveys have been carried out in many parts of the country to identify the general areas where action is needed. Some sources of plumbosolvent water have been replaced and a number of schemes to reduce plumbosolvency by chemical treatment have been introduced or are planned. Substantial reductions in lead concentrations have already been achieved by chemical treatment in places such as Glasgow. Lead plumbing is commonly replaced when housing is modernised and, occasionally, to deal with isolated examples of consistently high water lead levels in houses. Thomas et al (1979) have described the effects of pipe replacement

in a housing estate where water lead concentrations had been exceptionally high; the results are discussed in paragraph 103. Further action is planned by the industry and much supporting research is being done by the Water Research Centre and the water undertakings.

44. It is hoped that chemical treatment will generally suffice to reduce water lead to the desired concentrations. It is effective in many circumstances but there are technical difficulties (in particular with some harder plumbosolvent waters) and, in spite of intensive research, it cannot be assumed that these will be fully overcome. We have been told that the early replacement of lead pipes on a very large scale is not a practicable solution due to costs - and the extent of the requirement for trained labour and suitable material. Other methods such as pipe-lining are being investigated but none looks promising at present.

Future Concentrations of Lead in Water

45. It is too early to predict the future pattern of water lead concentrations or the time which will be taken to complete the programme of action. The reduction in lead levels will be greatest in soft, acidic waters where present concentrations are highest. In the case of plumbosolvent waters of high alkalinity it is too early to predict what can be achieved by water treatment; current lead concentrations in these waters do not, however, reach the high values which may be found in acidic waters. There is thought to be a good chance that chemical treatment will succeed in reducing the average concentration of lead in unflushed daytime samples of water to below 100 µg/l, except in houses where lead lined roof tanks are in use. If not, it should be practicable to deal with the remaining cases by such means as flushing or some measure of pipe replacement. Either lead lined tanks will have to be replaced or lined, or the contamination of drinking water minimized by supplying the kitchen tap from the rising main.

46. It will take several years to identify all the affected localities and to develop and install treatment, although much has already been done in the most seriously affected areas. It should therefore be considered whether any interim measures are possible and desirable.

The Consumption of Drinking Water

47. A Water Research Centre survey (report in preparation) has provided information on the amount of drinking water consumed by people in various age groups in Great Britain. The results are given in Table 5. The average adult consumes about 1 litre a day but consumption may be as high as 2¾ litres per day. The amount consumed includes all tap water, whether drunk at home or elsewhere, and beverages made from tap water, but not commercial drinks or water used in cooking.

TABLE 5 : TOTAL CONSUMPTION OF TAP WATER AT HOME AND ELSEWHERE GB BOTH SEXES

AGE YEARS	Total consumption of tapwater litres/head/day		
	Minimum/	Mean	Maximum//
1 - 3	*	0.50	*
3 - 14	0.04	0.57	1.54
15+	0.21	1.07	2.73

* Sample size too small for reliable estimate.

/ Under 1% in each age group consume less than the minimum value

// Under 1% in each age group consume more than the maximum value

48. Artificially fed infants drink approximately 0.15 l/kg/day and may take more in hot weather. They are particularly likely to be affected by the undesirable habit of filling kettles from the hot tap.

Transfer of lead from water during cooking

49. Lead is transferred from lead-containing tap water to some foods during preparation and cooking. Research to determine the extent of the transfer is described in paragraphs 29 and 30. It indicates that the net effect, for the average adult eating a typical British diet, is roughly equivalent to drinking an extra 0.18 l a day of the same tap water. (This estimate is obtained by dividing the figures in column 6 of Table 3 by the equivalent figures in column 2 and averaging and rounding the results.)

Total Intake of Lead from Water

50. Using the figures in Table 5 for water consumption and a range of lead concentrations, total intakes of lead from water by adults who consume an average amount of water, adults who consume the maximum amount and artificially fed infants have been calculated for the Working Party. The results are set out in Table 6; the figures include an allowance for lead transferred from water to food during cooking. It should be noted that some of the diets in the total diet studies discussed in paragraphs 13 to 17 were prepared with lead-containing water so that there is an element of double counting between the estimates of intake from food in that section of the report and from water in this. The figures for lead concentrations refer to the average concentrations for households.

TABLE 6 : DAILY LEAD INTAKE FROM TAPWATER

Daily consumption including allowance for cooking	Average concentration of lead in water (line a) Estimated daily intake of lead (lines b, c & d)								
	50		100		150		200		a
	µg/d	µg/kg/d*	µg/d	µg/kg/d*	µg/d	µg/kg/d*	µg/d	µg/kg/d*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Average for adult 1.25 l/day	62	1.0	125	2.0	188	3.0	250	4.0	b
Maximum for adult 2.9 l/day	145	2.3	290	4.6	435	7.0	580	9.3	c
Artificially fed infants 0.15 l/kg body weight/day	-	7.5	-	15	-	22.5	-	30	d

* For adults approximate values based upon average body weight.

51. Columns 2 and 3 of Table 6 illustrate intakes of lead from water which are, and are likely to continue to be, not uncommon. In Chapter 6 (paragraph 102) they will be taken as the upper limit of exposure to lead from water in cities not recognised as having a severe water lead problem.

52. Columns 4 and 5 show intakes of people consuming water which just complies with the EEC limit for lead plumbed houses. It is expected that all intakes will be below these levels when the national programme, based largely on chemical treatment, has been completed. The majority of people who will still have some lead in their tap water will have intakes which are substantially below these levels but these figures indicate that it will be possible for a small number of adults to have intakes approaching 300 µg/d until all lead plumbing is replaced. The proportion with intakes of this order will depend on the extent to which action is taken beyond that necessary to comply with the EEC Directive; but it will probably not be feasible to avoid such intakes altogether.

53. The intakes indicated in the last four columns may still be seen for some years in certain areas, until the national programme is completed. It is expected that, in the near future, substantially higher intakes than those illustrated here will no longer be encountered as a result of action now being taken or proposed in the worst affected areas.

CHAPTER 4
LEAD FROM AIR

54. Lead occurs naturally throughout the world and is found in soils, in the oceans and in the air. Natural mobilisation by weathering of mineral deposits and gaseous emissions by volcanic activity are estimated to release about 210,000 tonnes of lead into the global environment each year (Goldberg and Gross, 1971). However, the concentration of lead in air due to natural sources is very low. In most developed parts of the world emissions from human activities in the winning, processing, and utilisation of lead provide the main contribution to airborne lead.

Major Sources of Lead in Air

55. Lead found as a component of the particulate matter in air results primarily from the combustion of lead-containing petrol and from certain industrial processes and to a lesser extent from the combustion of coal, and weathering of paints. The chemical and physical form of the lead varies widely according to the source. Much of the lead emitted from cars and from industrial processes after the waste gases have been cleaned is fine enough to remain airborne for long periods and is within the respirable size range. These small particles are widely dispersed and lead resulting from man's activities has been detected at the polar regions. Coarse particles are generally deposited close to their source and may contribute appreciably to the lead content of dust. The short period concentration of lead found in the atmosphere close to sources is likely to vary considerably as the source strength and factors affecting dispersion change. However, as it takes the human body some time (weeks or months) to come to equilibrium with intake and excretion of lead, it is normal to express the concentration of lead in air as a long-term mean, for example a 3-monthly or annual mean. The variation in concentration between such periods is much less than is found between short-term averages.

Lead in Petrol

56. In 1978, 10,300 tonnes of lead as organic lead compounds were added to the 18 million tonnes of petrol used in the United Kingdom. Some 7,000 tonnes of this lead are emitted, mostly as fine particulates, with the exhaust gases from petrol-engined vehicles, along with many other pollutants, including approximately 7½ million tonnes of carbon monoxide, 360,000 tonnes of hydrocarbons and 300,000 tonnes of oxides of nitrogen (DOE 1979). Because of its wide dispersion only a minute proportion of the total lead exitted is liable to find its way directly into human beings. The particulate lead is mainly in the form of halides produced by reactions with the scavengers that are also added to petrol, but in the atmosphere these halides are converted gradually into oxides, carbonates and sulphates. The lead compounds emitted from petrol engines are commonly present in complex aggregates together with carbonaceous material and in this form they may be less available to man than if they were present in simpler form (Lawther et al,1973). Some organic lead enters the atmosphere from the evaporation of petrol, and to a minor extent as unburned compounds in the exhaust. This gaseous component normally represents only a very small proportion of the total lead in the general urban atmosphere (Harrison and Perry , 1977 ; Rohbock et al, 1980).

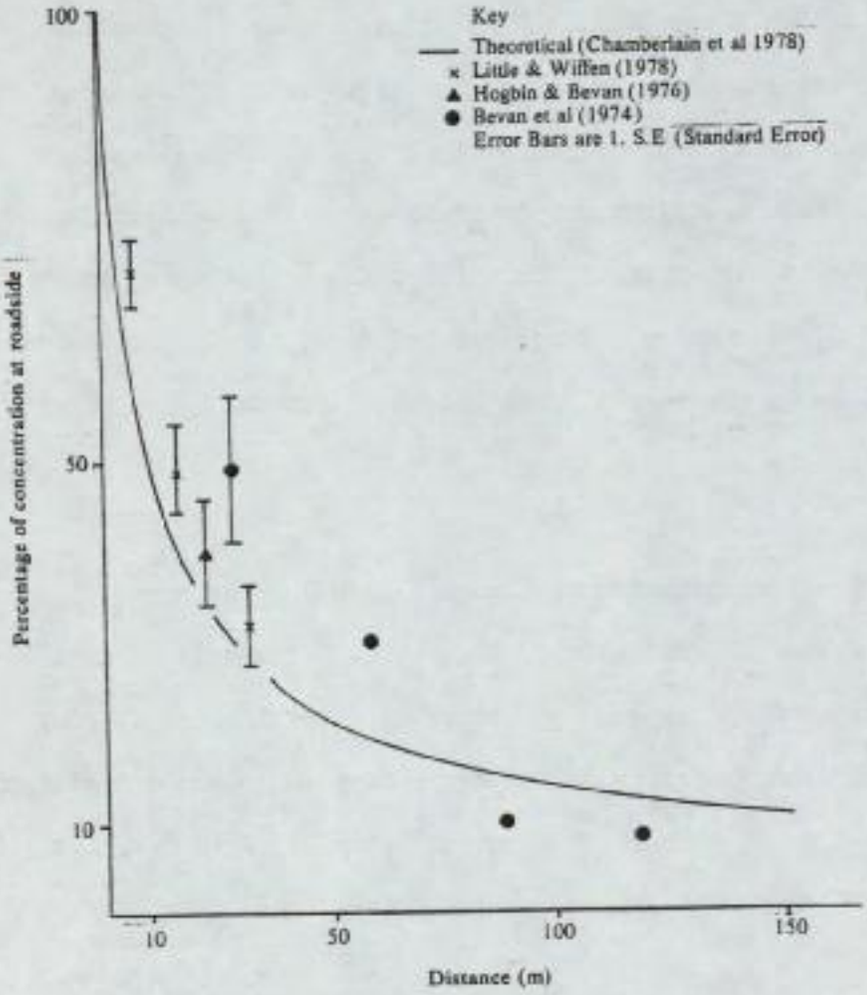
57. The concentrations of airborne lead resulting from the use of leaded petrol depend on factors such as traffic density, traffic speed, weather conditions and local topography,and they can be high in or very close to busy roads. Annual mean concentrations of more than 12 $\mu g/m^3$ were measured at the central reservation of the M4 in 1974 and 1975 (Colwill,1979/ personal communication). Values for recent years at this site have fallen to about 9 $\mu g/m^3$ reflecting, among other factors the changes in the lead content of petrol over the period. Annual mean concentrations measured in busy urban roads are usually within the range 2 to 6 $\mu g/m^3$. Mean concentrations over shorter periods, or those based on samples collected during daytime periods only, may be 2 or 3 times higher. Some typical values of roadside measurements are given in

Table 7a (page 29). Also included are recent figures obtained near the M4 at Hillingdon and the North Circular Road at Neasden where corresponding blood lead values were measured under the EEC programme of blood lead surveillance. (See Appendix 2) The relatively high values, approaching 6 $\mu g/m^3$, for Heath Street, Hampstead, which are included in Table 7a were obtained at a first-floor flat facing directly onto a narrow street, on a hill, with much slow-moving private car traffic throughout the day. This combination of circumstances results in higher values than are found either in a busier central area, eg Fleet Street, where a large proportion of the traffic is diesel-engined, or close to motorways, where the more open situation and rapid movement aids dispersion.

58. The concentration of airborne lead decreases rapidly with distance away from roads; a graph illustrating this (Figure 1) suggests that concentrations fall to about 20% of their kerbside value at a distance of 50m. At greater distances the merging of the contributions from all traffic produces a typical urban background value of about 0.5 $\mu g/m^3$ (Table 7b). In rural areas concentrations are generally less than 0.1 $\mu g/m^3$.

59. In view of the large variations in concentration that may occur over short distances, and the extent to which most people move around during the day, it is difficult to estimate true exposures to airborne lead. There may be some exceptional circumstances in which individuals are confined to a locality with relatively high concentrations, but few people are likely to be exposed to long-term average concentrations greater than about 1 $\mu g/m^3$, as indicated by the data in Table 7b. Concentrations of lead in the air inside houses are generally similar to, or a little lower than, those immediately outside.

Figure 1: Variation of concentrations with distance from motorway



Measurements made in Birmingham, in the vicinity of the Gravelly Hill motorway interchange, and others made in London are shown in Table 7c. These show indoor concentrations ranging from about 60 to 100% of those outside.

60. The total amount of lead emitted to air from traffic varies in proportion to the total consumption of petrol and its lead content. In 1971 about 10,600 tonnes of lead were consumed in petrol and the maximum lead content was 0.84 g/l. Since 1972 it has been UK Government policy to hold the total amount of lead used in petrol constant at the 1971 figure by decreasing the lead content to offset the growth in demand; it has been reduced by stages to its present value of 0.45 g/l, and there is a commitment to reduce it further to 0.4 g/l on 1 January 1981 in accordance with an EEC Directive (Official Journal of the European Communities, 1978) setting maximum and minimum values for the lead content of petrol.

61. Results of a study in Germany in which concentrations of airborne lead have been monitored following the reduction of the lead content of petrol from 0.4 to 0.15 g/l from January 1976 show that, while kerbside concentrations of airborne lead have fallen in proportion with this reduction, the change was less further away from roads (Jost and Sartorius, 1979). There has also been an interesting experiment in Italy where the isotopic ratio of the lead in petrol was changed for a limited period to provide a tracer for lead from that source; the results indicate that lead from petrol is the major contributor to airborne concentrations at urban kerbside sites, but not necessarily elsewhere (Facchetti, 1979).

Industrial Sources

62. Emissions of lead from the major lead industries in the UK have been estimated at 200-250 tonnes per annum (DOE, 1974). This figure is probably an underestimate of the total emission, as lead contained in ferrous scrap may be released on remelting. In addition there are numerous small industries handling and processing lead. Little is known of the emissions of lead to air from these sources. While industrial emissions may not be large on a national scale (representing under 10% of the total emissions) there may be 'hot-spots'. Local problems can arise, for example, from metal recovery operations in small scrap yards, from the burning of old lead-acid battery cases, or from demolition work. Recent measurements of airborne lead near five of the larger lead works where blood lead concentrations were also determined are given in Table 8. At only one site did the concentration exceed 2 $\mu g/m^3$; most of the other values were less than 1 $\mu g/m^3$. In general, at distances greater than 500m, the concentrations had fallen to values similar to or lower than those found in general urban areas.

Contribution of Airborne Lead to Deposited Dust

63. Much of the lead in street dust is the result of the fallout of airborne lead but some may also come from weathering of lead paint on houses, street fittings, or yellow lines on the road. This dust must contribute to the amount of lead ingested, particularly by children. Vegetables grown near roads and industrial sources are liable to retain lead deposited on their leaves; in addition the continued fallout year by year of lead from the air onto the ground will increase the concentration of lead in soil and may increase the uptake of lead by plants (see Chapter 2).

The importance of each of these possible pathways is not known but they must add somewhat to the effects of inhaled airborne lead. Table 8 gives some figures for deposited lead near lead works. The maximum deposition rates are about 10 times higher than those found near roads, although the airborne concentrations are similar.

64. Table 9 shows the results of measurements of lead in dust in the roadway near the entrance of four lead works. These illustrate the point that the lead content in dust falls off rapidly with increasing distance from the works. Vehicles leaving the premises carry out lead on their tyres, much of which is deposited within a short distance. The significance of these deposits for human exposure is unknown.

TABLE 7a

AIRBORNE LEAD. CONCENTRATIONS NEAR ROADS

LOCATION	PERIOD	Pb µg/m³ 24h	Pb µg/m³ DAY-TIME ONLY	NOTES
M4, central reservation	May - Dec 74	12.3		1
Housing area near M4	"	4.9		1
M4 Harlington: 25m from carriageway	11/4/79 - 9/7/79	2.2		2
95m " "	"	0.85		2
183m " "	"	0.66		2
N Circular Rd: 26m " "	20/4/79 - 13/7/79	0.93		2
33m " "	"	0.55		2
71m " "	"	0.42		2
96m " "	"	0.57		2
300m " "	"	0.42		2
Exhibiton Rd, SW7	1973		3.2	3
Seymour Place, W1	"		4.0	3
Talgarth Rd, W14	"		8.8	3
Upper Berkeley St, W1	"		4.3	3
Fleet St, EC4, centre	May 62 - Feb 63		3.2	4
Fleet St, EC4, centre	Apr 71 - Mar 72		6.4	5
"	" 72 - " 73	3.3	6.0	5
"	" 73 - " 74	2.8	6.2	5
Heath St, Hampstead NW3	" 72 - " 73	5.9		
"	" 73 - " 74	5.7		
Clerkenwell Rd, EC1	" 72 - " 73		2.8	
"	" 73 - " 74		2.5	
Salford Circus, Birmingham	Jan - Dec 73	1.83		6
"	" " 74	1.46		6
"	" " 75	1.79		6
Perry Barr, outside house by M6	1/3/73 - 22/3/73	0.98	1.01	
Birmingham, Stratford Rd	Jan - Dec 76	4.1		7
	" " 77	2.7		7
Cardiff, Queen St	Jan - Dec 74	2.5		
	" " 75	3.2		
	" " 76	1.7		
Glasgow, Hope St	Jan - Dec 74	2.0		
	" " 75	2.5		
	" " 76	1.7		
	" " 77	2.1		
Warwick, Jury St	Mar 65 - Feb 66	3.5		8

TABLE 7b

AIRBORNE LEAD, CONCENTRATIONS

AT URBAN SITES

LOCATION	PERIOD	Pb $\mu g/m^3$ 24h	Pb $\mu g/m^3$ DAY TIME ONLY	NOTES
St Bartholomew's Med. Coll., EC1	Apr 71 - Mar 72		1.5	5
	" 72 - " 73	0.8	1.3	
	" 73 - " 74	0.7	1.2	
Chiswick, W4	" 72 - " 73	1.3		
	" 73 - " 74	1.3		
Warwick	Mar 65 - Feb 66	0.8		8
Barnsley, town centre	Apr 76 - Mar 78	0.36		9
Motherwell, town centre	"	0.46		
Grangemouth, works yard	"	0.32		
London, Neasden, close to busy road	"	0.94		
Ellesmere Port, town centre	"	0.42		
Stoke-on-Trent, behind school	"	0.31		
Belfast, edge of housing estate	"	0.31		
Leeds, close to busy road	"	0.65		
" city centre	"	0.51		
" park	"	0.27		
Newcastle, old housing area	"	0.28		
Coventry, city centre	"	0.49		
Pembroke Dock, remote area	"	0.08		
Newport, town centre	"	0.38		
Bristol, city centre	"	0.35		
London, busy road, central area	"	0.72		
Bolton, hospital grounds	"	0.39		
Sheffield, close to busy road	"	0.53		
Cambridge, close to busy road	"	0.48		
Glasgow, close to busy road	"	0.93		
London - Endell St., WC2	Jan - Dec 73	1.0		10
	" 74	0.8		
	" 75	0.9		
	" 76	0.8		

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TABLE 7 c

AIRBORNE LEAD CONCENTRATIONS INSIDE AND OUTSIDE HOMES

LOCATION	PERIOD	Pb $\mu g/m^3$		%	NOTES
		INSIDE	OUTSIDE		
Birmingham - house 160m from Salford Circus	29/11/73-19/12/73	0.87	0.88	98	6
House alongside M6 at Perry Barr	1/3/74-22/3/74	0.69	0.98	70	
House with double glazing, M6, Perry Barr	26/4/74-15/5/74	0.44	0.70	63	
First-floor flat, Heath St, Hampstead	Apr 72-Mar 73	3.72	5.94	63	5
	" 73- " 74	3.81	5.70	67	

TABLE 7 - NOTES

1. Hogbin and Bevan (1976). The sites were at Harlington, Middlesex (outer London), and the measurements were made in connection with studies on the effects of a noise barrier on the spread of lead emissions. The figures quoted are arithmetic means of a series of 15 observations, with and without barriers in place.

