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B B 2015年12月15日 С С 上午10時05分恢復聆訊 D D 出席人士:許偉強大律師及鄭欣琪大律師,為外聘律師,代表食水含鉛超 Е 標調查委員會 Е 李柱銘資深大律師、譚俊傑大律師及吳思諾大律師,由何謝 F F **韋、李偉業律師事務所延聘,代表啟晴邨及葵聯二邨公屋居民** 代表 Lee Pui Yi、Chong So Nga 及 Lui Hui Ping G G 麥高義資深大律師及許佐賓大律師,由的近律師行延聘,代表 Η Η 保華建築營造有限公司 Ι Ι 何沛謙資深大律師及殷志明大律師,由羅夏信律師事務所延 聘,代表香港房屋委員會 J J 王鳴峰資深大律師、陳樂信大律師及羅頌明大律師,由律政司 **延聘**,代表水務署署長 K K Mr Ian Pennicott 資深大律師及林定韻大律師,由孖士打 L L 律師行延聘,代表中國建築工程(香港)有限公司 Μ Μ 林國輝大律師,由召十打律師行延聘,代表瑞安承建有限公司 Ν 黄佩琪大律師,由顧增海律師行延聘,代表有利建築有限公 Ν 司、明合有限公司及伍克明 0 0 Р Р 許偉強先生: 係, 主席, 喺 Professor Bellinger 畀證供之前, 因為 我哋之前就住有一位證人陳小華先生,咁佢就係何標記嘅前職員嚟。 Q Q 咁我哋就出過信畀佢,就係要求佢就做一張證人供詞,咁當時佢就有 回覆。然後我哋大概係喺呢個月7號、8號左右,就出咗一個證人傳 R R 票畀佢,咁陳先生今日亦都嚟咗我哋聆訊嘅。 S 主席:好呀,唔該。陳先生。 S 陳小華:係。 Т Т 主席:我係今次呢個專職委員會嘅主席陳慶偉法官。咁我哋較早之前就出 U U 吃一張證人傳票畀你,因為我哋就想就住今次嘅研訊有一啲問題係想

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В		В
С	問你嘅。	С
D	陳小華:好。	D
Е	主席:咁你冇律師代表你, 係咪?	E
	陳小華:冇。	2
F	主席:得,唔緊要,你自己代表自己都唔緊要嘅。	F
G	陳小華:唔。	G
Н	主席: 咁樣樣, 我哋基本上就係想問你一啲問題關於你喺何標記工作嘅時 候嘅情況, 尤其是係買一啲焊料嘅時候嘅情況, 明白吖嘛?	Н
Ι	陳小華:明白。	Ι
J	主席:咁嗰個證人傳票就要求你今日就出庭,不過就就出庭,但係就冇	J
K	講到就話你係幾時會畀口供。咁樣樣我哋就首先就會我哋嘅律師團隊 就會係同你約一個時間,可能係今日,可能係稍後嘅時間,咁樣樣就	K
L	係万便你,如果你有時間嘅話,咱佢吨就想見你,同你擁一份嘅證入 供詞,你明白吖嘛?	L
Μ	陳小華:明白。	М
Ν	主席:總之係一個大家都方便嘅時間。咁畀咗呢份證人供詞之後,你做完 呢份證人供詞之後,咁喺稍後嘅時間,你就會係被傳召係出嚟做證	Ν
0	人。至於實際上係邊一個月,邊一日,我哋暫時都未知,不過我哋又 唔想要你係日日都嚟呢度等,所以我哋遲啲如果知道係幾時會傳召 你,咁我哋早幾日就会通知你,就新用你聽後幾時條合哪, 在有問題?	0
Р	你,咱我吧牛孩口就曾通知你,就品工你聽你殘时你曾嗓,有打问题。	Р
Q	陳小華:冇問題。	Q
R	主席: 冇問題,得,唔該。基本上就而家你就可以離開,跟住離開之後, 我哋嘅律師團隊喺出面就會同你約一個時間,睇下係幾時同你落一份 口供,明白吖嘛?	R
S	ーレ、 ノコロー ////・ 随小	S
Т	体小学・切口、	Т
	土席・好、哈該。	
U	陳小華:好。	U

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В		В
С	許偉強先生:咁我而家要請 Professor Bellinger。	С
D	主席:好呀。	D
E	PROF DAVID CHUDLEIGH BELLINGER (sworn)	Е
F	(All questions and answers were in English)	F

CHAIRMAN: Thank you. Take a seat please, Professor.