2. Turner and Carroll (1980). The sites were in residential areas adjoining busy roads in outer London, with samplers close to ground level.

3. Harrison et al, (1974). Spot samples, over periods of 30-40 minutes only, were taken as part of a study of the proportion of organic to inorganic lead. The sites were at the kerbside in streets in the inner London area, at a height of 1m.

4. Waller et al (1965). Daytime samples were from 08.00-19.00 hours Mondays to Fridays only. The site was an island in the middle of Fleet Street, with the intake at a height of 1.2m.

5. Lawther et al (1973), with additional data supplied by the authors. The Fleet Street site was the same as in 4 above. The Clerkenwell Road Site was also in central London, about 5m from the road, at a height of 3m. The site at St Bartholomew's Medical College was nearby, about 70m from the road and at a height of 20m. The two other sites were in inner residential areas of London: at Heath Street, Hampstead, outside the window of a first-floor flat, immediately above the pavement at a height of 4m (and with an indoor sampler in the same room) and at Netheravon Road, Chiswick, about 100m from a busy arterial road, at a height of 3m.

6. Department of the Environment (1978). Daytime measurements were from 07.30-1930 hours. The Salford Circus site was within the large (Gravelly Hill) motorway interchange and the other sites were also adjacent to this junction.

7. Apling et al (1979a). The sites were in busy roads in each city, 0.5m from the kerb edge, at a height of 2.5m. In Cardiff and in Glasgow samples were taken on only a limited number of days each year. The street in which the sampler was sited in Cardiff became pedestrianised at the end of 1975.

8. Bullock and Lewis (1968). The street site was in the main thoroughfare (High Street/Jury Street), at a height of 3m, with a further site at the rear of the Council Offices, away from traffic, at a height of 4.5m.

9. McInnes (1979). The sites were chosen to be representative of residential, commercial and industrial areas, at heights between 4 and 25m.

10. Apling et al (1979b). This was a laboratory site in a commercial area of central London at a height of 12m. The sampler was moved during 1976 to a similar site by Vauxhall Bridge Road.

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TABLE 8 LEAD DEPOSITION RATES AND AIRBORNE LEAD CONCENTRATIONS AROUND LEAD WORKS

Distance m		Deposition rates*	Airborne Concentrations
From centre of works	From boundary of works	Pb mg/m^2 per 30 days 3 month means	Pb $\mu g/m^3$ 3 month means
Thorpe nr Leeds			
120	40	100	1.2
360	250	17	0.29
990	770	24	0.47
Abbey Wood			
130	25	250	1.8
220	125	210	1.8
465	365	23	0.49
538	445	38	0.59
800	700	14	0.38
Chester			
195	0	140	1.6
315	155	120	2.5
460	275	54	0.72
523	370	46	0.83
985	690	19	0.31
Market Harborough			
215	85	47	0.31
220	90	9	0.14
370	215	18	0.22
390	255	6	0.11
900	750	6	0.14
Gravesend			
465	330	62	1.4
540	505	15	0.70
745	670	13	0.56
820	740	16	0.57

* Measured by standard ISO gauge

From Turner and Carroll, 1980

TABLE 9 LEAD IN DUST IN THE ROAD NEAR LEAD WORKS

Site	% of lead in dust			
	At Gate	100 m	250 m	500 m
Abbey Wood	7.5	6.8	0.50	0.5-0.9
Chester	2.5-7.2	1.6-6.0	0.25-2.0	0.1-1.7
Market Harborough	3.5-4.0	1.2-2.4	0.1-0.5	0.1
Thorpe (nr Leeds)	7.5	3.5-5	1.2-4	0.25-2.7

From Turner and Carroll, 1980

CHAPTER 5

ADVENTITIOUS LEAD

65. Particular families or individuals may be exposed to sources of lead peculiar to a local environment or a specific product, as distinct from those encountered by the population as a whole in food, water and air. We have termed these sources "adventitious" and have sought to assess their relative importance and to identify those personal and cultural traits, other than employment in industries dealing with lead and its compounds, which may facilitate such exposure.

66. Most adventitious sources are encountered in or about the home or place of residence and young children are at special risk of exposure. The route of transmission is almost invariably by ingestion either directly, or following the contamination of foodstuffs and beverages. The potential hazards associated with these domestic sources of lead often go unrecognised, particularly by parents and guardians.

67. Exposure derived from adventitious sources may be substantial and markedly in excess of that from lead in the general environment. When such exposures are sustained serious illness and even death may result. In the United Kingdom children are most commonly affected and about 100 cases of childhood lead poisoning are recognised each year.

The Sources of Adventitious Lead

68. The following adventitious sources of lead have been recognised:

a. Paints and primers

b. Dust and soil

c. Glazed and soldered domestic vessels and utensils

d. Eye cosmetics and medicinal preparations from the Indian sub-continent

e. Hair darkening products

f. Metallic lead

g. Miscellaneous

Lead Paint

69. Lead compounds have long been used in the manufacture of domestic paints, initially as one of the major ingredients and subsequently as pigments and driers. The amount of lead paint sold has however markedly diminished with advances in paint technology and continues to decline; it has been estimated that leaded paints now make up less than 3% of total sales (involving the use at present rates of some 1500 tonnes of lead each year by UK paintmakers). Most leaded paint is used in the shipbuilding and construction industries. We understand that there is no readily available information on how much leaded paint, if any, is now used in homes or for other consumer purposes, but it is more likely to be applied to exterior surfaces because of its reputation for giving greater protection against weathering. We understand that, as a result of a voluntary agreement between the paint industry and government, paints manufactured in the UK which, for technical reasons, contain more than 1% lead, whether intended for interior or exterior use, are labelled "Not suitable for use on surfaces liable to be chewed or sucked by children". In accordance with an adopted EEC Directive (Official Journal of the European Communities 1977) / regulations are to be made requiring appropriate labelling on all paints containing lead in quantities exceeding 0.5% of the total weight. Proprietary lead primers for use on wood are no longer manufactured.

70. Although any hazard from lead in new paint has clearly been substantially reduced, we are concerned that there may still be some risk from lead paint used

out-of-doors in places accessible to children or from the domestic use of lead paints intended for industry. Warnings on labels are important but are not always effective. We believe that further steps should be taken to complete the elimination of this hazard.

71. In addition, restrictions on the use of lead in new paint cannot eliminate the hazard in all homes since, even when houses are repainted, old paint is seldom completely removed on redecoration and, even if it is, old lead primer may remain in the woodwork beneath. Flakes of paint, which may include old lead-containing layers, may break away or children may chew down to the wood. Old paintwork of high lead content accessible to children continues to be encountered in both public and private housing and in residential institutions and hospitals, although the extent of the problem is unknown. A survey in part of London revealed that over half of the homes visited had accessible paint with a lead content varying between 1% and 40% (Barltrop and Killala, 1969).

72. A small paint flake 2-3mms in diameter may contain over 1000µg of lead or over ten times the daily intake from all other sources (Barltrop and Killala, 1969). The habitual ingestion of such an amount by a child has resulted in severe clinical lead poisoning in 3-4 months (Chisholm and Harrison, 1956). Old lead paintwork in the home is the single most common cause of severe childhood lead poisoning in the United Kingdom and accounts for at least one third of all known cases (Barltrop et al, 1976). McLean (1980) reports that, in England and Wales from 1968 to 1976, 13 children were certified as having died from lead poisoning out of a total of only 46 due to poisoning by all non-medicinal substances other than carbon monoxide; of these 13 deaths 4 were attributed specifically to lead paint.

73. We note that in the United States there is an active programme of lead paint hazard detection and abatement; in 1976, some 500,463 American children were screened for lead poisoning, of whom 69,131 were found to have evidence of undue

exposure; 28,333 homes were found to have a lead paint hazard (Billick and Gray, 1978). We believe that steps should be taken in this country to identify housing areas, institutions, schools and play areas where there is a high lead content in existing paintwork. All practicable means should be taken to reduce or eliminate the hazard as soon as possible and research should be conducted to identify economical and effective methods of doing this.

74. Although the direct ingestion of paint flakes is probably the most important cause of lead poisoning in children, other routes of transmission of lead from paint have been recognised. Degradation of paint film in the home may result in contamination of house dust to which children are also exposed (Vostal et al, 1974); similarly, external paintwork, which may be of greater lead content, may contaminate garden soils immediately adjacent to the home.

75. Painted toys, nursery furniture, pencils, etc, are potential hazards of special importance because of the extent to which they are normally chewed by children. Paints intended for toys are limited by regulation to 0.25% lead and those used on pencils, pens, brushes etc to the stringent limit of 0.025%. Constant vigilance is however essential in the enforcement of these regulations, particularly with regard to imported goods.

Lead in dust and soil

76. Many reports implicate lead-contaminated dust and soil as sources of exposure. House dust may be contaminated with lead derived from a variety of sources in addition to the degradation of paint film; substantial amounts of lead may be liberated in the home at redecoration as a result of sanding, scraping and burning of paint films and may endanger the workers involved as well as the residents of the home (Feldman, 1978). Contaminated industrial clothing improperly brought to the home may carry substantial amounts of lead dust to the domestic

environment; the children of some lead smelter workers have been found to have excessive lead burdens which were attributed to this source (Baker et al, 1977). However, given full implementation of the existing Codes of Practice for the lead industry, this problem should diminish. Lead may be found in dust as a result of the use of lead-containing cosmetics in the home (paragraphs 79-83) and the burning of lead-containing fuels in fireplaces and heating appliances. The deposition of airborne lead particles from external sources may make a small but detectable contribution.

77. The lead content of soils of gardens and other areas near to the home has received insufficient attention. The blood lead of pre-school children increases by about 0.6 µg/dl for every 1000 ppm (0.1%) lead in soil (Barltrop 1975). Enhanced lead levels are encountered particularly in soils in lead mining and lead smelting areas, in land previously used for the deposition of industrial waste and refuse, and in land adjacent to motorways and arterial roads. Concentrations of up to 30,000 ppm of lead in soil have been found in rural villages in old lead mining areas (Barltrop et al, 1975). To date there have been no standards for the concentrations of lead to be allowed in soil on land used for housing or similar purposes. The lack of clear guidance has impeded some new housing developments and raised doubts concerning the safety of existing dwellings in some areas. We understand that guidelines are being developed to establish acceptable concentrations of lead in soil in gardens, agricultural land, parks and open spaces. We would support the adoption of such guidelines.

Glazed and Soldered Domestic Utensils

78. Domestic utensils and vessels used for the preparation of foods and beverages may, in certain circumstances, release substantial amounts of lead; regulations have therefore been made prescribing limits for extractable lead from cooking utensils, ceramic and enamelled ware. Imperfections in the glazing of ceramics and earthenware,

which can occur with small scale production, may pose a particular hazard. We note that, whereas modern "pewter" is lead-free, traditional pewter may have a considerable lead content and is still commonly used for drinking beer. The public should be made aware of the possible hazards of imperfectly glazed ceramic ware, and of old pewter. The hazard from lead-contaminated vessels arises particularly where prolonged storage of acid fluids is involved, for example in the fermentation and storage of beers, ciders and wines and in the storage of vinegars, fruits, fruit juices, pickles and preserves.

Eye Cosmetics and Medicines from the Indian sub-continent

79. Certain eye cosmetics from the Indian sub-continent contain lead, and members of immigrant communities in particular have been exposed from this source. The cosmetics concerned are the Khols or Surmas, which are applied to the eyes not only of adults, but also of children and infants. In earlier times they were formulated from antimony sulphide but in recent years economic factors have resulted in the use of lead in some preparations. Surmas are described as being white, grey or black. Our information is that the grey and black forms are likely to contain a large proportion of lead. The Pharmacy Department of the University of Nottingham report that Surmas may include up to 83% lead (Table 10).

TABLE 10

CHEMICAL ANALYSIS OF PROPRIETARY SURMAS SOLD OR BROUGHT INTO THE UNITED KINGDOM BUT MANUFACTURED IN INDIA OR PAKISTAN

Description	Powder colour	Percentage lead
Hashmi Surma Jowahar Chaharam, Karachi	Grey	80.2
Surma Moqawi Basar Taj Company, Lahore	Grey	53.7
Multani, Ayurvedic 36-H Connaught Circus, Delhi	Grey	Trace
Nag Jyoti, Murrari Brothers, Delhi	White	Trace (Zinc 4.5% + Menthol)
MD Hashim Surma, Bunder Road, Karachi	Grey	82.9
Bal Jyoti, Murrari Brothers, Delhi	Grey-Black	38.4
Indian Surma	Cream	Trace
Bhimsaini Kajal with Aela, Murrari Brothers, Delhi	Black Paste	Trace
Nargasi Surma, Hamdard, Pakistan	Grey	77.3
Binger Surma, Hamdard, Pakistan	Black	26.3
* Bhimsaini Kajal with Aela	Black Paste	Trace

Trace = $< 0.5\%$
*Carbon in soft paraffin base

from Aslam, et al (1979)

80. In 1968 the Home Office sought a voluntary ban on the sale of lead-containing cosmetics. We were pleased to learn that more recently the Cosmetic Products Regulations 1978, which implement an EEC Directive, have made the sale of lead-containing cosmetics in the course of business illegal. The use of lead acetate in hair care products is the only permitted exception. It appears that private imports of lead-containing cosmetics continue however and that use of these cosmetics is still a practice among immigrant families from the Indian sub-continent.

81. It is inevitable that there will be some absorption of lead from preparations such as Surma, particularly due to children sucking contaminated fingers. It seems that the use of Surma may be widespread and we are concerned that children may be seriously exposed in this way.

82. There are some reports of acute lead poisoning which have been attributed to Surma; it seems, however, that in homes where Surma is used there are commonly other sources of lead which may have played a part in the poisoning (Fernandes, 1969; Warley et al, 1968). Although studies of immigrant children (Josephs 1977; Ali et al 1978) indicate that the blood lead levels of those children who use Surma are significantly higher than of those who do not, we consider that Surma has not been proved to be the only cause of this difference. Studies by Waldron (1979 a) and unpublished work by Ali et al and Archer et al indicate that in this country blood lead concentrations of women and children are significantly higher in those of Asian extraction than in others.

83. We consider that the private importation and use of lead-containing cosmetics is unsafe and should be strongly discouraged. Potential users of these products should be made aware of the hazard.

84. Some unlicensed medicinal products prescribed by practitioners of traditional Indian medicine (the Hakims or Vaids) contain lead. Poisoning has been reported from the use of purported aphrodisiacs containing lead (Brearley and Forsythe, 1978). Formulations of several medicines which contain large amounts of lead and other metals are given in Table 11. The nature and use of these medicines are being investigated. Action to educate those concerned about the hazards of traditional remedies containing lead is, we understand, already in hand.

Hair Darkening Products

85. Some hair-darkening products on the market have contained lead acetate in concentrations ranging from 0.26-3.13%. Waldron (1979 b) reports that ingestion of a

TABLE 11
HEAVY METAL IMPURITIES IN SOME MEDICINES FROM THE INDIAN SUB-CONTINENT

	Impurities		
	Major Component	Minor Component	Trace Component
Khamira gaozaban			Zn 130 ppm contained with 41% dextrose and silver particles.
Female fertility stimulant, silver coated			Silver
Male fertility stimulant, orange brown, pliable mass			Zn 168 ppm contained in 15% sucrose together with vegetable matter.
Maha sudarshan. Churna powder		Iron	Titanium, manganese, zinc, rubidium, strontium
Cogoni oil			Iron, zinc.
Bajar, used by men and women	(Nicotine)		Manganese, iron, zinc, lead, copper.
Queen's balm			Zinc.
Bala guti pills (useful for children's diseases).			Lead 58 ppm, antimony 750 ppm, arsenic 2 ppm
Hari taki tablets			Iron, zinc, rubidium.
Chandraprapha pills	Iron	Titanium, chromium manganese, nickel, zinc, arsenic, strontium.	
Terminalia chebula powder	Zinc, rubidium.	Iron.	
Pushyanug churna powder		Iron.	Titanium, manganese, nickel, zinc, arsenic, strontium, lead.
Khadiradi pills		Iron.	Titanium, manganese, copper, zinc, rubidium, strontium.
Withania somnifera		Iron.	Titanium, manganese, zinc, arsenic (2 ppm), strontium.
Marayan churna			Manganese, zinc, strontium.

after Aslam et al (1979)

quantity of one of these preparations was responsible for a case of lead poisoning in a young West Indian girl in Birmingham. The Cosmetic Products Regulations 1978 restrict the use of lead acetate in hair-darkening products to a maximum concentration of 3% and require the following instructions to be given to users: "Wash hands after use. Do not use on broken or abraded skin. Keep out of reach of children". There is no compulsion on the manufacturers to state that their product contains lead, although a few of them do so. In our opinion all hair-darkening products which contain lead should have this stated clearly on the label of the container, together with the warning against their misuse.

Metallic Lead and Miscellaneous Sources

86. The use of car battery casings as fuel in domestic fires and heaters is an occasional cause of lead poisoning (Chisholm and Barltrop, 1979). Fuel "logs" made from coloured newsprint have been reported to release lead when burnt. Children who habitually chew coloured newsprint to produce "spitballs" have been found to have raised lead levels. Certain hobbies, including the making of jewellery or stained glass, may be dangerous. Metallic lead is not normally hazardous and to swallow a single lead-containing item is unlikely to be harmful unless it is sufficiently large to be retained in the stomach. The ingestion by children of many small pieces of lead such as lead shot, fishing weights or curtain weights, has caused lead poisoning.

Pica

87. Pica is defined as the ingestion of substances not normally regarded as foodstuffs. Its potential as a contributory cause of lead poisoning is very clear. Pica has been recognised among adults for centuries, notably as an

occasional feature of pregnancy but also as a manifestation of extreme hunger. The term pica is an allusion to the magpie (Pica pica pica (linn)), which is said to have an appetite which is both capricious and voracious. A variant of pica known as geophagia (earth-eating) was described by Livingstone and by Van Hambold and Bonfland in the natives of Africa and South America respectively. These and other historical reports have been reviewed in a classical monograph by Cooper (1957).

88. The occurrence of pica in childhood has been recognised only during the last few decades. Cooper (1957) surveyed 784 children and noted that pica was present in 21.9% and that it was rare after the age of six years. It has been suggested that pica is more common in negro than in white children (Cooper, 1957; Dickins and Ford, 1942; Millican et al, 1962) but Barltrop (1966) found no significant difference in the prevalence of pica in white compared with negro children in a randomly selected population, stratified for ethnic group. Many attempts have been made to determine the aetiology of pica in childhood. Thus Lanzkowsky (1959) related pica to concomitant iron deficiency and other authors have implicated several other mineral deficiency states. However, Gutelius et al (1962) and Gutelius (1963), in controlled supplementation trials, failed to confirm the role of nutritional deficiencies. Millican et al (1956) attributed the practice to a disturbed mother-child relationship and Lourie et al (1958) suggested that it represented an early pattern of addiction. Barltrop (1966) noted that the practice was commonplace and inversely related to age in the range one to six years, and he therefore suggested that pica was a normal manifestation of development. Recently, Bicknell (1975) reported studies on children in hospital and found pica to be related to a low mental age, the presence of additional handicaps and behavioural disturbances. She argued that selective and highly motivated pica represented a maladaptive behaviour pattern rather than a developmental phenomenon.

Pica and Lead Paint

89. Numerous reports of pica involving lead based paint have appeared in the literature and it is still regarded as a most important aetiological factor for severe clinical lead poisoning in childhood. It is standard procedure to record the presence or absence of pica in paediatric practice and to X-ray the abdomen for evidence of ingested paint flakes in suspected cases of lead poisoning. Several authors have advocated that enquiries should be made for pica as a means for the detection of childhood lead poisoning. A positive history of pica in 94% of 30 cases of clinical lead poisoning in childhood has been reported by Tanis(1955).Similarly, Bradley et al (1956) in a study of 604 children found that 69.6% of those with blood lead concentrations of 50µg/dl or more gave a history of pica. On the other hand, Greenberg et al (1958) found evidence of lead poisoning in only 24% of 194 children with pica. Griggs et al (1964) argued that knowledge of the place of residence is a more helpful diagnostic aid than a history of pica. More sensitive and more specific methods for screening populations of children for lead poisoning have now been developed although they have yet to be applied generally in the United Kingdom.