Examination-in-chief by MR KHAW

for coming all the way to Hong Kong to provide

MR KHAW: Prof Bellinger, first of all, thank you very much

assistance, as an expert appointed by this Commission

J for the purpose of this Inquiry. K We understand that you have prepared a report, dated 1 December this year. This report can actually be found in our e-bundle at V1. It is now shown on the screen. M Your report has also been downloaded to the website of this Commission, so that in fact the public could have access to the same.

I don't intend to read out the contents of your report verbatim, as I don't think people here can bear my voice for so long. Instead, I will try to go through and summarise most of the issues that you have addressed in your report.

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食水含鉛超標調查委員會

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Unlike the chairman, my science knowledge is rather limited, so perhaps, in the course of going through your report, I will ask you to further explain some of the

matters which might call for further discussion.

If I may now first turn to internal page 3 of your report, page 47 of the bundle, where you have set out the areas on which you have been instructed to provide your opinion for the purpose of this Inquiry. Perhaps I will just go through those items:

"(1) to explain the short, medium and/or long-term health effect(s) ... of elevated blood lead level on human beings in general, and in particular on (a) infants; (b) children under six years of age; (c) children/teenagers between six and eighteen years of age; (d) pregnant women; (e) lactating mothers; (f) Μ elderly persons; (g) immunocompromised patients; and (h) long-term patients with chronic illnesses;

(2) to explain the internationally accepted or recognised guidelines and/or parameters (and their rationales), particularly those adopted by the ... ('WHO') on the content of lead in (a) tap water and (b) blood in human beings;

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(3) if the guidelines and parameters considered in (2) above have changed/evolved over time, to explain the reasons for such changes;

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С	(4) to opine on the adequacy and suitability of the	С
	reference values for blood lead level and the care plan	
D	published or followed by the Hong Kong Special	D
Ε	Administrative Region Government;	Е
	(5) to opine on the adequacy and suitability of the	
F	acceptance criteria laid down by the Water Supplies	F
G	Department for heavy metals and make	G
н	recommendations, if necessary."	п
11	If we first look at the introductory part of your	п
Ι	report, at internal page 4, page 48 of this bundle	Ι
J	I think here, before you deal with the first question	J
	that we have just seen, you have provided some	-
K	introductory comments on the availability of information	K
L	on the adverse effects of lead on human health. It	L
	seems that you have come to a conclusion, at I think	
М	around the fifth line under "Introductory comments",	Μ
Ν	that:	Ν
0	" the evidence base permits robust inferences	0
0	about the range of effects of exposure to lead, as well	0
Р	as the characteristics of the dose-response and	Р
0	dose-effect relationships that describe the levels of	0
-	exposure associated with increased risk."	x
R	May I just ask you to briefly explain what you mean	R
S	by "dose-response and dose-effect relationships"?	S
_	A. Yes. That's a distinction made in toxicology, referring	
Т		Т
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В			В
С		to how an adverse effect is related to exposure.	С
		A dose-response relationship, if one exists, means that	
D		the higher the dose an individual is exposed to, the	D
Е		greater the risk of some adverse effect such as cancer.	E
_		And a dose-effect relationship pertains to an outcome	
Е,		that is not dichotomous, such as do you have cancer or	F
G		don't you have cancer, but something like	G
п		an intelligence quotient score. So a dose-effect	т
11		relationship would mean that the higher the dose of some	н
Ι		chemical an individual is exposed to, the IQ goes down,	Ι
J		as dose increases.	J
	Q.	Thank you. Then you go on to say:	0
К		"In my response to the queries" ie the questions	K
L		set out above "I focus on the so-called 'subclinical'	L
		health effects of chronic exposure to lead, that is, at	
Μ		levels of exposure that do not cause clinical signs and	Μ
Ν		symptoms, as the likelihood that clinical lead poisoning	N
0		would occur from consuming water with the lead	0
0		concentrations measured in the Hong Kong estates is very	0
Р		low."	Р
0		If I may just ask you to explain this observation.	0
×	A.	My understanding is that the highest water lead	Y
R		concentration that was measured in the Hong Kong estates	R
S		was 83 micrograms per litre, but most of the levels were	S
		in the range of 10 to 20 micrograms per litre.	
Т			Т
U			U