CHAPTER 6

UPTAKE OF LEAD

90. Earlier chapters have reviewed what is known of the amounts of lead which people may ingest from food and water, the concentrations of lead in air to which they may be exposed and the additional sources which may contribute to the exposure of some individuals. In this chapter we shall consider the extent to which lead is absorbed by different routes and retained by the body, in order to assess the relative importance of the different sources of lead.

The Absorption and Fate of Lead in the Body

91. Lead enters the body primarily by absorption from the gastrointestinal tract of a proportion of ingested lead and by absorption from the lower respiratory tract of the proportion of inhaled airborne lead which is retained there. Further details of these routes are given in paragraphs 96 - 108. A proportion of airborne lead which is trapped in the upper respiratory tract is removed to the throat by ciliary action and may be swallowed. Having gained access to the blood, the lead is carried on the surface of the red cells, quickly reaching higher concentrations in whole blood than in serum or extracellular fluid generally. Lead is stored in and mobilised from bone and teeth in a similar way to calcium. Some lead is stored in soft tissues but in adults some 95% of the total amount of lead in the body is in bone, the proportion being somewhat lower in children. The amount of lead in bone tends to increase through adult life, whereas the amount in soft tissues tends to remain constant. Lead is excreted in both urine and faeces, that in the latter being due to unabsorbed lead as well as to lead positively excreted from the biliary tract; under some circumstances the

total amount of lead excreted exceeds the total of that ingested plus that absorbed from the respiratory tract. Blood lead tends to reach equilibrium within about 2-3 months of a change in exposure but it is uncertain whether equilibrium between bone and blood is ever reached; blood lead therefore tends to reflect recent rather than long term exposure. The relationship between the concentrations of lead in blood and in soft tissues after critical exposure is not known, although they are presumed to move together. Lead crosses the placental barrier freely and concentrations tend to be similar in mothers and in their new born babies.

92. The effects of lead may be thought of as a continuous spectrum having normality at one extreme, passing through absorption of lead with no detectable change, to absorption with detectable biochemical change of uncertain significance for health and, finally, to poisoning with the presence of symptoms and signs at the other extreme (Windeyer Report, 1972).

93. The contribution of a given source to lead in the body is usually expressed as the concentration of lead in the blood due to that source. Ideally, one would use the amount of lead in the entire body, or the concentration of lead in the parts of the body of most concern (such as the brain) instead of blood lead but this information can obviously be obtained only by post mortem examination; difficulties would in any case arise with the use of any measure of the total body burden of lead, since it represents the net accumulation of lead over a lifetime and information on the exposures which had contributed to it would never be available in practice. In studies of the clinical effects of past exposure to lead, on the other hand, measures of the total body burden are useful; tooth lead concentrations

are believed to give a reasonably accurate reflection of long term exposure and, since children can be persuaded to give their deciduous teeth for research, tooth lead is becoming widely used in studies of this type. Hair accumulates lead and should in theory represent exposure in the medium term but the techniques which are available for analysing lead in hair are not yet sufficiently developed; there are major problems with these techniques, especially in the standardisation of sampling procedures and in separating lead which has contaminated the hair surface from that stored within the hair. Blood lead is widely regarded as the best available indicator of recent exposure to lead and it is thus appropriate for use in studies of the relative importance of the lead to which people are currently exposed from different parts of the environment.

94. Three types of study are available in the literature which help to determine these relative contributions. First are experiments in which individuals are exposed to varying but known amounts of lead through the air they breathe or by ingestion, and their blood lead concentrations are determined. Such studies commonly involve very high exposures of uncertain relevance to everyday life and can be conducted only on small numbers of volunteers; the results may therefore be dominated by individual variations in response. Second are "balance studies" in which the lead excreted in faeces and urine, as well as the lead ingested, is assessed and the net gain or loss of lead calculated. Studies can combine features of both these first two types. A variant involves labelling experimentally administered lead with a radioactive isotope, which allows the distribution of the dosed lead within the body to be studied. Third are epidemiological surveys in which concentrations of lead occurring in the environment are studied and linked with observations on blood lead amongst samples of the population. Such studies have generally been conducted

on populations thought to be specially at risk (the so-called "target" populations), particularly from high levels of lead in water, and they have not taken account of lead in more than one part of the environment. The results of studies of these kinds which have been undertaken in relation to ingested and inhaled lead, in adults and in children, are reviewed in paragraphs 96 to 108.

95. No studies have been undertaken which provide direct and accurate data on lead in all parts of the environment to which a study population has been exposed. We have therefore examined data on blood lead drawn from samples of the general population in particular areas in relation to estimates of representative levels of lead for the same localities. Appropriate blood lead data have become available recently from survey work in the United Kingdom to implement the EEC Directive on Biological Screening of the Population for Lead (paragraph 110, Table 12 and Appendix 2).

Experiments and Balance Studies: Lead by Ingestion

96. Kehoe (1961, a, b, c, & d,), Rabinowitz et al (1974) and Hursh and Suomela (1968) have carried out isotope studies involving the ingestion of ^{203}Pb or ^{212}Pb by adult volunteers. The studies indicated an average absorption rate of 11% although the number of individuals studied was small. Both Blake (1976) and Barltrop and Strehlow (1978) undertook balance studies and found a very wide range of absorption rates amongst adults, with some individuals being in overall negative balance. It has been generally accepted that the average net absorption of ingested lead by adults is 10%. The absorption factor is not constant, even for an individual, but depends upon such factors as amounts of fat, minerals (particularly calcium) and vitamins (Barltrop and Khoo, 1976) in the diet and the physical and chemical

form of the lead. Experiments show that absorption of lead is somewhat greater when lead is ingested (eg in water) between rather than with meals but there is no direct evidence on the absorption of lead from tap water in normal circumstances. It is reasonable to assume for present purposes that all ingested lead is absorbed to a similar extent whatever the source.

97. There are three groups of experimental or related theoretical studies which deal with the relationship of ingested lead and blood lead. In theoretical studies based on the absorption factor discussed above, Chamberlain et al (1978) predicted that the increase in blood lead concentration per 100 µg/day of lead in the diet would be 3.6 µg/dl; assumptions were also made concerning the fraction of uptake from the gut that is transferred to red cells and the biological halflife of lead in blood. The results from four experimental studies cited by Chamberlain (involving only 17 subjects in all) show an average increase in blood lead concentrations per 100 µg/day of lead intake of 1.99 µg/dl and a range of 1.4 - 4.3 µg/dl. In studies of three subjects using ^{204}Pb as a tracer, the proportions of blood lead attributed to current diet were 53, 53, and 75% respectively (Rabinowitz et al, 1976). The remainder of the blood lead was reported as being due not only to intake from other sources, mainly by inhalation, but also to resorption from storage in bone.

98. Ethical considerations limit work on children to the use of balance studies. Few such studies were carried out by Alexander et al (1973) on eight normal children aged 3 months to 8½ years. They showed an average intake of 10.61 µg/kg/day and an average absorption (ie intake less faecal excretion) of 5.47 µg/kg/day (52%); there was wide variation between individuals. Recently Ziegler et al (1978) carried out a number of three day balance studies on each of nine infants aged 2 weeks to 2 years, who were on ordinary diets. Average intake was 10.29 µg/kg/day and average absorption was 4.39 µg/kg/day (43%). In a second series of studies Ziegler et al (1978) showed that the proportion of intake which is absorbed is very dependent on the dose; infants on diets providing low intakes of less than 5 µg/kg/day were in negative balance.

99. In longer-term balance studies in 29 hospitalised children, who may not necessarily reflect the response of children living in their normal environment, Barltrop and Strehlow (1978) found that a considerable number of children given hospital diets, duplicate samples of which were analysed for lead, were in negative balance. Wide individual variations in net retention of lead were observed ranging from a negative balance of 57% to a positive balance of 99%, with an average negative balance of approximately 40% of the dietary intake in children ranging in age from 3 weeks to 14 years.

100. To allow the uptake of lead by children from food and water to be compared with that from air, assumptions must be made about average intake and average proportion absorbed. Because the proportion of lead absorbed varies so greatly, estimates of the average absorption based on studies of small numbers of children must be treated with caution, but it is clear that the proportion absorbed is much greater in children than in adults; in our calculations we shall assume 40% absorption. Paragraph 17 quotes an estimate of lead intake based on national dietary studies in 2-4 year old children. The figure of 70-80 µg/day is roughly equivalent to 5.5 µg/kg/day, which is substantially less than reported from the balance studies. We shall assume an intake of 8 µg/kg/day and hence an absorption of 3.2 µg/kg/day, when making a comparison with inhaled lead in paragraph 114.

Epidemiological Surveys:

101. Surveys of lead in water and blood lead were reviewed by Berlin et al (1977). Leaving aside the results of Moore et al (1977a) which are discussed below, the range of results was 0.7 - 3.4 µg/dl blood lead per 100 µg/l water lead, with a median of 1.3 and an unweighted mean of 1.8. Assuming an average

intake of 1.25 l/day (Table 5 and paragraph 49) this corresponds to a range of 0.5 - 2.8 µg/dl blood lead per 100 µg/day ingested water lead with a median of 1.1 and a mean of 1.5. These figures are lower than those reported from experimental and theoretical work quoted in paragraph 97 but the difference may be largely explained by the use of first draw water samples in many of the surveys.

102. Individual studies have not been large enough for the form of the relation between water lead and blood lead to be examined. However, Moore et al (1977a) collated data from a number of Scottish studies and reported that mean blood lead concentrations tends to rise in a curvilinear manner as illustrated by Line A of Figure 2. A damping of the effect on blood lead as water lead rises can be seen. The actual regression equation derived from the data expressed in µmols/l is as follows:

$$\text{Mean blood lead} = 0.533 + 0.675\sqrt[3]{\text{first draw water lead}}$$

103. Thomas et al (1979) derived a simlar curve, illustrated by Line B of Figure 2, from their study of a small community in North Wales mentioned in paragraph 43. Two adjacent housing estates, one with lead plumbing and one with copper plumbing, both received the same highly plumbosolvent water. Water leads in the lead-plumbed estate were exceptionally high, with a median concentration of 1075 µg/l and a maximum of 2826 µg/l in first draw samples. The median blood lead concentrations among people living in the lead plumbed houses, at about 38 µg/dl, were more than twice those of people in the houses with copper plumbing; the maximum individual figure recorded was 68 µg/dl.

A special feature of this study was that the opportunity arose to study the effect on blood lead of a substantial reduction in environmental lead when all the lead pipes were replaced; the mean blood lead concentrations then declined in the previously lead-plumbed estate by about 50% within six months, confirming that very high water lead has a marked effect on blood lead.

104 Caution is needed in defining the precise form of the relationship derived in these studies. That of Thomas et al (1979) was based on relatively few people; Moore et al (1977a) themselves point out that their data were drawn from a number of studies and do not represent any one defined population. It seems likely that the extent of the increase in blood lead which results from small increases of water lead, especially from a low initial level, will depend on the size of the intake from other sources such as food. Nevertheless it is safe to conclude from these studies that the relationship between ingested lead and blood lead is curvilinear.

The Effect of Ingested Lead on Blood Lead

105. Estimates of the factor linking blood lead to ingested lead vary considerably. The increases in blood lead per 100 µg/day of ingested lead, estimated from experiments, range from 1.4 to 4.3 µg/dl blood lead (paragraph 97); estimates from surveys are reasonably compatible. From the results and from theoretical work, Chamberlain et al (1978) suggested a factor of 3.5 µg/dl blood lead per 100 µg/day ingested lead. All these estimates however are based on the assumption of a linear relationship and we have seen (paragraphs 102 to 104) that this is unlikely to be correct.

The implications of a curvilinear relationship can be demonstrated by making some calculations from the regression equation of Moore et al (1977a) although, for reasons set out in paragraph 104, it would be unjustified to rely on the exact figures obtained. It can be calculated using the equation that a small increase of lead by ingestion increases blood lead at the rate of approximately 7 µg/dl of blood lead per 100 µg/day ingested lead when starting from a baseline of 18 µg/dl blood lead; of approximately 2 µg/dl blood lead per 100 µg/day ingested lead from a baseline of 24 µg/dl blood lead; and of approximately 1 µg/dl blood lead per 100 µg/day ingested lead from a baseline of 30 µg/dl blood lead. It thus seems likely that the factor linking blood lead to ingested lead is higher at common levels of lead in the environment than has been calculated from experimental work and from surveys on highly exposed populations. The existence of a curvilinear relationship may well explain why factors derived from research work do not fully account for blood lead concentrations as found in the general population (Chamberlain et al, 1978) and may help to explain the great range of factors reported from different studies. At the same time, it makes the assessment of the relative importance of different sources of lead difficult; this question is taken up again in paragraphs 109-113.

Inhaled Lead

106. The determination of the contribution that airborne lead makes to the total uptake of lead is complex, since it depends not only on the volume of air breathed and the average concentration of lead to which a person is exposed, but also on the extent to which the particles are retained in the respiratory tract and on how much of the lead is then absorbed

into the blood. Retention and absorption are markedly affected by the physical and chemical characteristics of the particles, and since many of these present in the air are complex aggregates (as noted in paragraph 56) they are liable to behave differently from the regularly shaped particles on which classical laboratory experiments on the retention of lead have been based. Studies which deal specifically with particulate lead as it actually occurs in the atmosphere and which include measurements of blood lead are therefore required to investigate the contribution of airborne lead.

107. The results of extensive investigations on the retention and absorption of lead as present in the particulate emissions from a small petrol engine have been reported by Chamberlain et al (1978). The lead alkyl in the petrol was labelled with a radioactive isotope so that the exhaust products could be traced when inhaled by volunteer subjects. From their observations the authors were able to calculate a factor which they referred to as α, representing the increment in blood-lead (in $\mu g/dl$) corresponding with each $\mu g/m^3$ of lead in the air that they breathed. This is analogous with the factor which relates blood and ingested lead, discussed in paragraph 105. The mean value of α that they reported was about 2, but there was a wide scatter in results among the small number of volunteers studied. There is no reason to suppose that the value of α will be constant over the whole range of air-lead concentrations to which man is exposed and every reason to assume from experience of occupational exposures to high concentrations that it is not (Richter et al, 1979).

All the evidence indicates that the value of α falls as the concentration in air rises (Hammond et al, 1979), although the form of the equation relating blood-lead to air lead has not been defined clearly. Similar findings for ingested lead are reported in paragraphs 102 and 103. Some support for a value of α around 2 within the range of air-lead concentrations found in urban atmospheres comes however from the work of Azar et al (1975) in which personal samplers were used to assess exposures from the general air, and from that of Griffin et al (1975) in which adults were exposed to artificially produced lead aerosols in an experimental chamber. In view of the diversity of concentrations and forms of lead aerosols involved in all these studies, doubts must remain about the most appropriate value of α for the circumstances prevailing in the general air, but for the purpose of assessing the effects of airborne lead in the concentrations normally found in British cities it may be accepted as 2; an annual mean concentration of airborne lead of 1 $\mu g/m^3$ then represents a contribution of 2 $\mu g/dl$ to the concentration of lead in blood.

108. Ethical constraints prevent experimental studies and epidemiological work involving the taking of blood from children, unless it is thought that they may be at risk. In the case of children not exposed to abnormal levels of lead, calculations can be made based on studies employing a variety of physiological measurements and assumptions, although these studies lack the direct and detailed experimental verification that is possible in adults. Using the calorie requirements for young children which were set out in Table 1, it may be calculated that the ventilation rate during the first three years of life is $0.49 m^3/kg$ body weight/day. No measurements have been reported on the proportional deposition of lead aerosols inthe lungs of children. The airways in young children are smaller and their respiratory rate is greater than in adults.

James (1977) has calculated that in a ten year old child the percentage retention of very small particles will be slightly higher than in adults so that it is reasonable to assume that 70% of an inhaled lead aerosol is deposited in the lower respiratory tract of children and that, as with adults, 100% of deposited lead will be absorbed. From all this information, it can be assumed that the equivalent volume of air from which lead is taken up per day by the young child is $0.34 m^3/kg$ body weight.

The Relative Contribution of the Different Sources to Blood Lead.

109 The relative contributions of the different sources of lead in the environment will be estimated from recent data on blood lead and from the information on amounts of lead in the environment which was given in earlier chapters. A number of uncertainly based assumptions have to be made and the results can indicate only the approximate relative importance of each source for that part of the urban population which face no special exposures; the effect of "hot-spots" will not be reflected in these estimates.

110. Data on the blood lead concentrations of adults in six English cities have been taken from the results of surveys carried out in the UK in 1979 as part of the EEC programme of blood lead surveillance and they are shown in Table 12. In these surveys samples of adults had been selected in accordance with good statistical practice as being representative of those who live in the cities in question but who are not known to have any abnormal exposure to lead. Analysis of the blood samples was strictly monitored by an international quality control scheme. (Details of the programme and the results of the surveys carried out in the UK are given in Appendix 2.)

TABLE 12 BLOOD LEAD CONCENTRATIONS IN 6 CITIES

	Geometric Mean, ug/dl		
	Inner City	Outer City	Differences
London	12.0[1]	10.2[1,2]	1.8
Birmingham	13.6	11.1	1.5
Leeds	15.6	13.3	2.3
Sheffield	14.6	13.2	1.4
Liverpool	14.2	13.8[2]	0.4
Manchester	17.0	16.6	0.4
6 cities	12.8[1]	11.0[1,2]	1.8

1. Weighted by total number of electors in each area surveyed
2. Adjusted for sex bias

111. Table 12 shows that the blood lead concentrations of inner city adults are higher on average than those of outer city adults; the differences vary from 0.4 - 2.3 µg/dl and representative values for the mean blood lead concentrations of inner and outer city adults are assessed as 12.8 and 11.0 µg/dl respectively. These means are heavily weighted towards the London figures because of the size of London's population. The differences in mean blood lead concentrations between cities may be partly accounted for by differences in water lead; none of the cities is recognised as having a major problem with plumbosolvent water but London has virtually no lead in tap water whereas Manchester has somewhat raised levels and the other cities for which there is some information have intermediate levels. (DOE, unpublished.)

112. We have assumed that the estimates of the range of the national average adult intake from food of 70 to 150 µg/day reported in paragraph 24 can be applied to these cities. Water lead is very unevenly distributed but from such information as is available we have assessed the range of concentrations in these cities to be approximately 0-50 µg/l; the great majority of the inhabitants will be exposed to little lead in water. We have taken the "typical urban background value" for air lead of 0.5 µg/m^3 reported in paragraph 58 as applying as an average to suburban areas; so as to avoid any risk of underestimating the importance of air lead in inner city areas, we have used as an average for those areas the figure of 1 µg/m^3, although it should be noted that this figure is quoted in paragraph 59 as a concentration to which few people are likely to be exposed as a long term average.

113. The assumption that the relationship between ingested lead and blood lead is linear has been shown to be incorrect but we do not have adequate data from which to support the use of a curvilinear relationship. In the face of this difficulty we have proceeded by apportioning the mean blood lead concentrations for the six cities between the main sources, on the following basis. The proportion of the observed blood lead which is due to air lead was first calculated on the basis of the estimated concentrations of 0.5 and 1.0 µg/m^3, and a value of 2 for α

TABLE 13 ESTIMATED CONTRIBUTIONS OF SOURCES OF LEAD TO BODY BURDEN OF ADULTS

		INNER CITY		SUBURBS	
LEAD IN ENVIRONMENT	WATER	0 & 50 µg/l	a	0 & 50 µg/l	a
	AIR	1.0 µg/m^3	b	0.5 µg/m^3	c
INTAKE OF LEAD PER DAY	FOOD	70 & 150 µg	d	70 & 150 µg	d
	WATER	0 & 62.5 µg	e	0 & 62.5 µg	e
MEAN BLOOD LEAD		12.8 µg/dl	f	11.0 µg/dl	f
BLOOD LEAD FROM AIR		2.0 ug/dl (16%)	g	1.0 ug/dl (9%)	g
BLOOD LEAD FROM FOOD	WATER LEAD = 0	84%	h	91%	h
	FOOD LEAD = 70 µg/d WATER LEAD = 50 µg/l	44%	i	48%	i
	FOOD LEAD = 150 µg/d WATER LEAD = 50 µg/l	59%	i	64%	i
BLOOD LEAD FROM WATER	WATER LEAD = 0	0		0	
	FOOD LEAD = 70 µg/d WATER LEAD = 50 µg/l	40%	i	43%	i
	FOOD LEAD = 150 µg/d WATER LEAD = 50 µg/l	25%	i	27%	i

NOTES
a From paras 51 & 112.
b From paras 59 & 112.
c From paras 58 & 112.
d From paras 24 & 112.
e Assuming mean consumption 1.25 l/day of water (including contribution from cooking) From (a), para 49 and Table 5.
f From para 111 and Table 12.
g Assuming α = 2 - From (b), (c), (f) and para 107.
h 100% less percentage at (g).
i Assumes Water Lead and Food Lead are absorbed similarly. Calculated as follows and similarly:

eg $\frac{70}{70 + 62.5} \times 84\% = 44\%$

The remainder was then apportioned between food and water, assuming in turn the maximum and minimum concentrations set out in paragraph 112. Calculations are set out in Table 13. They suggest in round terms that adults living in cities who are not specially exposed to lead derive from 45 - 90% of their blood lead from food, 0 - 45% from water and 10 - 20% from air.

114. Data on blood lead in concentrations in representative samples of children who are not specially exposed to lead are not available, so that calculations have to depend upon estimates of absorption rates. Using the figures for absorption of ingested and inhaled lead quoted in paragraphs 100 and 108, the estimate of dietary intake also given in paragraph 100 and the assumptions about lead in air and water given in paragraph 112, our calculations suggest in round terms that children living in cities who are not specially exposed to lead derive 55 - 95% of their blood lead from food, 0 - 40% from water and 3 - 10% from air. The lower proportion from air compared with adults depends upon the assumption that rates of absorption from the intestine are very much higher in children than in adults.

115. The above results assume no mineralisation of garden soil and no intake from paint, dust or other adventitious sources. Such assumptions may not be correct, particularly for dwellers in inner cities. The mean difference in blood lead concentrations between dwellers in inner and outer city areas as indicated by the EEC Surveys is 1.8 µg/dl which is slightly more than would be predicted from the likely differences in air lead. These city dwellers are not subject to major industrial emissions of lead but an additional source may be lead paint, which is regularly found in the older housing stock of these areas. If lead paint does affect adults it must be by the dust derived from it blowing onto food which is insufficiently cleansed before it is eaten. Some effect of this kind cannot be excluded but it does not seem likely that it is a significant source of pollution to adults except in special and localised circumstances. The difference in blood lead concentrations between dwellers in inner and outer city areas is as great in London as elsewhere which suggests that differences in water lead cannot account for it.

Some Special Exposures

116. Sources of exceptionally high exposure of children have been reviewed in earlier chapters and especially in Chapter 5 (Adventitious Sources). Much has been published on the body burden of individual children with overt poisoning but there are relatively few data on the burden of lead of populations of children who may be at special risk. Some findings which have been published are reviewed below.

117. Many surveys of children living close to leadworks in the United Kingdom have been undertaken during the past decade. Recently 16 surveys have been carried out under the EEC programme on children living close to lead industries or in a leadworkers' family; the details are in Appendix 2. Most of the groups of children studied readily met the EEC criteria for blood lead in populations but three groups did not. Local factors which enhance exposure to lead have been identified in these cases and appropriate action is being taken. There was a difference of 2.9 µg/dl in mean blood lead concentrations between a sub group living close to a leadworks and another living further away in one survey, and a difference of 3.0 µg/dl in another. From earlier work the effect of distance is still noticeable at 0.5 km but has disappeared by 1 km.

118. Some of the EEC surveys dealt specifically with leadworker's children. The effect of living in a leadworker's house varies. In one survey the mean blood lead of such children was 17.4 µg/dl, compared with 16 and 12.1 µg/dl for two groups of neighbouring children. In another, the difference was only 1 µg/dl for boys and 1.5 µg/dl for girls. We know of no explanation of the increased blood lead in these children other than a build up of lead in the home environment due to lead taken home by the worker on his person or his car.

119. Other surveys carried out under the EEC programme dealt with both adults and children living near to busy road junctions and motorways. The results show that blood lead concentrations are within the recommended reference levels, though there are indications that in some localities contributions from traffic increases blood-lead concentrations.

120. There is evidence that children living in areas where the soil is contaminated with lead experience an increase in their mean blood lead concentration that is proportional to the amount of lead in the soil. Barltrop et al (1975) estimate that blood lead increases by 0.6 µg/dl for each 1000 ppm of lead in soil. Factors that influence this increase, other than soil lead levels, have not been identified. Barltrop (1975) did not find a similar correlation for adults.

121. Lead in drinking water may have a marked effect on body burden in the case of artificially fed infants in areas where the water lead is exceptionally high (Table 6). A study is in progress in Glasgow, where some households have markedly raised levels of lead in tapwater, to assess this problem and the first results that are available to us suggest that in many cases the infants are ingesting an undesirably large amount of lead. There are as yet insufficient data to confirm this or to allow the implications to be assessed. The field work for this study is due to be completed by April 1980.

122. In the United States old lead paint in poorly maintained property has long been recognised as a major source of lead for young children. A large scale screening programme has been in progress for many years, in which blood lead measurements have been made on over one and a half million children, to identify those at risk and to take remedial action where necessary. In a recent report (Billick and Gray, 1978), the accumulated results were considered in relation to ethnic origins and other factors

and it was noted that the overall trends in seasonal mean blood lead values for New York showed some similarity to those in air lead concentrations over the same period. When the same blood lead data were considered in relation to trends in the amount of lead in gasoline sold in the region there was an even closer correlatio (Billick et al, 1979). This does not necessarily imply a causal relationship and it would be surprising if it did, for at the individual level it is clear that paint is responsible for the more extreme blood lead values. One possible explanation is that since this is specifically a long term screening exercise rather than a survey of random populations there could well be a tendency for the worst cases to be sought first, producing a decline in the mean value over the years, and the peaks seen in summer could reflect a greater exposure of children to dusts then, or special efforts in the more favourable weather to seek out those at risk. The downward trend in lead from gasoline observed is probably related to the increased use of lead free grades in the New York area and the increased amount in summer may reflect greater consumption during holiday periods. These points may become clearer when further details of the study are published.

123. A very careful study of the distribution of blood-lead concentrations among school children in Sydney, New South Wales, has been reported recently (Garnys et al, 1979). Mean values were higher among children at two schools in an urban area than among those in a rural area and, while it was possible to attribute some extreme values to the ingestion of flaking paint, the authors considered that the overall differences between the groups were related to airborne lead. One surprising feature of the results was that many values in the urban group were higher than those reported in most of the recent EEC surveys in the United Kingdom,

2 (turn over)

despite the apparently more limited opportunities for intake of lead from tap water and old paint. From the information available, concentrations of airborne lead did not appear to be higher in Sydney than they are in similar places in the United Kingdom. The assessment of exposure in this study was not detailed enough to allow any quantitative relationship between blood-lead and airborne lead to be calculated and the relatively high blood lead values must be regarded as unexplained.

Conclusions

124. The main purpose of this chapter of the report has been to assess the importance of the different sources of lead to which the population of the United Kingdom as a whole are exposed. The importance to the population of the main environmental sources is, in descending order, food, water and air; although our calculations are based in part on uncertain assumptions, this general conclusion is clear. Special consideration has been given to the importance of lead derived from vehicle emissions and we estimate that in city dwellers it may account for between 10 and 20% of blood lead. The contribution of dust and other adventitious sources to the exposure of the population as a whole is not known but we have found no reason to conclude that it is a major factor.

125. No firm evidence exists for guidance on what might be taken as a wholly "safe" level in the environment or the body. After considering the available data, the Commission of the European Communities has suggested "reference levels" for blood lead in members of the general population. Under the terms of the recent Directive (CEC 1977) surveys of blood lead levels are required to determine the distribution of values

in samples of the population in each member country; remedial action is called for if any group which has been surveyed fails to meet the following criteria: Blood lead shall be no more than 20 µg/dl in 50% of the group; no more than 30 µg/dl in 90% and no more than 35 µg/dl in 98%. As has been mentioned earlier the results of the 1979 surveys in the United Kingdom are given in Appendix 2; it will be seen that the EEC criteria are easily met in most situations. Exceptions are a survey in Glasgow, where lead in tap water is known to be a problem, and three out of sixteen surveys related to lead industries. Remedial action is in hand in all these cases. As already noted, the criteria are well met amongst children living close to motorways and road junctions.

126. Our study of the effects of the different sources of lead has been handicapped by the lack of information simultaneously on blood lead and on exposure to lead from each of the major sources in a defined population. While it is likely that lead from one source affects the net retention of lead from another, there is no actual evidence that this occurs at the levels of source lead or blood lead found in the general environment and the general population. At present it is safe only to assume that summation will occur to a considerable degree.

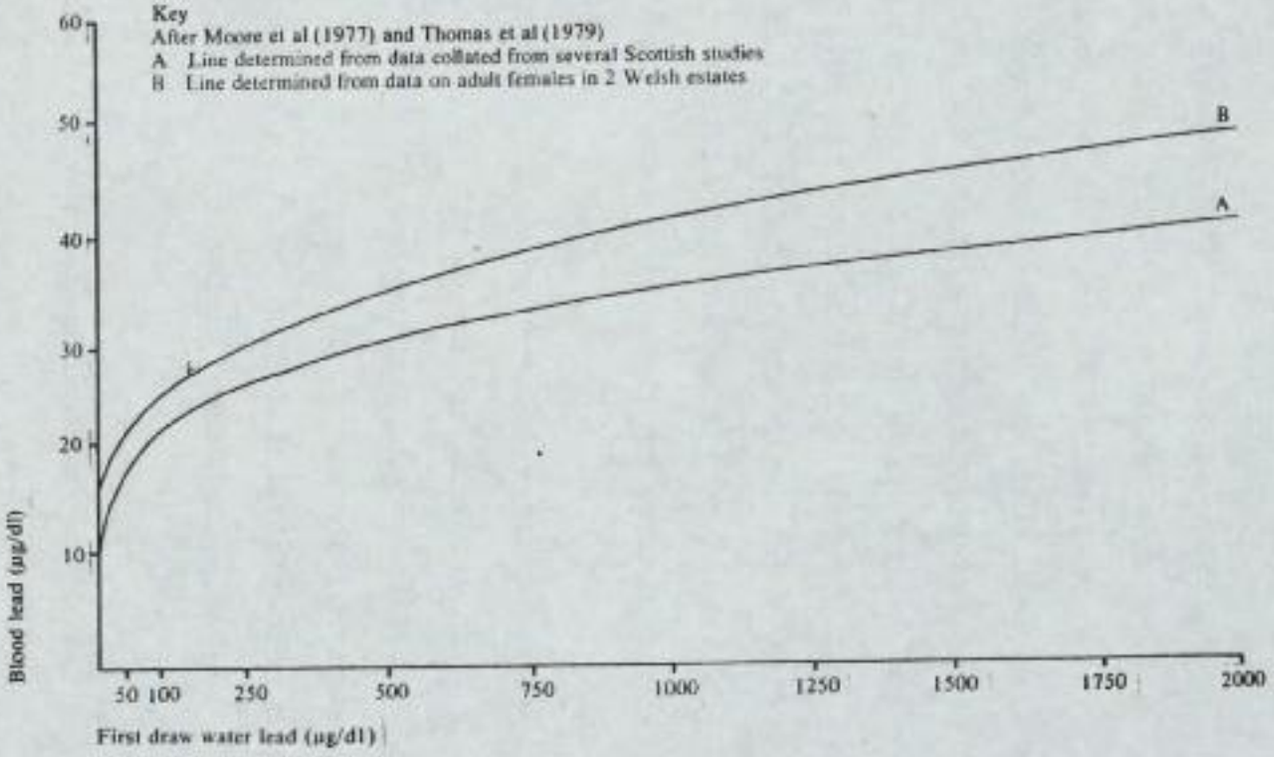
127. The last 3 paragraphs have been concerned with the impact of representative levels of environmental lead upon the health of representative groups of people. They have dealt essentially with averages, with the advantages and disadvantages that the term implies. Exceptions are well known to occur. Variations both in the biological response to lead and ? (run on)

in exposure are known to result in individual cases where the blood lead concentration is raised to levels meriting clinical concern. Effects on health that are judged to be lead-related may, however, not correspond to the observed blood lead concentration; sometimes there is an unusually high or low response of the blood lead concentration to a given exposure to lead. Most critically, of course, individual blood lead concentrations are affected by many external factors and notably by variations in environmental lead and by exposures to lead which are specific to the individual or the immediate locality. In the recent surveys carried out in collaboration with the EEC individuals with blood lead concentrations meriting clincial concern were specially looked for but only a few were found. The Working Party regard this as reassuring although not grounds for complacency as the EEC surveys did not examine small localised "hot spots" where only a few people are exposed to higher than usual amounts of lead.

128. The existence of isolated "hot spots" provides one of the most difficult questions with which we have had to deal. We have already indicated that, with a few carefully defined exceptions, we regard any deliberate use of lead in consumer products as most undesirable, however small the number of people who may be at risk. The difficulty lies rather with the general environmental sources, when a combination of chances may result in much higher than usual concentrations of lead in a very small area. Even to find such areas presents a problem. We would stress however that the concentrations of lead which can be anticipated in such circumstances are very much lower than those associated with overt lead poisoning and that, indeed, we have no evidence that there are people with seriously raised blood lead concentrations for this reason. The finding that blood lead does not rise in linear fashion with

increasing exposure provides some further reassurance. It is clearly important to identify some representative "hot spots" and to study concentrations of environmental lead and of blood lead amongst people affected. However we find the very possibility of the existence of such hot spots reason to take a more cautious approach to the control of lead in the environment than would otherwise be necessary.

Figure 2: Relation of blood lead to first draw water lead



CHAPTER 7

NEUROPSYCHOLOGICAL EFFECTS ON CHILDREN

129. There is no doubt that lead is a toxic substance which / in sufficient amounts can cause an encephalopathy which could result in permanent brain damage to babies and children. The response of a particular child exposed to lead from any source depends upon so intricate a network of inter-related factors that a simple relationship between dosage and degree of injury which would allow the relative risks to be calculated has not and possibly cannot be established. As with all biological phenomena, the sensitivity of any individual child to lead exposure will vary; nevertheless it is recognised that once a child shows signs of lead encephalopathy there is a danger that permanent damage may result.

130. A large proportion of the Working Party's time was devoted to the consideration of the effect of lead on the intelligence, behaviour, attainment and performance of children. Particular attention was given, therefore, to the possibility that exposure to lead at levels below those producing symptoms of poisoning can result in impaired intellectual functioning and related problems.

Problems of Analysis and Interpretation

Measurements

131. The total body burden of lead is divided among 3 compartments:

(i) lead in blood and some soft tissues, which form a rapidly exchangeable pool; (ii) lead in soft tissue and loosely bound to bone, also rapidly exchangeable; and (iii) lead tightly bound in the skeleton which comprises the major body burden. Although the determination of the concentration of lead in blood has limitations, it does give an indication of the amount of lead circulating in the blood at any one time. /As has been explained earlier (paragraph 93) it is generally considered the most reliable biochemical index of recent lead exposure particularly in relation to environmental sources. The determination itself requires skill and meticulous attention to detail if inaccurate and imprecise results are to be avoided, especially at low concentrations of blood lead. At a value of 15 µg lead per dl blood the analyst should achieve a result within ± 10% provided the quality control is meticulous. Many publications give no indication of accuracy and precision, making it impossible to assess the significance of the findings. Independent quality control schemes are essential to maintain standards of analysis Results found in such schemes indicate that satisfactory accuracy and precision are not always obtained.

132. Since determinations on bone, which would be the best indicator of long-term exposure, are not feasible, some studies have been made on shed or extracted teeth of children. The determination of tooth lead is more complex than that of blood lead. Moreover, concentration appears to be higher in incisors than in molars, and dentine is reported (Shapiro et al 1972) to have an increased concentration of lead compared with that of enamel. In some studies the whole tooth is analysed, in others the crown and in some lead is determined in the individual tissues of the tooth. Note should be taken of these variables when comparing different sets of data. Accuracy and precision and the reproducibility of methods for separating dentine

are exceedingly important in these determinations.

133. Some work has been performed on hair lead (Pihl & Parkes, 1977). This material presents problems with respect to the removal of surface contamination without extracting lead from the hair itself (paragraph 93). Hair is also affected by cosmetic treatments, and samples of hair must be taken from identical parts of the scalp and an identical part of the length of the hair. Lead concentration in hair is not such a good indicator as blood of recent exposure, or as teeth as a measure of long-term exposure.

134. The Working Party was hampered surprisingly often by the omission of necessary data from published papers and in several cases direct approaches were made to the authors to obtain supplementary information. Published findings were assessed as far as possible in a standard manner, checking carefully such specific matters as the sampling and analytical methods used in the determination of lead in the environment, blood, teeth or other tissues, the types of tests used to study intellectual and behavioural development in children and the way in which the studies were designed and conducted. As a result it became apparent that there are critical defects in large parts of the evidence. Correct epidemiological methods are essential in such work; the selection of an appropriate population for study, the choice of controls and the need to obtain results from a sufficient proportion of those selected for study, are examples of points which are vital if valid results are to be obtained but which are often neglected in the work which we have reviewed. At the same time we emphasise that the subject is inherently difficult. Variations in intelligence and behaviour are associated with many social, genetic and environmental factors, which must be taken into account in any

study which hopes to distinguish any effects of lead. Intelligence, behaviour and the interfering factors are very difficult to measure reliably. A point which requires emphasis is that association does not necessarily imply causation; in order to judge the confidence with which cause-and-effect relationships could be inferred from the studies as a whole, we used the requirements set out originally by Sir Austin Bradford Hill and which are reproduced in Appendix 3.

135. There are difficulties in obtaining sensitive and valid measures of children's intellectual and behavioural functioning, especially if group tests have to be applied to samples of the general population. Tests used vary from rather crude screening to detailed individual testing of a wide range of skills. The former will not only constitute less valid reflections of intelligence, but will also be more likely to miss deficits which are restricted to certain specific types of intellectual functioning. For most standard tests the child has only to sustain his attention and performance over limited periods. Consequently the tests tend to be insensitive to deficits which concern the child's ability to organise his work and to sustain application and attention over long periods when unsupervised.

136. The results of most intelligence tests are expressed as an Intelligent Quotient (IQ) which is standardized for age to give a mean of 100 points with a standard deviation of 15 points. Where the tests are carried out by several examiners, the variation can sometimes be very large unless testers are well trained. However, the most likely source of bias can be the examiner's prior knowledge of the child's lead levels, for where assessments have not been 'blind' there is alway the possibility that any differences found may have been an artefact

resulting from the examiner's expectations.

137. The problems concerned with the measurement of behavioural disorders are discussed later in this chapter. It is desirable to carry out the observations on eg activity level, in at least two situations as the assessments made at home and at school only correlate weakly.

Effect of Social Conditions on the Measurements

138. One of the major problems in both analysing and interpreting studies of this type is that of confounding variables. Exposure to lead tends to be associated with poor environmental conditions, eg old houses with lead-containing paintwork, houses close to sources of lead emission, such as smelter or battery works, or to roads with high traffic density. In general, children with lower than average intelligence tend to come from families living in areas where the standard of nutrition and schooling may be low and where their companions are affected by the same depressed environment. Often such areas are in the inner part of a city where the exposure to lead is also greatest.

139. For example, descriptions of the living conditions of the children from areas close to lead smelter works at the time of some of the studies considered illustrate the type of social problems which can occur. In the first the description is of Mexican Americans living in the community of Smeltertown, El Paso. "Smeltertown was a small (o.1 km x 0.5 km) community isolated by the Rio Grande River and a large lead smelter. The area contained no drainage system, no municipal sewage system, no grass and essentially no traffic. Annual precipitation is 6-8 inches a year, but approximately half of this

comes in one or two storms during the summer. The earthen yards and streets provided a convenient playground for year-round out-door activity. We identified 206 children living in this area" (McNeil et al 1975). The second written by a journalist in 1972 refers to the Isle of Dogs in England. ".....A Desperate Place.....Every indication of urban health is pointing resolutely downward. The housing is mostly unattractive and unpopulated.....At one stage there were 400 Council flats untaken. It is hard to see why any young people should stay".

140. However, although the same terms are used in the USA, UK and other countries to describe variables such as poor housing or social class, social patterns may differ widely so that their effect cannot be easily translated from one country to another oreven from one study to another.

Effect of Medical Conditions on the Measurements

141. As well as the confounding variables due to social conditions there are many medical conditions which can have a depressing effect, both permanent and transitory, on the child's response to an IQ test. Babies who have suffered various forms of birth injury and anoxia, as well as children who have brain damage from an infection or an accident may well have a permanent IQ deficit ranging from slight to gross. Although it is normal practice to exclude these children from the analysis, it is not always done. Minor degrees of ill-health, such as an infection, anaemia or poor nutrition, may cause a temporary lack of responsiveness. While motivation is usually included as part of the general psychological assessment of the child, most studies rely on a single IQ measurement so that no allowance is made for any

temporary upset in the child. Children who are mentally retarded may take longer to learn to walk and may therefore be exposed to lead containing dust and dirt for a longer period than those who are mobile earlier, as well as being more likely to have abnormal habits, such as eating paint, plaster and dirt. Thus, they run the risk of having a higher than average intake of lead.