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В		В
С	According to our current knowledge, regularly consuming	С
	water with water lead in the concentration of 10 to 20	
D	would be unlikely to give a large enough dose that	D
Ε	someone would show clinical signs of lead toxicity,	E
Б	which tend to occur at much higher blood lead levels, in	_
F	the range of it varies from individual to individual,	F
G	but it's rare to see clinical symptoms in someone with	G
н	a blood lead below 40, 45 micrograms per decilitre, and	п
11	higher than the blood lead levels observed in the	п
Ι	residents of those estates.	Ι
T	Q. Under the same paragraph, you then continue to talk	T
U C	about the overt signs of acute intoxication.	J
K	CHAIRMAN: Before you ask that question, can I ask you,	K
L	Prof Bellinger, how long can one be regarded as	L
	chronically exposed?	
Μ	A. That's a very difficult question to answer. It	Μ
Ν	typically refers to a period of months to years, would	Ν
0	be chronic exposure. Anything else shorter would be	0
0	considered more of an acute exposure.	0
Р	CHAIRMAN: Thank you.	Р
0	MR KHAW: Under the same paragraph, you then continue to	0
x	talk about the acute the overt signs of acute	Q
R	intoxication, acute lead intoxication, and also chronic	R
S	lead exposure.	S
	Then, if we turn to internal page 5, the second	
Т		Т
U		U

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食水含鉛超標調查委員會

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B B paragraph, about the second sentence, you mention that: С С "The major classes and sources/pathways of exposure D D to inorganic lead (the form of lead in solder) include food, air, soil, paint, and water, although exposure can Е Е also occur as a result of many other activities F F ([including the] use of contaminated folk or herbal medicines)." G G Then further down, in about the middle, you talk Η Η about the places in a person's body where lead resides. Ι I think, in short, just to summarise what you have set Ι out here, in adults lead in bone accounts for about J J 90 per cent of the total body burden, whereas in K K children, lead in bone accounts for about 70 per cent of the total body burden, because in the case of children L L lead will move in and out of bone more rapidly, due to Μ Μ the changes in bone structure. Then there is a discussion regarding Ν Ν re-equilibration process. If I may just quote what you 0 0 have stated here, about the last ten lines on this page, Р starting from the word "Therefore" -- can you see that? Р

"Therefore, the blood lead level measure for an individual at any time reflects the equilibrium between an individual's current exposure to 'new' lead and the 'legacy' lead" -- ie the old lead which has accumulated in our body for a relatively long period of

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С		time from past exposures. The half-life of lead in	С
		blood is approximately 30 days, meaning that if two	
D		atoms of lead enter the blood, in a month's time only	D
E		one will remain there, and the other one either excreted	E
		from the body or moved to storage in hard or soft	
F		tissue. Because of the re-equilibration processes, the	F
G		half-life of 30 days does not mean that an individual's	G
н		blood lead level will fall by half in a month's time if	п
11		major exposure sources/pathways are removed. The	п
Ι		greater an individual's past exposures to lead, the	Ι
J		harder it will be to reduce blood lead by	J
		an intervention"	_
K		May I just ask you to elaborate a bit more on the	K
L		re-equilibration process that you have just mentioned	L
		here.	
М	A.	Certainly. Over time, the lead that is distributed into	Μ
Ν		the three major compartments, the mineralised tissue,	Ν
0		the soft tissue by which I mean organs such as the	0
0		brain, kidneys and the liver and the blood is the	0
Р		third compartment, will come to a balance that reflects	Р
0		the amount of lead someone is taking in and the amount	0
-		that they are excreting.	×
R		Now, if there's some intervention that changes	R
S		an individual's exposure at a given time, such as	S
		removing exposure to water lead or administering in	
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cases of much more severe exposure, giving drugs that С С bind to the lead and promote its excretion from the D D body -- then the amount of lead that's distributed in those three major compartments will find a new balance. Е Е And what happens is if blood lead is reduced because of F F cutting off an exposure pathway, blood lead will decline reflecting that, but lead from the other two G G compartments, the hard and the soft tissue, will come Η Η into the blood compartment and a new balance will be Ι Ι achieved between those three compartments. How long that takes will reflect how much the J J exposure is decreased and how much past lead K K an individual has been exposed to and is storing in those other compartments. L L Q. Thank you. Then you continue to talk about a study, one Μ Μ study of children -- at internal page 6, page 50 of the bundle -- who had a blood lead level of 25 to Ν Ν 29 micrograms per decilitre and were placed in a case 0 0 management system; it took an average of two years for Р the blood lead to drop below 10. Р Can you provide any reasons for this slow drop in Q Q that study? R R A. Yes. That's because children who had a blood lead of 25 to 29, in this particular study were living in homes S S that had deteriorated lead paint, and they had been Т Т U U