Terminology

142. Several terms used in the studies have different meanings in the USA and the UK or are not precisely defined and are difficult to interpret.

(a) Asymptomatic lead poisoning: The symptoms which suggest early lead intoxication are apathy, loss of appetite, anaemia and abdominal pain. Convulsions, ataxia, persistent vomiting and coma denote the onset of encephalopathy. The terms clinical, subclinical, asymptomatic and symptomatic are used to distinguish the cases clinically, but they are often not precisely defined. This means that whereas cases with lead encephalopathy will be called clinical or symptomatic, it is not always clear into which group patients with symptoms or signs of lead poisoning not involving the central nervous system are assigned. (b) Pica: This term is used loosely in the literature and is usually defined as the ingestion of non-food materials such as paint and dirt and is described in more detail in Chapter 5. The same word is sometimes used to describe 'mouthing' where the material is not ingested. The term is used differently by various authors. (c) Hyperactivity: The term is used differently in the USA from the UK. This subject is discussed in more detail later in this chapter.

Selection of Cases for Study

143. Population studies carried out in the UK have shown that the proportion of children with raised lead levels is small. With the increasing use of more sophisticated psychological tests which are time consuming and expensive, the number so examined has to be restricted and as it is rarely possible to include all children, some form of sampling has to be carried out.

144. In many studies the concentration at which the blood lead is called "raised" is prejudged; usually around 30 or 40 µg/dl. A child with a blood lead above this is then matched with another child whose blood lead is below this level. Because there is no top limit the "raised" blood lead concentrations can have a wide range. Nevertheless, if a deficit in the IQs is found, the prejudged cut off point is often taken as the threshold level above which the lead in the blood can have a deleterious effect, although this may not be so. In interpreting these findings it is important to bear in mind that the number of children with the higher blood lead concentrations is usually very small and the results in this group can vary considerably. The results of matched control studies cannot reveal directly a dose response relationship; only studies sampling across the total population can do so.

145. The greatest problem, however, lies in the selection of children for comparison. The majority of studies attempt to find matched controls but with so large a number of variables the matching has to be limited and it is rare to take more than one control. In some cases no attempt has been made to match the groups and statistical methods, eg multivariate analysis, are used to assess the relative contributions made by various factors to explain the associations observed. Unfortunately full details of the methods used are often

omitted from the published reports. Most statistical tests are applicable to a normal distribution but that of blood lead values is skewed. The use of inappropriate methods of analysis will therefore result in problems of interpretation.

Effects of Lead on Intellectual Function

146. Different issues arise in connection with different types of investigation. These are discussed under the following headings: clinic-type studies; studies of mentally retarded children; smelter studies; and general population studies of dental lead.

Clinic-type studies of children with high lead levels

147. Under this heading the following studies were considered: De la Burde and Choate (1972, 1975); Perino and Ernhart (1974); Kotok (1972); Kotok et al (1977); Rum et al (1979); Baloh et al (1975); Needleman (1977); Albert et al (1974); Sachs et al (1978, 1979); Pueschel et al (1972). Some of these studies report on patients who have received treatment with chelating agents to reduce the blood lead concentration. All these studies were carried out over a period of seven years during which time there has been a considerable accumulation of knowledge. The findings tend to be contradictory; some studies claim that persistently raised lead levels above 60 µg/dl can be associated with a reduction in performance in intelligence tests among even asymptomatic children; on the other hand, other studies do not claim to show this relationship. Greater decrements and associated behavioural disorders are evident in children who have suffered from lead encephalopathy.

Studies of mentally retarded children

148. Under this heading the following studies were considered: David et al (1976, 1978); Moncrieff et al (1964); Gibson et al (1967); Youroukos et al (1978); Beattie et al (1975); Moore et al (1977b). Imperfect methods were used in all of these studies which makes it difficult to draw any conclusions (Rutter, 1980). The findings are sufficient to mark these out as potential risk groups for increased lead exposure but it remains uncertain how far the raised lead levels are a cause or effect of the mental retardation.

Smelter studies

149. Under this heading the following studies were considered: Lansdown et al (1974); Landrigan et al (1975 a & b); Whitworth et al (1974); McNeil et al (1975); Hebel et al (1976); Ratcliffe (1977); Wagner (1976); Gregory et al (1976). As noted, studies of children living nearby compared with those far away from an extrinsic source of lead should constitute a good test of the hypothesis that raised lead levels cause intellectual deficits or behavioural deviance. In fact this has not proved to be the case, in part because very large samples are needed to test for small differences and in part because of incomplete reporting and inadequate analyses of some of the studies undertaken. Some of the studies report a mean IQ deficit of up to 5 points associated with raised lead concentrations in an approximate range of 40-80µg/dl. However, other studies with equally high blood levels do not show this relationship.

General population studies of dental lead

150. Several general population studies of dental lead published in the last few years have suggested that modest exposure to environmental lead may be causally related to intellectual deficits in children. In view of the importance and implications of this suggestion, a fuller discussion of the relevant studies will

be included in this section.

151. Needleman and Shapiro (1974) reported that dentine lead levels are higher in children with lead poisoning than in asymptomatic children; similar results have been obtained by De la Burde and Choate (1975). It is also known that dentine lead is higher in a school district in Philadelphia in which there was a high concentration of smelters, foundries and lead processing plants than in a district without these industrial activities (Needleman et al 1974) and this difference has been attributed to airborne lead.

152. A more recent study (Needleman et al 1979) has investigated the neuropsychological functioning of children in the general population with 'high' and 'low' levels as assessed by dentine analysis using shed deciduous teeth from first and second grade children in two towns in Massachusetts between 1975 and 1978. Of 3329 children, 2235 donated one or more teeth and the teachers completed a behavioural assessment questionnaire on 2146 of these children. The mean lead level of the teeth was 14 ppm (µg/g) with a Standard Deviation of 9 (Needleman 1979). The analysis was repeated for those in the highest 10th centile (greater than 24 µg/g) and in the lowest 10th centile (less than 6 µg/g). If the concordant samples gave a mean level of greater than 20µg/g or lower than 10µg/g they were classified as 'high' and 'low' lead respectively and the remainder were called unclassified. This gave a total of 524 subjects of whom 254 were excluded because of "bilingual homes, not interested, moved, infant at home, two working parents etc"; the remaining 270 children were tested but of a further 112, 76 children "whose birth-weight was below 2500g, who were not discharged at the same time as their mother after birth, or who had a history of noteworthy head injury and any child who had been diagnosed as lead-poisoned" were excluded; the remaining 36 were excluded because the later tooth analysis was discordant. The final sample for statistical analysis was 158, i.e. 100 'low' and 58 'high' lead.

153. Detailed neuropsychological testing was then carried out in the children of both groups while the mothers completed social and medical questionnaires and tests to assess attitude and vocabulary. In addition, the teachers completed an 11 - item forced - choice behavioural rating on each child. The choice of the tests was generally sound. The high and low lead groups were broadly similar on background variables but the high lead group was slightly older, slightly more socially disadvantaged and the parental IQ's were slightly lower. Variables other than pica, which differentiated the two groups, were used throughout the analyses as covariates. The validity of the high-low dentine lead differentiation was tested through the association with blood lead levels estimated 4-5 years earlier in approximately half of the children. The high lead group had had a mean blood level of 35.5 µg/dl (range 18-54) compared with 23.8 µg/dl (range 12-37) for the low lead group. Unfortunately, no analyses of the children's behaviour or educational attainment were undertaken in relation to these blood levels.

154. After an analysis of covariance, the corrected mean full scale WISC-R IQ of the low dentine group was 106.6 compared with 102.1 for the high lead children ($p = 0.03$). Examination of the individual subtest scores and of the various additional tests showed a general tendency for the high lead children to perform less well. The authors state that verbal performance and auditory processing was particularly impaired but the variations between different types of test functions were quite small. The findings are highly suggestive but some caution is needed in their interpretation. Several questions were left unanswered in the published paper (Needleman et al, 1979) but some were adequately dealt with in personal communication. For example, the dentine lead levels reported, are quite different from those of Hrdina and Winneke (1978), and

De la Burde and Choate (1975). This may be due to methodological differences in sampling dentine lead; a possible source of bias lies in the effect of caries or fillings since both are associated with social variables. However, since less than 1% of teeth were discarded for this reason it seems unlikely that this had any appreciable effect on the results.

155. A further limitation in the published paper is the fact that pica was not used as a covariate although the high lead children had a much higher frequency of this condition (29% cf 11%). Although pica was not associated with the behavioural ratings it was associated with performance IQ in both the low and the high tooth lead group and with verbal IQ in the low lead but not the high lead group. The possibility remains that both pica and raised lead levels are independently associated with lower IQ. Another question concerns the effect of omitting the middle group of children with dentine lead levels between 8.5 and 20. It seems important to know whether the intermediate lead group was also psychologically intermediate; if it were not it would weaken the argument that the association represents a causal influence of lead. Furthermore it is not known how much bias has been created by the very high non-cooperation rate.

156. These data also raise the broader question of how the high lead group had come to have a higher body lead burden and also the adequacy of the control of the family variables which relied on relatively crude and imcomplete questionnaire data. Two further uncertainties arise in the comparison of the results of the Needleman study with those of other investigators. Firstly, his findings are strongest with respect to behaviour whereas in other studies the associations between raised lead levels and behaviour disturbances have been both weaker and less consistent than those with impaired intelligence. Secondly, the findings of a 4-point IQ difference in the means with respect to dentine lead levels equivalent to the difference of mean blood lead of 35.5 to 23.8 µg/dl suggests that a very much greater IQ difference should be associated with blood lead concentrations in the range 40-80µg/dl.

However, this has not been shown in any studies and IQ differences associated with high blood lead concentrations /in asymptomatic children have also been in the 4 to 5 points range, which implies a mechanism very different from that with respect to other biological hazards to the brain, e.g. head injury.

157. It must be emphasised that many of the queries raised here apply even more strongly to most other investigations but the Needleman study has been discussed in detail because it is one of the most comprehensive so far undertaken. The implication of the findings is that children in roughly the top 10% of the dentine lead distribution as defined in this study differ from those in the bottom 10% in intelligence and the mean difference in the intelligence quotient is of the order of 4 points after correcting for differences in family background. It is suggested that the 4 point mean difference in the two groups is associated with a difference in mean blood lead concentrations between 23 and 35 µg/dl although this is based on blood lead determinations performed some 4-5 years previously on approximately half of the children involved in the study.

158. There is an urgent need for independent replication of the above study and in this connection that of Hrdina and Winneke (1978) appears particularly crucial. The basic design, i.e. studying extreme groups was similar. Incisor teeth were collected from 458 seven to ten year old children in the German city of Duisburg. Twenty-six children with a dentine lead below 3 µg/g (mean 2.4) were compared with 26 with a level exceeding 7 (mean 9.2); the groups being matched on age, sex and father's occupation. The response rate differed between the groups (77% control and 61% high lead). The two groups did not differ significantly in background characteristics but the high lead group showed more perinatal risk factors. The high lead group had a mean IQ level some 5 to 7 points below controls but the difference fell short of statistical significance. The results of the study are generally in keeping with those of Needleman et al (1979) but unfortunately the numbers were small and the group differences were not controlled for background factors. The queries raised with respect to the Needleman et al (1979) study also

apply in this case. It should also be noted that the dentine lead levels in this study were lower than those of Needleman et al (1979) ('the mean of 9.2 μg/g in the high lead group was less than half the lower cut-off of 20 used in the latter study).

157. Together these studies (Needleman et al 1979 ; Hrdina and Winneke 1978) provide some evidence of an association between raised tooth dentine lead levels and a slight lowering of measured intelligence. There are a number of reservations about these studies and the inferences to be drawn from them which in our view weakens their conclusions.

Effects of Lead on Educational Attainment and Behaviour

160. In an earlier study on children with lead poisoning (Byers and Lord, 1943) most of the children showed poor school performance after lead intoxication but the absence of either controls or pre-poisoning measurements makes it impossible to determine how far the psychological deficits were directly due to the lead intoxication. Following these findings concern has been expressed that exposure to lead has adverse effects on children's psychological development. However it should be noted that methods of treatment have now improved considerably. In recent years the hypothesis has been proposed that lower levels of lead absorption than those leading to lead intoxication may be associated with an increase in learning difficulties and behavioural problems. In particular, it has been claimed that increased blood lead concentrations are associated with hyperactivity. This section wil examine the evidence in relation to associations with children's behaviour in three areas:- (i) educational attainment; (ii) hyperactivity and (iii) other behavioural disorders.

(i) Educational attainment

161. Although widespread concern has been expressed that raised blood lead concentrations are

associated with poor educational attainment, sound evidence on the strength and nature of such an association is lacking. Some studies have relied on global ratings made by teachers or parents, often after the lead level is known, and little attention has been paid to the intricacies of measuring educational attainment. Two main conceptual distinctions need to be recognised. Firstly, poor educational attainment is clearly related to a wide range of indices of social disadvantage (Rutter, et al 1970b). Since such measures also appear to be related to higher blood lead concentrations it is necessary to demonstrate statistically that lead and attainment are still related after the influence of mediating social factors has been taken into account. Secondly, it is recognised that backwardness in attainment must be differentiated from underachievement (Rutter and Yule, 1975). Whilst it would be of concern to find that children with relatively high blood lead concentrations tended to score at lower levels than their peers on standardised tests of reading, mathematics, spelling or other tests of educational attainment, it would be of equal concern to discover that they were underachieving in the sense of doing less well than expected on the basis of their measured intelligence. To date, no study has used adequate measures of intelligence and attainment to allow such questions to be answered.

162 Albert et al (1974) reported an increase in special class placements in schools in children with symptoms of lead poisoning other than encephalopathy (19%) and in children with blood levels above 60 µg/dl (9%) compared with a control group (3%). However, the children's attainment was not measured, and the groups were not matched for socio-economic variables. Pihl and Parkes (1977) attempted to examine the association the other way round. They compared the hair lead levels of 31 "learning disabled" children with 22 controls. Unfortunately, their definition of "learning disability" is unacceptable psychometrically, so that their findings of higher levels of many elements, including lead, is of doubtful validity. Lansdown et al (1974) gathered data on children's intelligence and reading levels, but did not publish the latter results. However, they found no

relationship between blood lead levels and scores on a word reading test. (Lansdown, personal communication).

163. Hebel et al (1976) report a tendency, although not statistically significant, for children living closer to a battery factory in Birmingham to score about 1 or 2 points lower on verbal reasoning, mathematics and English than those living further away. The differences remained after adjusting for social class, birth rank and maternal age. However, since the children's blood lead levels were not taken it is difficult to relate these findings to actual, as opposed to assumed, lead exposure. Needleman et al (1979) assessed the children's educational attainment but do not report their results.

(ii) Hyperactivity

164. Although it appears to be widely held that an association has been demonstrated between high body lead levels and hyperactivity in children, there is no satisfactory evidence which confirms this view. It is clear that American writers use the terms "hyperactivity" and "hyperkinesis" much more loosely than clinicians in Britain (Sandberg, et al 1978). Recent evidence suggests that children's levels of activity must be monitored in at least two different settings before a diagnosis of hyperactivity can be considered. Moreover, few of the existing rating scales stand close psychometric scrutiny.

165. The main papers which relate to this question are summarised below. Baloh et al (1975) compared 27 high lead children with a similar number of low lead children. While the two groups did not differ on a number of indices such as IQ scores, and did not differ on their level of activity during testing, nevertheless, 44% of the high lead children compared with 15% of the controls were regarded as 'hyperactive' by either parents or teachers. It is unfortunate that standardised questionnaires were not used since this markedly reduces the weight that can be given to this isolated finding. Landrigan et al (1975 a & b) found no

differences between high lead groups and controls on hyperactivity whether measured by parental questionnaire or as observed by a physician. McNeil et al (1975) used the Werry-Weiss-Peters hyperactivity scale and found no difference between high lead children and controls. Needleman et al (1979) asked teachers of over 2,300 children to complete an unstandardised, crude rating scale of 11 simple yes-no items. Nine of the items showed increasing "pathology" with increasing tooth lead levels. One of the items which failed to show such a relationship was 'hyperactive'. David et al (1972, 1976b,1977) studied hyperactive children and claimed that they had higher levels of lead in their blood. However, his definition of hyperactivity in this study is dubious and, the methodology is such that no firm conclusions can be drawn from his work.

(iii) Other behavioural disorders

166. What is really at issue is whether small increases of lead in the body cause subtle alterations to the functioning of the central nervous system (CNS). Unfortunately, only the grossest changes in CNS functioning can, at present, be reliably detected (Rutter, et al 1970a). Attributes which have long been regarded as associated with CNS dysfunction, such as disturbances in attention span, distractibility, poor learning, etc, cannot be readily measured. Certainly they cannot be adequately measured by rating scales completed by parents and teachers. It is possible to make some assessments using time-consuming individual testing in laboratories. To date such studies are rarely done with any groups of children and so it is not surprising to find few good studies of children with high body lead burdens.

167. Following work with adult patients affected by very high lead doses, some studies have investigated children's reaction times. Needleman (1977) reports a significantly slowed reaction time in his high lead group. Landrigan et al (1975 a & b) reported that their high level group were significantly slower in a wrist

tapping test. Rummo (1974) reports that high lead concentrations were associated with slowed reaction times, slower wrist-tapping and poor leg co-ordination. The effects were most marked at very high lead levels, but trends were also evident at more modest levels. Baloh et al (1975) found that their high lead group did less well on tests of fine motor ability, although the difference was not statistically significant. Two studies report on the results from applying the Frostig Test of Developmental Perception; Needleman (1977) found significantly lower scores on eye-hand coordination, but Ratcliffe (1977) reported only small and non-significant differences between her groups. This discrepancy may reflect little more than the crudeness of the tests used. De la Burde and Choate (1972) found that their high lead group contained 32% with reportedly short attention spans compared with only 14% in their control group. Only one other study appears to have commented on this directly. Needleman et al (1979) report near-linear relationships between tooth lead level and distractibility, lack of persistence, impulsivity and daydreaming. Unfortunately the rating scale items were not standardised and social and other factors were not taken into account.

/68. In summary it can be stated that up to the present no study has satisfactorily demonstrated a relationship between increasing body lead burden and either educational attainment or hyperactivity. Measuring subtle effects requires sophisticated techniques, and these have not so far been employed. There are far fewer data on all aspects of behaviour and adjustment other than intelligence. There are a few indications that reaction times and fine motor coordination may be impaired at high lead levels, but it must be stressed that these are very tentative findings.

Epidemiological Aspects of the Papers on the Effect of Exposure to Lead on the Mental Development of Children

/69. The object of this section has been to devise a framework which would enable the

results from several studies on the effect of exposure to lead on the mental development of children to be compared with each other. Sixteen published papers were found which would allow such a comparison. The studies were of three types:-

(a) Effect of pollution from smelters or lead battery works. There were five in all. Two compared the children with blood levels of over 40 µg/dl with matched controls who had levels of less than 40 ug/dl (Landrigan et al 1975b; Gregory et al 1976). One had a complicated structured sample comparing children with different blood lead levels (Ratcliffe 1977). The remaining two compared populations living at varying distances from the smelter (Lansdown et al 1974: McNeil et al 1975).

(b) Population studies. In two cohort studies, the children had been followed up since birth and, from information already gathered, groups were defined and compared with matched controls from the same cohort (De la Burde and Choate 1972, 1975). There were three studies where the children had been selected from a school population who had donated teeth. Those whose teeth had a high lead content were matched with others with a low lead content (Hrdina and Winneke 1978) or the group with the highest tooth lead was compared with another group with the lowest tooth lead, but they were not matched (Needleman et al 1978, 1979).

(c) Hospital studies In these five studies, selected hospital patients with a history of exposure to lead were compared with a control group. In the first patients were matched with their siblings (Sachs et al 1978). In three studies patients with varying degrees of lead intoxication were matched with controls (Albert et al 1974; Kotok et al 1977; Rummo et al 1979). In the fifth, patients with blood lead levels greater than 50µg/dl were matched with patients with a level of less than 30µg/dl (Baloh et al 1975).

Measurements

170. To compare the results it was assumed that the deficit between two IQ means using the same standardised scale could be compared with the deficit between two IQ means using another standardised scale, regardless of the age of the children. While it is possible that these differences are not strictly comparable, it is unlikely to have any appreciable effect upon the results and the conclusions drawn from this analysis. Unfortunately, the lead levels were not so easy to compare, as different methods were used to identify the high and low lead groups. In some cases the blood analysis had been carried out several years before the IQ tests. Where the blood tests had been repeated when the IQ tests were carried out, those nearest in time were used in the analysis. Sometimes mean levels were not given, merely the cut-off points, e.g. above and below 30µg/dl blood lead. In some the mean related to a wide range of observations, while in others the distribution was curtailed. Therefore, the differences between the mean IQs and the mean blood levels could not be compared in all the studies. A major difficulty which is inherent in any combination of studies is that the results of investigations of a very different quality have to be pooled.

Effect of ordering the mean IQ differences

171. The studies were first ordered according to the differences in the mean IQs between the high and low lead groups and according to the type of study. Two of the hospital studies included different groups of patients, compared with a single control and these were separated so that each group could be compared with the control. There were, therefore, 20 items among the 16 studies.

172. The comparison is presented in Table 14 and diagramatically in Figure 3. Along the bas of the figure are the number of studies according to the differences in mean IQ and above each study is the highest and lowest mean blood lead level (where known). It can be seen

that there is little relationship between the size of the difference between the mean blood lead concentrations and the mean IQ differences. However, there is an ordering of the studies. The results from the hospitals spread from no effect to a large deficit in IQ. Those from the smelter studies range from no loss to a deficit of 5 points, and those from the population studies a deficit of 4 up to 10 points. All three types overlap around the 5 point mark resulting in a clustering of the observations.

173. Both of the smelter studies where no loss of IQ was noted were concerned with the proximity of the homes of the children to the smelter works. In the first the whole population was used. In the second those living close to the works were matched with children living further away. These were the only two independent studies which had similar designs; in both cases the blood tests were carried out two to four years before the IQ tests. One showeda deficit of 2 and the other of 5 points in the IQ. One study was different from the others because of the sampling method, the use of the Griffiths test, the young age of the children, the fact that the source of the lead was a battery works and that the blood samples were taken two years before the IQ test. In this study there was a deficit of 5 points IQ.

174. Only two population studies recorded the blood lead measurements and the differences between the means were the smallest among all the papers. These two and one other study did not use matched controls and relied on later statistical analysis to correct for any bias. On the other hand in the study with the smallest IQ deficit, the children who had pica for paint were matched with others in the cohort who did not; unfortunately blood lead measurements were not given but the differences between the mean tooth lead levels were large (202 and 112 µg/g).

175. In the hospital studies the criteria for selecting the index cases were usually more carefully defined than in the other studies. All were compared with controls and, where the blood lead concentrations were known, the mean differences were greater.

The largest deficit in IQs occurred in those children with symptoms and there was little or no deficit where the differences in the mean blood lead concentrations were small. Intermediate deficits occur but it is difficult to draw conclusions from them since they are associated with wide ranges of blood lead concentrations, not all are controlled for pica and there is wide variation in the duration of exposure.

176. The hospital studies suggest that the presence of lead encephalopathy can result in an overall lowering of the IQ of the children, but the extent of the deficit is difficult to quantify and may even be relatively small if the family background and improved treatment over the years is taken into account. They do also suggest that only minor effects can be demonstrated despite quite high blood lead levels if the patients are asymptomatic. However, hospital patients are a highly selected group and studies based on their experience and extrapolated to the community as a whole can be misleading.

177. Logically it might be expected that the children living close to smelter works would be exposed to the same hazards as the population as a whole as well as the emissions from the works so that their blood lead levels would be higher than those in the population studies. With one exception this is true. In one study the control group had a slightly lower mean blood lead level than that of the low lead groups from the population studies, but in this case the control group was taken from children living some distance from the works. All the high levels were much greater than those of the population studies and, therefore, the differences between the blood means were much greater. But, contrary to expectations, the IQ deficits were generally less than those found among the population studies.

178. This review has shown that the deficits in IQs noted in the various studies show little relationship with the size of the difference in the mean blood lead levels. It suggests that the selection of the control group is of crucial importance and it may be that factors other than the exposure to lead may have a

more direct bearing on the IQ differences. In addition, several of the studies suffer seriously from a large loss of cases, which could introduce serious bias and from inadequate matching. It should also be noted that in most of the studies there is inadequate description of the main source of lead, its chemical and physical form, the length of exposure or the dosage.

Applicability of Findings to the United Kingdom

179. As already mentioned most of the surveys on the effect of exposure of lead on children have been carried out in countries other than the UK where social and educational conditions may be different. In the American studies where a group of children with "raised lead" levels had been matched with a "low lead" group for sex, social class and other variables, the mean IQs of the low lead control groups were below the population average of 100. For example, in the three American smelter studies (McNeil et al 1975; Landrigan et al 1975b; Gregory et al 1976) the mean IQs of the matched controls were 89, 93 and 96 and in the hospital studies they were in the lower 90s or the upper 80s. It is only in the unmatched population studies that the mean IQs of the control groups were above 100. In the two American studies (Needleman et al 1978, 1979) they were 109 and 107 (WISC-R) and in the German study 130 (HAWIK) (Hrdina and Winneke 1978).

180. No general population surveys have been carried out in this country. Three smelter type studies have been undertaken, but without matched controls as they were designed to demonstrate the effect of lead emitted from a single source and either all the affected population or a representative sample was examined. In one of these studies using WISC the children living close to the smelter had results which were marginally higher than those of the children living furthest away (Lansdown et al, 1974). In another, with assessments based on 11+ examination results, the children living close to a source of lead contamination (a battery

works) had results which were virtually no different from those for children living further from the source (Hebel et al 1976). In neither of these studies did the differences reach statistical significance. In the third (Ratcliffe 1977) the general quotient was 108 (Griffiths) in the "moderate" lead group and 102 (Griffiths) in the "high" lead group; this difference was not statistically significant and an analysis of the various factors affecting the results showed that the variations in the developmental scores appeared to be related to age and attendance at primary school.

/81/ There have been several surveys of mentally handicapped children in the UK which have shown that mentally retarded children, on average, have higher blood lead levels than children who are not retarded (Moncrieff et al 1964: Gibson et al 1967; Moore et al 1977b; Beattie et al 1975). As already discussed, it is not possible to say from these studies whether the lead was a contributory cause of the mental handicap or vice versa. Thus, the few studies in the UK of asymptomatic children have not so far demonstrated a significant deficit in IQ due to exposure to lead and, in the light of the results from the EEC survey (Appendix 2) the impression is gained that the proportion of children with a raised blood lead level might not be as great as that found in the USA (Morbidity & Mortality Weekly Report 1979). However, the number of UK studies is very limited and the need for further research is again stressed.

TABLE 14

STUDIES ORDERED ACCORDING TO THE TYPE OF STUDY AND THE DIFFERENCE IN MEAN IQs

Study No.	Difference in IQ	Test	Difference in mean Blood Lead	Range Blood Lead High	Range Blood Lead Low	Notes
SMELTER STUDIES						
1	+ †	W	-	-	-	Total population.
2	+ 1	W	30	14-93	7-43	Living close to smelter matched with those away.
3	- 2	W	26 ♯	-	-	> 40 matched with < 40
4	- 5	W	14 ♯	22-58	15-39	> 40 matched with < 40
5	- 5	G	16 ◇	36-74	18-35	> 35 and < 35 structured sample. Battery works.
POPULATION STUDIES						
6	- 4	W	Tooth	-	-	Pica with paint v controls. From known cohort.
7	- 5	W	Tooth (Blood 12)	Top blood level (54.0)		Selected from lowest and highest tenth centile. Not matched.
8	- 5	SB	-	-	-	Pica with paint plus those with raised blood lead v controls. From known cohort - no blood lead measurements.
9	- 7	W	Tooth (Blood 11)	(18-54) Blood	(12-37) Blood	Tooth < 8.5 compared with > 20. Not matched.
10	- 7	W(H)	Tooth	-	-	High tooth (mean 9.2) matched with low (mean 2.4).
11	- 10	Mc	-	40-70	10-30	Inner city population. Not matched.
HOSPITAL STUDIES						
12	+ 5	W	Tooth ◇	-	-	Blood lead < 60 both groups. Tooth high in one.
13	+ 2	W	-	50-365	<40	Patients v siblings.
14	+ 1	Mc	25	Max 61	Max 23	Short exposure v controls.
12	+ 1	W	Tooth ◇	-	-	Blood > 60 asymptomatic v < 60.
15	- 1	W	20 ♯	13-69	13-39	> 50 v < 30 at earlier test.
16	*	-	51	61-200	11-40	Pts. v controls. Matched for pica.
14	- 6	Mc	30	Max 68	Max 23	Long exposure v controls.
12	- 12	W	Tooth ◇	-	-	Blood > 60 symptomatic v < 60.
14	- 17	Mc	37	Max 88	Max 23	Encephalopathy v controls.

FOOTNOTES

All blood leads are expressed as µg/dl.

≠ Sampled from results of an earlier blood test. The mean concentration is that at the time of the IQ.

◇ Blood lead levels taken some years before the test.

( ) The figures in brackets are differences in mean blood lead concentration (taken 4-5 years previously) the primary measure being difference in tooth lead.

† A series of different measurements given. All mean IQ results higher in high lead group.

* A series of cognitive measurements given but no formal IQ tests performed. The differences in IQ equivalents varied from -1 to -9. No significant differences in classes evaluated.

IQ Tests: W = WISC SB = Stanford Binet W(H) = WISC (Hamburg Weschler Intelligence test for Children)

Mc = McCarthy G = Griffiths

REFERENCES

STUDY NO.

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14. Rummo, J.H. et al. (1979)
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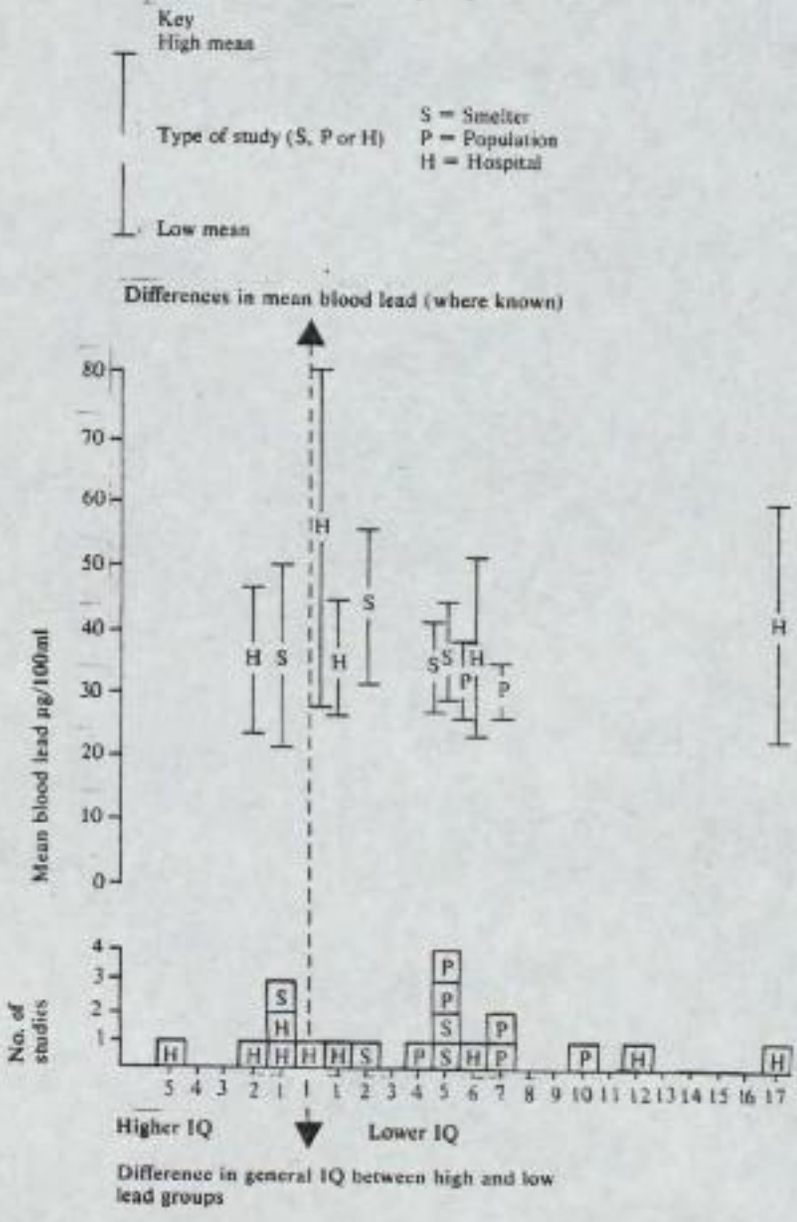
16. Kotok, D. et al. (1977)

Figure 3: Differences in mean IQ and mean blood lead in high and low lead groups



CHAPTER 8

DISCUSSION AND GENERAL CONCLUSIONS

182. The main body of our report gives a clear indication of the complexities of the issues that we have studied and the inconclusive nature of the evidence concerning adverse effects of small amounts of lead taken up gradually from environmental sources. Despite the appearance of several new and important reports on this topic during the course of our work, many uncertainties remain; there is still much difficulty in assessing the magnitude of any effects and in trying to disentangle the role of lead from that of many other relevant factors liable to affect mental development and behaviour. We have noted that several new studies are in progress, in this country as well as abroad, and we have put forward recommendations for further research. The problem is by no means resolved; while we hope that better designed studies will help to clarify some of the outstanding issues, we recognise that it will remain difficult to obtain clear-cut answers.

183. We have not considered it necessary to devote much time to the relatively well-understood question of lead poisoning. While there has been a reduction in the occurrence of such cases over the past few decades, we are concerned about the numbers that still occur. An attendant worry is that there

may be additional cases that are not reported or that remain undiagnosed. By far the largest proportion of clinical cases of lead poisoning among children arise through pica (defined in paragraph 142), as has been described earlier in this report.

184. We have noted the requirements of the EEC regarding blood lead concentrations in the general population, and the reference levels recommended by WHO. In the absence of clear findings relating blood lead concentrations encountered in the general population to defined effects on health we have not ourselves sought to give any guidance on threshold levels.

185. An important part of our work has been to identify the circumstances liable to result in elevated blood lead concentrations, particularly in children. Our comments are based on existing exposure levels in the United Kingdom and we have seen that a great diversity of sources is involved. There is clear evidence that 'hot spots' occur and it must be asked whether the exposures involved are acceptable. Progress which is being made, eg in the elimination of special problems of contamination of tap water in some areas, is mentioned in the relevant sections below.

Lead in Food

186. Recent investigations, including monitoring and analysis of diets by MAFF, have shown clearly that most people in the UK derive the major part of their lead body burden from food. We have seen no evidence that conflicts with this conclusion. Part of the lead content of some foods comes from the air through direct contamination and from translocation from soil into vegetables and grasses. The

contribution that this makes to the body burden needs further investigation.

187. The World Health Organisation has set international guidance criteria on permissible levels for lead in food. These are well above the usual maximum amounts that are found in food in the United Kingdom. However, we do not consider it satisfactory to rest on the assumption that because exposure to lead from food in the UK is below WHO limits, a satisfactory state of affairs necessarily exists. We also recognise that MAFF, with the cooperation of the food industry, has been grappling with this problem for some years and that there has been recent amending legislation limiting still further the lead content of - - - food .

188. We have noted that canned foods are a well defined source of lead. Special attention to this point has been given by MAFF who, in conjunction with industry, has introduced specific measures to ensure that lead solder is no longer used in the manufacture and packaging of canned food for infants. Older children tend however to eat the same food as the adult members of the family and it is important to ensure that permitted levels are kept to the lowest possible values. Such action would also minimise pre-natal exposure through the mother. A review of metals in canned food is currently being undertaken by an independent advisory group, the Food Additives and Contaminants Committee, and we would welcome any proposals for further reductions in the lead content of food.

Lead in Tap Water

189. Results from the Department of Environment survey show that,

for some 60 to 70% of the population, drinking water makes no appreciable contribution to the total intake of lead. With some waters, notably those which are soft and acidic, the levels of lead in water are increased when lead plumbing is used; in a few localities a high intake of lead is attributable to this source. The use of such contaminated water for the preparation of infant milk feeds is of particular concern. The lead content of food can also be increas if such water is used for cooking and food preparation. A national programme is under way with the aim of reducing substantially the levels of lead in affected tap water, primarily by the chemical treatment of plumbosolvent waters. An upper limit has been proposed for lead in tap water of 100 µg/l as an average in any household, even in the worst affected areas. We were concerned to learn that it is not at present certain that chemical treatment will always be sufficiently effective, particularly with some plumbo-solvent hard waters, and that where lead lined tanks are fitted it will be ineffective. Pipe replacement would not be practicable on a wide scale but it will have to be considered where there is no effective alternative; where drinking water is at present drawn through lead lined tanks, these should be replaced, lined or bypassed. Water which has stood in lead pipes for some hours usually has a substantially higher content of lead than that drawn after flushing. Water drawn from the hot tap is also likely to have a relatively high content of lead; because of the effect of heat on soldered joints this can be true even with a non-lead system.

190. We welcome the action which is being taken to reduce the levels of lead in water. Urgent attention should be given to areas where water lead levels are sufficiently high to have a marked effect on blood lead concentrations in the population and measures

should be taken to reduce exposure, especially to infants.

Lead in air

191. For most people in the UK uptake of lead from air is of a low order and generally much less than that from food and water. The long-term average concentrations to which rural and most urban dwellers are exposed are almost certainly less than 0.5 $\mu g/m^3$ and for the rest they probably do not exceed 1 $\mu g/m^3$. If it is assumed on the basis of results from experimental studies that each $\mu g/m^3$ in the air raises the blood lead concentration by about 2 $\mu g/dl$, then with blood leads in the typical range of 10 to 20 $\mu g/dl$ (derived from all sources) the contribution from air-lead for such people would be of the order of 10% and possibly a little more if allowance is made for intake of airborne lead via dust. Doubts remain however about the form of the relationship between air-lead and amounts in the blood. There are some "hot-spots" where long-term average concentrations may be as high as 6 $\mu g/m^3$; continuous exposure to such air lead concentrations may well make air lead the major contribution to uptake for some individuals. We recommend that further monitoring of lead in air should concentrate on identifying local "hot-spots", whether arising from traffic or from industrial sources and that the extent of the increase in blood lead which results from long term exposure in such circumstances should be investigated.

192. About 90% of airborne lead is derived from petrol; industrial sources may however contribute appreciably to air lead levels in their immediate vicinity. Although there are indications that in some localities contributions from traffic slightly increase blood lead concentrations, the results of recent surveys among adults and children living near busy road junctions and motorways show that blood lead concentrations are within the limits specified by the EEC. The surveys also show that effects from living close to a smelter or in a leadworker's family on the blood lead of children need not be great but the EEC criteria for blood lead in populations were not met in the case of three groups of children due to local factors related to the lead works. It is therefore clear that there need be little ri

of increased intake for people living near a lead works but constant care is needed if emissions are to be kept to acceptably low levels and particular attention may have to be given to scrap yards and some small lead-using industries.

193. On the basis of the information available to us we consider that to avoid the possibility of excessive intake of airborne lead annual average concentrations should not exceed the 2 $\mu g/m^3$ limit suggested by the EEC for places where people are exposed continuously for long periods. We return to the role of lead in petrol and in vehicle emissions in paragraphs 208-209.

Adventitious sources

194. In some sections of the community a wide variety of sources that are not common to the environment as a whole may be encountered, particularly by children, in and around the home. The main adventitious sources of lead are commonly associated with elevated blood lead concentrations and they are the most important and perhaps the only cause of overt clinical lead poisoning in the non-industrially exposed population in the United Kingdom. We believe that the majority of such cases are preventable.

195. Risks of exposure depend on personal and social factors as well as on the presence of lead-containing materials; among such factors believed to be important are the age of the child, his nutritional status, how

well he is cared for, the socio-economic status of the family and its ethnic group. The habit of pica is of particular importance. Many of these factors are inter-related and it is not always possible to predict which combination of factors may result in a real as opposed to a potential hazard. Thus, some young children in families in low socio-economic groups may be at increased risk by virtue of residence in an old, poorly maintained home and lack of adequate supervision. Indeed we believe that many cases of lead poisoning from adventitious sources reflect social deprivation.

196. The most important risk is that associated with the presence of old lead-based paint and primers on surfaces in and around houses, or other premises and playgrounds to which young children, and especially those with pica, may have access. In Chapter 9 we recommend a series of measures to minimise exposure from this source. In some localities there are excessive amounts of lead in the soil, for example from former mining or industrial operations, which may also result in increased uptake, especially among young children with pica. Guidelines are being developed for the acceptable lead content of soil in gardens, agricultural land, parks and open spaces, and we strongly support such efforts. Results from a number of surveys have also drawn attention to elevated blood-lead concentrations among Asian sections of the community and some cases of lead poisoning have been reported. These risks appear to be related, at least in part, to the use of lead containing cosmetics or medicines which have been privately imported. The importation and use of these products should be discouraged.

197. Details are given in Chapter 5 of a number of other sources of lead which may affect people in the home and it is clear that unexpected sources are discovered from time to time. The sale of lead-containing

consumer products is controlled by a range of regulations but we stress the constant vigilance required to reduce exposure to adventitious sources in and around the home. While risks remain, there is a strong need for an educational programme for parents and health workers to increase awareness of these potential hazards.

198. We have not considered directly the risks of exposure of workers in lead processing industries and scrap yards to elevated levels of lead, since industrial exposure is the concern of the Health and Safety Executive and/ outside our terms of reference. We have however considered indirect impacts on the community, such as risks of lead dust being dispersed in the home from the contaminated clothing of workers. Studies among occupationally exposed groups with elevated blood lead concentrations have made a valuable contribution to our understanding of possible effects of lead; workers with blood lead concentrations hitherto considered to be 'acceptable' form a group which merits further study, since recent reports (Haenninen et al, 1978, Baker et al, 1979) have drawn attention to the possibility of neurological and other adverse effects among workers with blood lead concentrations below 80 µg/dl.

Effects on Children

199. A large proportion of our time has been devoted to the consideration of the effect of lead on the intelligence, behaviour, attainment, and performance of children. While it has long been known that lead in certain concentrations is toxic, it is only comparatively recently that the possibility has been raised that relatively low levels of exposure may result in permanent impairment.

200. There are many medical and social conditions which can cause or contribute to a deficit of measured intelligence. In coming to conclusions on research reports we were aware that exposure to lead is often associated with poor environmental circumstances. In general, children with lower than average intelligence come from families living in depressed areas, where the standards of nutrition and schooling are often low. It is thus difficult to distinguish between the effects of lead and of other factors. Carefully controlled studies with appropriate methods of statistical analysis are essential to the assessment of the relative contribution made by these various factors.

201. The problem of measuring the total lead intake received by a child over a long period has not been solved. The concentration of lead in the blood is generally considered to be the most reliable index of recent exposure to lead. At a blood lead concentration of 15 ug/dl the results will be accurate within ± 10%, providing that the quality control is meticulous. Tooth lead is increasingly being used as an indicator of long term exposure but the concentration of lead varies according to the tooth examined and the part analysed. Again accuracy and precision are exceedingly important. Most of the studies we have seen have relied upon a single measurement of the lead concentration in the blood, without making allowance for the intensity, duration, and time of exposure. The source of the lead is rarely determined and the physical condition of the child is often not assessed.

202. Difficulties exist in the measurement of intelligence and behaviour. Intelligence test construction, administration, and the interpretation of results all present problems and the measurement

of behaviour relies largely on rating scales which may lack precision and reflect what is observed in only one situation. Unless the examinations are carried out by one person or all the testers are rigorously trained, there can be considerable variation in the results. We have taken particular notice of studies carried out by Needleman and his colleagues which use tooth lead as a measure of exposure as they are by far the most comprehensive so far undertaken. We have a number of reservations about these and other studies using tooth lead (see Chapter 7).

203. Some studies have also attempted to examine the relationship between lead and hyperactivity and lead and poor educational attainment but in our opinion the design of these studies falls far short of the quality needed to demonstrate effects and we conclude that a clear relationship between an increasing lead burden and either of these conditions has not yet been demonstrated.

204. In two ranges of blood lead concentrations we have no doubt about effects. There is no convincing evidence of deleterious effects at blood lead concentrations below about 35 µg/dl. It might be thought that the dentine lead studies provide a <u>possible</u> exception to this statement but, as we have pointed out earlier in this report, there are difficulties in their interpretation and it is not possible to translate dentine lead concentrations into blood lead concentrations. We also have no doubt about the neuropsychological consequences of high concentrations of blood lead. Symptoms of lead poisoning and encephalopathy occur with levels in excess of, say, 80 µg/dl. Permanent brain damage may follow encephalopathy, although prompt effective measures to reduce exposure and also blood lead concentration may reduce the risk of permanent sequelae.

205. It is therefore in the range of blood lead concentrations

between 35-80 µg/dl that doubt remains. In the published studies it is customary either to compare the difference between two groups of children, the average blood lead levels being higher in one group than in the other, or to consider blood lead concentrations in several broad groups. There are some studies which report that mean blood lead concentrations in this range are associated with deficits in intellectual functioning of the order of 5 points on the IQ scale, while other studies do not show such an effect. In considering the relative weight to be given to apparently conflicting reports, we note that contrary to usual dose-effect principles there appears to be no consistent relationship between the concentration of blood or tooth lead and the degree of reported intellectual impairment. If there were a causally-linked association one would expect to see such a relationship and its absence lends some support to those reports which have noted no deficit in IQ within the 35-80 µg/dl range of blood lead. At present no single blood concentration of lead within this range can be defined above which an individual child is liable to be harmed. Nevertheless, where a child is found to have a blood lead concentration over 35 µg/dl we would recommend that he or she should be carefully followed up to ascertain the source of the lead and to reduce the exposure of the child and of other persons who might be affected.

206. A number of animal studies have suggested that excessive maternal exposure to lead can cause raised foetal blood lead and subsequent learning difficulties among the offspring. The period of maximum brain growth in animals varies with the species and it is very difficult to extrapolate from animal models to human infants. In humans lead is known to pass the placental barrier and foetal blood lead equates closely with maternal blood lead

although concentrations are usually a little lower. There is a need for further research into the important subject of pre-natal exposure to lead and its relationship to the subsequent mental and physical development of the child. Studies carried out so far have not been of the standard of those following the exposure to lead in childhood.

General Conclusions

207. We believe that one of the objectives required by our terms of reference has been attained, in that we have been able to assess the role of lead from petrol in relation to the other sources of lead in the environment. The temptation to recommend its urgent removal is great, especially in view of the statement which opens our Report: "Lead and its compounds are potentially toxic: the element has no known physiological functions.....". But the task given to the Working Party was to assess the evidence of effects of lead from all sources and our conclusions must be based on strictly scientific grounds, though our recommendations are tempered by considerations of prudence. The Working Party was absolved from the need to take into account economic factors and the question of conservation of energy in making its assessment and consequent recommendations.

208. We have seen that in the vast majority of the population, airborne lead, including that derived from petrol is usually a minor contributor to the body burden. Normally, food is the major source and we have seen no evidence that this is substantially enhanced by contamination by airborne lead. However, our

attention has been drawn not so much to the bulk of the population among whom, according to recent surveys done in the UK in fulfilment of the EEC directive blood levels meet the reference values, but to the small proportion which falls into the upper part of the distribution of blood lead concentrations. There is no indication from the surveys that these relatively raised blood concentrations are due to lead from petrol; they would seem more likely to be due to a miscellany of adventitious sources such as lead-containing paint in and around the home, the use of special cosmetics and medicines containing lead, or to tap water in some localities where the water is especially plumbo-solvent and lead plumbing is used. We recognise that there are local 'hot spots' where airborne lead concentrations are high and we advise that such places merit urgent attention.

209. After the most careful consideration, the Working Party is unanimous in advising Government and industry to take steps by which emissions of lead into the air, whether from the use of leaded petrol or from other sources, are progressively reduced provided that such action does not lessen the priority which it believes must continue to be given to reducing the opportunities for ingestion of old lead-containing paint and primers and of other adventitious lead which have been seen to cause demonstrable harm, and to the control of the lead content of some tap waters which have been seen to be clearly associated with raised blood lead concentrations. Although we have seen no firm evidence that the contribution made by lead from petrol has caused harm, yet recognising that any additional contribution is undesirable in persons whose body burden may already be high as a result of absorption of lead from other sources, measures should be taken to keep the annual mean concentration of lead in air to less

than 2 $\mu g/m^3$ in places where people are liable to be continuously exposed. Such measures could include further reduction in the lead content of petrol, the use of devices to trap some of the lead within the exhaust system, improvements in traffic flow through traffic management schemes, and the re-location of any industrial operations that create local problems.

210. We have not been able to come to clear conclusions concerning the effects of small amounts of lead on the intelligence, behaviour and performance of children. There are some studies which have failed to demonstrate any effects, and there are others which have yielded positive results, but many of the studies which we have scrutinised do not provide evidence from which valid conclusions can be drawn. We are agreed that adverse effects in children who have, for one reason or another, absorbed undue amounts of lead cannot be discounted. We have made recommendations about increased monitoring, general vigilance, and the development of educational programmes aimed at the identification and increasing awareness of unusual risks from any environmental source; we would add a strong plea for the development and application of more satisfactory test procedures for examining intellectual function and behaviour among small groups of children whose exposure to lead can be satisfactorily defined.

CHAPTER 9

RECOMMENDATIONS

Recommendations for Action

211. Although these points have not been given any relative weighting the first three listed are those where there is clear evidence that individual exposure to lead in certain circumstances could be high, with potential risk to health. Urgent attention should be directed to these matters. Recommendations 4,5 and 6 are no less important but the value in further reduction of lead in food and air lie in the need to reduce the cumulative effect from a multiplicity of sources.

(1) There should be a programme for the detection of lead in paint coatings accessible to young children in areas where a high incidence of old lead paint surfaces may be suspected, such as old inner city residential areas.

The lead content of all paint available for retail sale, including paint intended for the exterior surfaces of houses and for institutions, schools and play areas should be as low as is technically feasible. Any paint intended for industrial use which contains lead should be labelled to indicate its lead content and its unsuitability for use in and around the home; all possible steps should be taken to discourage the improper use of such paint (paragraphs 69-75).*

(2) The strongest possible support should be given to local authorities and water undertakings in the programme to reduce levels of lead in tap water in affected areas. The reduction should generally be to the maximum extent possible by reasonable means. Priority should be given to effective

*refers to relevant discussion in main text.

action in areas where individual exposures to lead from water are markedly high. Pipe replacement, or other adjustments to plumbing, must be considered where there is no effective alternative; in particular, lead lined tanks should be replaced, lined or bypassed. The possibility of making grants available to assist in these circumstances may need to be considered. While special problems still exist in some areas, it should generally be recommended that people in affected households should avoid drawing the first run-off for drinking or food preparation, after cold water has stood in the pipes for a few hours or more. Water from hot taps should not be used for these purposes, especially not for preparing infants' feeds. Special attention should be given to affected households where there are babies or expectant mothers and it may even be necessary to make changes to plumbing in an individual dwelling or to supply safe bottled water (Chapter 3).

(3) The private importation and use of lead containing cosmetics should be discouraged and potential users of these products made aware of the hazards which they may present. Hair care preparations which contain lead should state this on the label, together with a warning against misuse (paragraphs 79-85).

(4) Action to eliminate lead contamination of manufactured foods is endorsed, and it is recommended that permitted levels in all foodstuffs be kept as low as practicable (paragraphs 23-30).

(5) Emissions of lead to the air from traffic and other sources should be progressively reduced, subject to an appraisal of any other possible effects on health of altering the constituents of petrol (paragraphs 56-61).

(6) Measures should be taken to keep the annual mean concentration of lead in air to less than 2 $\mu g/m^3$ in places where people are liable to be continuously exposed for long periods. These measures may include the reduction of emissions, the relocation of industry or housing, or traffic management schemes (paragraphs 106-107, 193).

(7) There should be maximum vigilance to identify toys for sale which are coated with paint containing lead in excess of the quantity allowed in current regulations (paragraph 75).

(8) Encouragement should be given towards the current development of guidelines for acceptable concentrations of lead in soil in gardens, agricultural land, parks and open spaces (paragraph 77).

(9) The public should be made aware of the potential hazards of imperfectly glazed ceramic ware and of old lead pewter (paragraph 78).

(10) Steps should be taken to give parents and health workers a better understanding of known lead hazards, including the dangers of pica (paragraphs 79, 81, 82, 86 -89).

(11) Adequate training, equipment and facilities should be ensured for Medical Officers of Environmental Health and Environmental Health Officers or others responsible for the investigation of domestic lead hazards

(12) Consideration should be given to the need for co-ordination through a central unit of activity on lead in the fields of environmental monitoring and clinical investigation.

Recommendations for Further Research and Monitoring

(13) The detailed identification of areas with high levels of lead in tap water should be pursued vigorously and technical research to allow intake to be more accurately estimated from water lead measurements should be supported.

(14) Further monitoring of lead in air and dust should concentrate especially on identifying places where people are liable to spend long periods in the presence of high concentrations. Attention should be directed not only to residential areas close to traffic, but also to areas close to industrial sources, including small (and often poorly controlled) sources such as scrap yards.

(15) Surveys to monitor blood lead in the general population should continue, especially in areas with relatively high exposures to lead in water, air and dust.

(16) In the event of any major change in exposures to lead, monitoring programmes for both environmental lead and blood lead should be designed to allow trends to be followed over a number of years.

(17) Since in some cases blood lead determination based on capillary samples can be unreliable, it is recommended that in general, venous samples should be used in both clincal and survey work.

(18) Individuals and particularly children, whose blood-lead concentrations are found to be over 35 µg/dl should be followed up, in order to identify the source of the lead exposure, and to take appropriate action.

(19) Further research projects should be conducted to investigate relationships between exposure to lead and intelligence, educational attainment and behaviour in children. These may require the development of new testing procedures for studying behavioural aspects. Attention will also need to be given to methods of determining exposure to lead at the relevant time. In this connection, further investigations on the value of analyses on teeth and other tissues may be needed.

(20) Where substantial reductions in exposure are achieved, the effect in terms of changes in psychological functioning as well as in terms of changes in body lead should be studied.

(21) To gain further information on possible effects of moderately elevated levels of lead in adults, more studies among occupationally exposed populations with blood-lead levels below 80 µg/dl should be encouraged.

(22) To supplement information obtained from experimental work on the relationship between lead in the environment and blood lead, additional studies, including further work on the alpha factor (α) and on the extent to which airborne lead contributes to blood lead via food, are required.

APPENDIX I

Membership of the DHSS Working Party on Lead

Chairman

Professor P J Lawther CBE, MB, BS, DSc, FRCP	Professor of Environmental and Preventive Medicine St Bartholomews Hospital Medical College University of London

Members

Dr D Barltrop MD, BSc, FRCP, DCH	Director Department of Child Health Westminster Medical School University of London
Dr R N Chamberlain MB, ChB, FFCM, DCH	Senior Epidemiologist Central Public Health Laboratory London
Professor B E Clayton MD, PhD, FRCP, FRCPath	Professor of Chemical Pathology and Human Metabolism University of Southampton
Professor W W Holland MD, BSc, MRCGP, FRCP, FFCM	Professor of Clinical Epidemiology and Social Medicine St Thomas' Hospital Medical School University of London
Dr R G Lansdown MA, PhD	Principal Psychologist Department of Psychological Medicine Hospital for Sick Children London
Dr B Moore MD, BSc, FRCPath	Honorary Research Fellow Department of Mathematical Statistics and Operational Research University of Exeter
Professor T E Oppe MB, BS, FRCP, DCH	Professor of Paediatrics St Mary's Hospital Medical School University of London

Professor M Rutter MD, FRCP, FRCPsych, DPM	Professor of Child Psychiatry Institute of Psychiatry University of London
Dr H A Waldron MD, PhD, MRCP, MFOM	Senior Lecturer in Occupational Medicine London School of Hygiene and Tropical Medicine University of London
Mr R E Waller BSc	Member of MRC Scientific Staff St Bartholomews Hospital Medical College University of London
Dr W Yule MA, Dip Psych, PhD.	Senior Lecturer in Psychology Institute of Psychiatry University of London

Secretaries

Dr M F Cuthbert MB, BS, PhD (Medical Secretary)	Department of Health and Social Security
Mr B G Wrigley (Administrative Secretary)	Department of Health and Social Security

Representatives of the following Government Departments and organisations were in attendance: The Department of the Environment; the Ministry of Agriculture, Fisheries and Food ; the Department of Health and Social Security; the Medical Research Council; the Scottish Home and Health Department; the Welsh Office.

APPENDIX 2

EEC BLOOD LEAD SURVEY

Results from the 1979 UK Campaign

1. The UK campaign was announced in the House of Commons on 22 February 1979. It fulfils the EEC Directive 77/312/EEC (Official Journal L 105/10, 28 April 1977) on the biological screening of the population for lead which calls for two campaigns co-ordinated across the Community and separated by two years. The UK campaign is made up of autonomous surveys carried out by local medical and environmental health authorities on different groups of people. Their work is co-ordinated by the Department of the Environment assisted by other Government Departments. Originally, 42 groups of people in various towns were to take part. During the campaign this was reduced to 39: the results for 2 groups in Bristol were not compatible with the others and the survey of lead workers' children in Dartford comprised only 3 donors, not enough for a statistically valid sample. Results for 2 groups, mothers and their new born babies in Glasgow, will not be available until Spring 1980. The tables reproduced in this Appendix cover the following groups of people:-

Adults in major urban areas

Inner Birmingham (Handsworth)
Inner Birmingham (Sparkbrook)
Outer Birmingham (Sutton Coldfield)

Glasgow

Inner Leeds
Outer Leeds

Inner Liverpool
Outer Liverpool

Inner London (LB Islington)
Inner London (LB Lambeth)
Outer London (LB Kingston upon Thames)
Outer London (LB Waltham Forest)

Inner Manchester
Outer Manchester

Inner Sheffield
Outer Sheffield

Persons specifically exposed to lead

Beverley - Children of lead workers

Chester - Children of lead workers
Chester - Children near lead works

Dartford - Children near battery works

Ellesmere Port - Children of lead workers
Ellesmere Port - Children near organic lead works

Gravesham - Children of lead workers
Gravesham - Children near lead works

Leeds (Tingley) - Children near motorway
Leeds (Thorpe) - Children of lead workers
Leeds (Thorpe) - Children near lead works

LB Brent - Adults near North Circular Road
LB Greenwich - Children of lead workers
LB Greenwich - Children near lead works
LB Hillingdon - Adults near M4
LB Hillingdon - Children near M4
LB Tower Hamlets - Children near main road

Persons specifically exposed to lead

Market Harborough - Children of lead workers
Market Harborough - Children near battery works

Newport (Gwent) - Children of lead workers
Newport (Gwent) - Children near battery works

2. The groups of people studied in the UK fall under three headings prescribed by the Directive:-

Indent 1. randomly selected adults in major urban areas;

Indent 2. persons exposed to significant sources of lead pollution; (comprising, in the UK, children of lead workers, children living near lead-using works, people living near main roads, certain mothers in Glasgow); and

Indent 3. persons at special risk (in the UK, children born to the mothers in Glasgow in Indent 2).

All surveys exclude people exposed to lead in their work.

3. The Directive defines "reference levels" expressed in microgrammes of lead per 100 millilitres of blood (µg/100 ml) to be applied to each group of people in assessing the results of the survey:-

a maximum of 20 µg/100 ml for 50% of the group
a maximum of 30 µg/100 ml for 90% of the group
a maximum of 35 µg/100 ml for 98% of the group

If the levels are exceeded, the EEC Commission must be told and measures taken to trace and reduce the source(s) of exposure. Any individual whose blood-lead exceeds 35 µg/100 ml must be told and the environmental circumstances must be investigated. The tables reproduced in this appendix apply the reference levels

to the groups reported: the right-hand column in each table gives the percentages of the group of people below each reference level.

4. The Department of the Environment prepared the following notes to accompany the results of the UK surveys:-

Notes on the EEC Blood Lead Results

i. Anybody who was medically followed for occupational exposure to lead should not have been included in the surveys. In a few cases blood samples were taken from people who were medically followed but these blood-lead values are not included in the tables.

ii. Repeat blood samples were obtained wherever possible if the first sample was technically unsuitable for analysis or if there was a high blood-lead level - generally over 30 µg/100 ml for children and over 35 µg/100 ml for adults. In the surveys where intravenous sampling was practised, the tables reported results for the first analyzable specimens obtained. In surveys using a capillary sampling method , the results reported are generally for the first analyzable specimens but if repeat (venous) specimens had been taken, their values are reported. The adult surveys all used intravenous sampling, but the children's surveys reported here used both the capillary and intravenous methods; a note on each table indicates the method(s) used.

iii. The tables report the results of analyses by laboratories that had to meet stringent national and international quality control criteria. Throughout the UK campaign strict measures were applied to the participating laboratories of the NHS Supra-Regional Assay Service and an associated laboratory in Scotland to ensure consistency and accuracy of results. If a laboratory's performance fell outside the

control limits, its work was repeated by a laboratory within the limits. The tables report only the values determined by the second laboratory.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER BIRMINGHAM - HANDSWORTH

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	42	76	76	40	91	91	82	83	83
21 - 30	11	20	96	4	9	100	15	15	98
31 - 35	-	-	96	-	-	-	-	-	98
Over 35	2	4	100	-	-	-	2	2	100
TOTAL	55	100	100	44	100	100	99	100	100

Notes:

1. This survey meets the reference levels
2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER BIRMINGHAM - SPARKBROOK

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	35	76	76	49	96	96	84	87	87
21 - 30	11	24	100	2	4	100	13	13	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	46	100	100	51	100	100	97[2]	100	100

Notes:

1. This survey meets the reference levels.

2. A further 2 results were received but were excluded from the table since the respondents were medically followed for occupational exposure to lead. Their blood lead levels were 57 µg/100ml and 13 µg/100ml

3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: OUTER BIRMINGHAM

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	43	93	93	53	98	98	96	96	96
21 - 30	3	7	100	1	2	100	4	4	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	46	100	100	54	100	100	100	100	100

Notes: This survey meets the reference levels.

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: GLASGOW

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	55	56	56	79	81	81	134	68	68
21 - 30	32	33	89	16	16	97	48	24	92
31 - 35	5	5	94	2	2	99	7	4	96
Over 35	6	6	100	1	1	100	7	4	100
TOTAL	98	100	100	98	100	100	196	100	100

Notes:

1. Since more than 2% of the sample had blood lead levels above 35 µg/100ml, this survey does not meet the reference levels.

2. Blood samples were taken by venepuncture.

3. A further 2 forms were received but were excluded from the table since the respondents were medically followed for occupational exposure to lead. Their blood lead levels were 28 µg/100ml and 38 µg/100 ml.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER LEEDS.

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	39	71	71	39	87	87	79[2]	78	78
21 - 30	14	25	96	5	11	98	19	19	97
31 - 35	-	-	96	1	2	100	1	1	98
Over 35	2	4	100	-	-	-	2	2	100
TOTAL	55	100	100	45	100	100	101	100	100

Notes:

1. This survey meets the reference levels

2. Includes one person whose sex was not reported on the questionnaire.

3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: OUTER LEEDS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	36	80	80	54	96	96	90	89	89
21 - 30	9	20	100	2	4	100	11	11	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	45	100	100	56	100	100	101	100	100

Notes:

1. This survey meets the reference levels
2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER LIVERPOOL

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	34	79	79	52	91	91	86	86	86
21 - 30	8	19	98	4	7	98	12	12	98
31 - 35	1	2	100	1	2	100	2	2	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	43	100	100	57	100	100	100	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: OUTER LIVERPOOL

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	27	73	73	59	94	94	86	86	86
21 - 30	7	19	92	4	6	100	11	11	97
31 - 35	1	3	95	-	-	-	1	1	98
Over 35	2	5	100	-	-	-	2	2	100
TOTAL	37	100	100	63	100	100	100	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEI 1979

INDENT 1: ISLINGTON (INNER LONDON)

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	35	90	90	47	98	98	82	94	94
21 - 30	2	5	95	1	2	100	3	3	98
31 - 35	2	5	100	-	-	-	2	2	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	39	100	100	48	100	100	87	100	100

Notes:

1. This survey meets the reference levels
2. Percentages have been rounded independently and therefore may not sum to totals shown.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: LAMBETH (INNER LONDON)

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	86	91	91	103	98	98	189	95	95
21 - 30	8	8	99	2	2	100	10	5	100
31 - 35	-	-	99	-	-	-	-	-	100
Over 35	1	1	100	-	-	-	1	1	100
TOTAL	95	100	100	105	100	100	200	100	100

Notes:

1. This survey meets the reference levels.

2. Percentages have been rounded independently and therefore may not sum to 100.

3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: KINGSTON UPON THAMES (OUTER LONDON)

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	112	92	92	36	100	100	148	94	94
21 - 30	10	8	100	-	-	-	10	6	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	122	100	100	36	100	100	158	100	100

Notes:

1. This survey meets the reference levels
2. A further 10 samples were not sufficient for analysis.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: WALTHAM FOREST (OUTER LONDON)

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	89	94	94	102	100	100	191	97	97
21 - 30	6	6	100	-	-	-	6	3	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	95	100	100	102	100	100	197	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER MANCHESTER

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	26	57	57	45	83	83	71	71	71
21 - 30	17	37	93	9	17	100	26	26	97
31 - 35	1	2	96	-	-	-	1	1	98
Over 35	2	4	100	-	-	-	2	2	100
TOTAL	46	100	100	54	100	100	100	100	100

Notes:

1.This survey meets the reference levels

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: OUTER MANCHESTER

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	36	72	72	39	76	76	75	74	74
21 - 30	11	22	94	11	22	98	22	22	96
31 - 35	3	6	100	1	2	100	4	4	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	50	100	100	51	100	100	101	100	100

Notes:

1. This survey meets the reference levels
2. Percentages have been rounded independently and therefore may not sum to totals shown.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1: INNER SHEFFIELD

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	44	85	85	47	98	98	91	91	91
21 - 30	8	15	100	1	2	100	9	9	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	--	-	-	-	-
TOTAL	52	100	100	48	100	100	100	100	100

Notes:

1. This survey meets the reference levels
2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 1 : OUTER SHEFFIELD

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	43	91	91	51	98	98	95[2]	95	95
21 - 30	4	9	100	1	2	100	5	5	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	47	100	100	52	100	100	100	100	100

Notes:

1. This survey meets the reference levels.
2. Includes 1 person whose sex was not reported on the questionnaire.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: BEVERLEY - LEAD WORKERS' CHILDREN

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	55	80	80	57	88	88	112	84	84
21 - 30	14	20	100	8	12	100	22	16	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	69	100	100	65	100	100	134	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: CHESTER: CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	24	62	62	22	55	55	46	58	58
21 - 30	14	36	97	11	28	83	26[2]	33	90
31 - 35	1	3	100	2	5	88	3	4	94
Over 35	-	-	-	5	13	100	5	6	100
TOTAL	39	100	100	40	100	100	80	100	100

Notes:

1. Since more than 2% of the sample had blood lead levels above 35 µg/100 ml, this survey does not meet the reference levels.

2. Includes one child whose sex was not recorded on the questionnaire.

3. Percentages have been rounded independently and therefore may not sum to totals shown.

4. The vast majority of the blood samples were taken by venepuncture. A small number of samples at the beginning of the survey were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: CHESTER: CHILDREN LIVING NEAR LEADWORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	30	51	51	24	60	60	54	55	55
21 - 30	22	37	88	15	38	98	37	37	92
31 - 35	1	2	90	-	-	98	1	1	93
Over 35	6	10	100	1	3	100	7	7	100
TOTAL	59	100	100	40	100	100	99	100	100

Notes:

1. Since more than 2% of the sample had blood lead levels above 35 µg/100ml this survey does not meet the reference levels.

2. Percentages have been rounded independently and therefore may not sum to totals shown.

3. The vast majority of the samples were taken by venepuncture.

4. A further 58 samples were received from children who attended schools near the leadworks, but who lived more than 1000 metres from the works. These results were excluded from the table and were distributed as follows:

Blood lead µg/100ml	MALES		FEMALES		PERSONS	
	NO	%	NO	%	NO	%
Less than 20	21	81	27	84	48	83
21-30	5	19	5	16	10	17
Over 30	-	-	-	-	-	-
TOTAL	26	100	32	100	58	100

EEC BLOOD LEAD SURVEY 1979

INDENT 2: DARTFORD: CHILDREN LIVING NEAR BATTERY WORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	29	85	85	18	78	78	47	82	82
21 - 30	4	12	97	4	17	96	8	14	96
31 - 35	1	3	100	1	4	100	2	4	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	34	100	100	23	100	100	57	100	100

Notes:

1. This survey meets the reference levels.

2. A further 3 results were excluded from the table since the respondents were also children of battery workers. Their blood lead levels were 27 µg/100ml, 29 µg/100ml and 33 µg/100ml.

3. Blood samples were taken by venepuncture

4. Percentages have been rounded independently and therefore may not sum to totals shown.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: ELLESMERE PORT: CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	18	90	90	13	100	100	31	94	94
21 - 30	2	10	100	-	-	-	2	6	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	20	100	100	13	100	100	33	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: ELLESMERE PORT: CHILDREN LIVING NEAR LEAD WORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	29	94	94	28	80	80	57	86	86
21 - 30	2	6	100	7	20	100	9	14	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	31	100	100	35	100	100	66	100	100

Notes: This survey meets the reference levels.

2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: GRAVESHAM: CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	52	57	57	51	57	57	104[2]	57	57
21 - 30	37	40	97	35	39	96	73[3]	40	96
31 - 35	2	2	99	3	3	99	5	3	99
Over 35	1	1	100	1	1	100	2	1	100
TOTAL	92	100	100	90	100	100	184	100	100

Notes:

1. This survey meets the reference levels.

2,3. Each of these rows includes a child whose sex was not reported on the questionnaire.

4. Percentages have been rounded independently and therefore may not sum to 100.

5. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: GRAVESHAM: CHILDREN LIVING NEAR LEADWORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less then or equal to 20	26	81	81	27	93	93	53	87	87
21 - 30	6	19	100	2	7	100	8	13	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	32	100	100	29	100	100	61	100	100

Notes:

1. This survey meets the reference levels.

2. A further 36 control samples were received but were excluded from the table since the respondents lived more than 1000 metres from the lead works. The blood lead levels of these respondents were distributed as follows:

Blood lead µg/100ml	MALES		FEMALES		PERSONS	
	NO	%	NO	%	NO	%
Less than or equal to 20	22	100	14	100	36	100
Over 20	-	-	-	-	-	-
TOTAL	22	100	14	100	36	100

3. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: TINGLEY - CHILDREN LIVING NEAR MOTORWAY INTERCHANGE

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	135	100	100	138	98	98	274[2]	99	99
21 - 30	-	-	-	3	2	100	3	1	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	135	100	100	141	100	100	277	100	100

Notes:

1. This survey meets the reference levels.
2. Includes one child whose sex was not reported on the questionnaire.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: THORPE, LEEDS - CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	21	68	68	29	83	83	50	76	76
21 - 30	8	26	94	5	14	97	13	20	95
31 - 35	1	3	97	-	-	97	1	2	97
Over 35	1	3	100	1	3	100	2	3	100
TOTAL	31	100	100	35	100	100	66	100	100

Notes:

1. Since more than 2% of the sample had blood lead levels above 35 µg/100ml this survey does not meet the reference levels.

2. Percentages have been rounded independently and therefore may not sum to totals shown.

3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: THORPE, LEEDS: CHILDREN LIVING NEAR LEADWORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	79	90	90	88	97	97	170[2]	93	93
21 - 30	9	10	100	3	3	100	13[3]	7	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	88	100	100	91	100	100	183	100	100

Notes:

1. This survey meets the reference levels.
2. Includes 3 children whose sex was not reported on the questionnaire
3. Includes 1 child whose sex was not reported on the questionnaire.
4. Percentages have been rounded independently and therefore may not sum to totals shown.
5. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: BRENT - ADULTS LIVING NEAR N. CIRCULAR ROAD

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	90	91	91	94	100	100	184	95	95
21 - 30	8	8	99	-	-	-	8	4	99
31 - 35	-	-	99	-	-	-	-	-	99
Over 35	1	1	100	-	-	-	1	1	100
TOTAL	99	100	100	94	100	100	193[2]	100	100

Notes:

1. This survey meets the reference levels
2. A further 3 blood samples were not sufficient for analysis.
3. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: GREENWICH - CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	37	86	86	40	91	91	77	89	89
21 - 30	6	14	100	4	9	100	10	11	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	43	100	100	44	100	100	87	100	100

Notes:

1. This survey meets the reference levels.
2. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: GREENWICH - CHILDREN LIVING NEAR LEADWORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	170	89	89	192	93	93	366[3]	92	92
21 - 30	20	11	100	12	6	99	32	8	99
31 - 35	-	-	-	1	1	100	1	1	100
Over 35	-	-	-	1			1		
TOTAL	190	100	100	206	100	100	400	100	100

Notes:

1. This survey meets the reference levels.

2. Percentages have been rounded independently and therefore may not sum to totals shown.

3. Includes 4 children whose sex was not reported on the questionnaires.

4. Blood samples were taken by venepuncture.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: HILLINGDON - ADULTS LIVING NEAR M4

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	39	75	75	48	92	92	87	84	84
21 - 30	13	25	100	4	8	100	17	16	100
31 - 35	-	-	-	-	-	-	-	-	-
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	52	100	100	52	100	100	104	100	100

Notes:

1. This survey meets the reference levels
2. One further blood sample was insufficient for analysis
3. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: HILLINGDON - CHILDREN LIVING NEAR M4

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	28	64	64	32	67	67	60	65	65
21 - 30	15	34	98	16	33	100	31	34	99
31 - 35	-	-	98	-	-	-	-	-	99
Over 35	1	2	100	-	-	-	1	1	100
TOTAL	44	100	100	48	100	100	92	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: TOWER HAMLETS: CHILDREN LIVING NEAR MAIN ROAD

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	75	72	72	52	66	66	127	69	69
21 - 30	28	27	99	26	33	99	54	30	99
31 - 35	1	1	100	1	1	100	2	1	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	104	100	100	79	100	100	183[2]	100	100

Notes:

1. This survey meets the reference levels
2. A further 20 blood samples were not sufficient for analysis.
3. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: MARKET HARBOROUGH - CHILDREN OF LEADWORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	17	77	77	21	75	75	38	76	76
21 - 30	5	23	100	6	21	96	11	22	98
31 - 35	-	-	-	1	4	100	1	2	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	22	100	100	28	100	100	50[2]	100	100

Notes:

1. This survey meets the reference levels
2. A further 3 blood samples were not sufficient for analysis.
3. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: MARKET HARBOROUGH: CHILDREN LIVING NEAR LEAD WORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	55	76	76	42	76	76	97	76	76
21 - 30	17	24	100	11	20	96	28	22	98
31 - 35	-	-	-	1	2	98	1	1	99
Over 35	-	-	-	1	2	100	1	1	100
TOTAL	72	100	100	55	100	100	127[2]	100	100

Notes:

1. This survey meets the reference levels
2. A further 19 blood samples were not sufficient for analysis.
3. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2 NEWPORT - CHILDREN OF LEAD WORKERS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	19	70	70	13	54	54	32	63	63
21 - 30	8	30	100	9	38	92	17	33	96
31 - 35	-	-	-	2	8	100	2	4	100
Over 35	-	-	-	-	-	-	-	-	-
TOTAL	27	100	100	24	100	100	51	100	100

Notes: This survey meets the reference levels

2. Blood samples were taken by the capillary method.

EEC BLOOD LEAD SURVEY 1979

INDENT 2: NEWPORT - CHILDREN LIVING NEAR LEAD WORKS

Blood lead µg/100ml	MALES			FEMALES			PERSONS		
	NO	%	CUM.%	NO	%	CUM.%	NO	%	CUM.%
Less than or equal to 20	84	84	84	61	88	88	146[2]	86	86
21 - 30	16	16	100	7	10	98	23	14	99
31 - 35	-	-	-	-	-	98	-	-	99
Over 35	-	-	-	1	1	100	1	1	100
TOTAL	100	100	100	69	100	100	170	100	100

Notes:

1. This survey meets the reference levels
2. Includes one child whose sex was not reported on the questionnaire
3. Percentages have been rounded independently and therefore may not sum to 100.
4. Blood samples were taken by the capillary method.

APPENDIX 3

REQUIREMENTS FOR CAUSE AND EFFECT RELATIONSHIPS
(BASED ON "A SHORT TEXTBOOK OF MEDICAL STATISTICS" BY AUSTIN BRADFORD HILL, HODDER & STOUGHTON, 1977.)

1. Strength of the Association

Consideration of the relative incidence of the condition under study in the populations contrasted. Thus to take a specific example, prospective enquiries into smoking have shown that the death rate from cancer of the lung in cigarette smokers is 9-10 times the rate in non-smokers while the rate in heavy cigarette smokers is 20-30 times as great.

On the other hand, the death rate from coronary thrombosis in smokers appears to be no more than twice, possibly less, the death rate in non-smokers.

2. Consistency of the Observed Association

Has it been repeatedly observed by different persons in different places, different circumstances and time? Different results of a different enquiry certainly cannot be held to refute the original evidence. Yet the same results from precisely the same form of enquiry will not invariably greatly strengthen the original evidence. Much weight should be put upon similar results reached in quite different ways, eg in prospective and retrospective enquiries.

3. Specificity of the Association

If the association is limited to specific workers and to particular sites and types of disease and there is no association between the work and other modes of dying, then clearly that is a strong argument in favour of causation.

4. Relationship in time

5. Biological Gradient or Dose Response Curve

Thus, the fact that the death rate from cancer of the lung has been shown to rise linearly with the number of cigarettes smoked daily adds a very great deal to the simpler evidence that cigarette smokers have a higher death rate than non-smokers.

6. Biological Plausibility

It is helpful if the causation suspected is biologically plausible, though this is a feature that cannot be demanded. What is biologically plausible depends upon the biological knowledge of the day.

7. Coherence of the Evidence

The cause and interpretation of an association should not seriously conflict with the general known facts of the natural history and biology of the disease. It should have coherence.

8. The Experiment

Occasionally it is possible to appeal to experimental or semi-experimental evidence. For example, because of an observed association some preventive action is taken. Does it in fact prevent?

9. Reasoning by Analogy

Finally, it would be fair to judge by analogy. With the known effects of the drug Thalidomide and the disease Rubella, we would be ready to accept slighter but similar evidence with another drug or another viral disease in pregnancy.

Clearly, none of these nine viewpoints can bring indisputable evidence for or against the cause and effect hypothesis and equally none can be required as a "sine qua non". What they can do with greater or less strength, is to help us to answer the fundamental question; is there any other way of explaining the set of facts before us; is there any other answer equally or more likely than cause and effect?

APPENDIX 4

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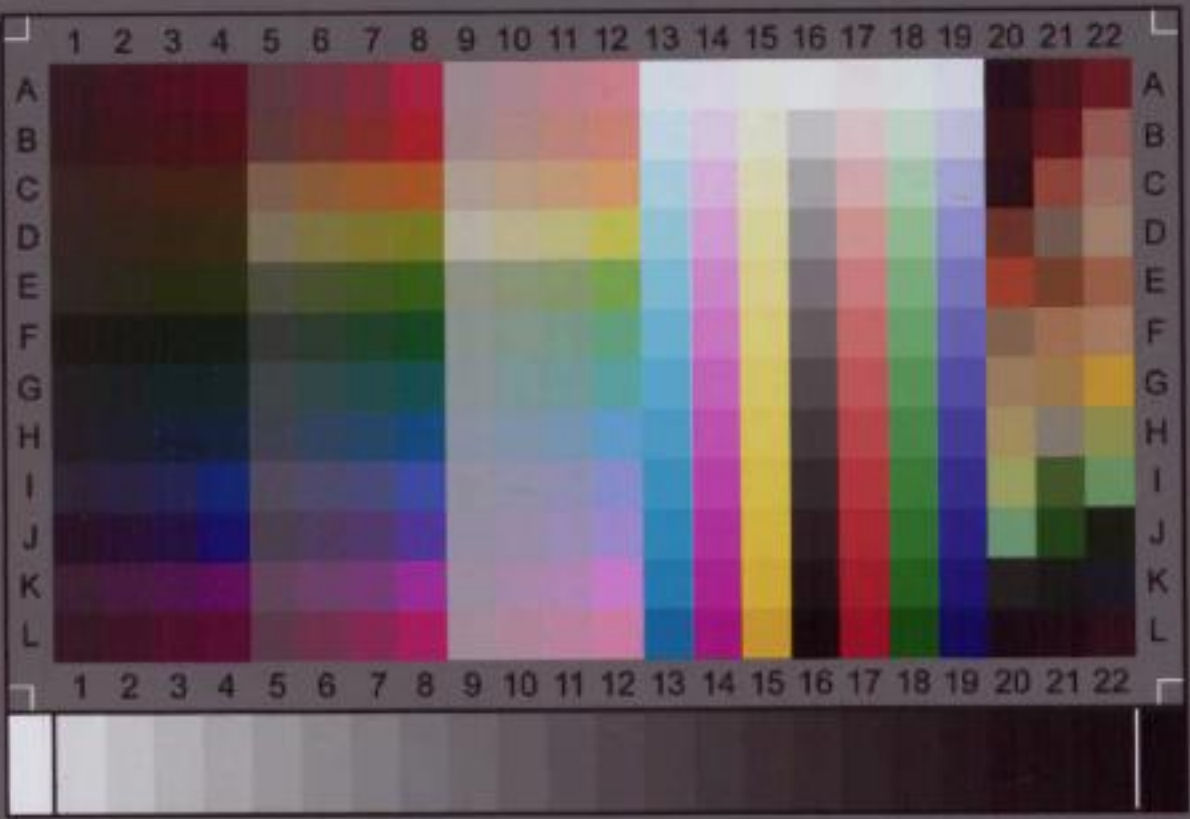

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