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B B living there for some time, so they had been С С continuously exposed and had built up a considerable D D amount of lead in their bones and in their soft tissues, so that when the children were removed from those homes Е Е and placed into the case management system, which means F F that their current exposure was drastically reduced, because they were removed from the hazardous environment G G they had been in, then their blood lead fell quite Η Η slowly, because of this equilibration process, because Ι Ι they had been exposed to so much lead in the past that during the re-equilibration it was being drawn out of J J the hard tissues and the soft tissues into the blood, so K K that the blood lead fell very, very slowly, certainly longer you would expect from the simple fact of L L a half-life of lead being 30 days. That's why you can't Μ Μ expect blood lead to drop by a half in 30 days. It depends on the entire exposure history of an individual. Ν Ν Q. Thank you. 0 0 I think most people would be interested in the next Р topic, because that goes to the IQ score of children. Р Most parents want their children to obtain a high IQ Q Q score and they would like to see whether the lead R R content in water --CHAIRMAN: You have to speak up, Mr Khaw. S S MR KHAW: Sorry. I think most parents want their children Т Т U U

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C to achieve a high IQ score, and they also want to know the effect of lead content in water on this particular D aspect.

You have started your discussion by saying that young children are considered to be most vulnerable subgroup of the population. Then you went on to say that children with blood lead levels below 25 micrograms per decilitre generally do not show any signs or symptoms that bring them to medical attention. But studies also show that children with such levels are at increased risk of a variety of cognitive and behavioural adversities that are persistent and affect many aspects of an individual's health and wellbeing.

> Then you talk about what you call the most complete and compelling evidence in respect of children. That is I think the last ten lines on this page:

"The most complete and compelling evidence available pertains to children's intelligence. A set of analyses in which the data from 7 prospective studies were pooled (a sample size of 1,333 children) found that the inverse association between children's IQ scores and their blood lead concentrations had a supra-linear form, such that the slope of the association (the rate of decline in IQ per [microgram per decilitre] increase in blood lead concentration), was steeper over the range below 10 ...

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B B than it was over the range between 10 and 30 ... С С Although the biological mechanism of this is not known, D D the finding has now been replicated in several independent studies." Е Е Professor, just one question here. We all know that F F children's IQ score may be affected by various factors -- environmental factors, behavioural factors, G G et cetera -- so to what extent can these studies on lead Η Η content demonstrate the extent of the impact of lead on Ι Ι children's IQ scores? A. That's a very important question, and it's always --J J whether or not investigators have addressed and measured K K and taken adequately into account the other factors that influence a child's IQ is always the major point of L L contention in interpreting a study such as lead, because Μ Μ we can't do an experimental study with children like we can with animals. We have to observe samples of Ν Ν children who are exposed to different amounts of lead 0 0 and see if we can see an association with their Р cognitive outcomes. Р So in each study -- and as I say, it's very Q Q

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important to measure the parents' socioeconomic status,

their education, if possible the parents' IQ, because

that's very strongly predictive of a child's IQ. It's

important to take account of a child's nutrition, how

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C stimulating the home environment is, whether they are
 exposed to other things that can pose a threat to their
D cognition.

So the statistical models that have to be implemented in these studies can be quite sophisticated and very detailed. And what we find is if we take account of all of these other factors to the best that we can, is there still a relationship between lead and children's IQ, and what these studies indicate is yes, there is.

We can also get a sense of how important lead is in the context of all these other factors by asking what per cent of the variability in children's IQ scores can be explained by their lead exposure. Typically, what we find is that it's a relatively small amount. It's statistically significant and consistent across studies, but it explains usually less than 5 per cent of the variation in children's IQ, whereas something like socioeconomic status captures about 30 per cent of the variation in children's IQ.

> So lead is important but it's not the most important predictor of children's outcomes, and this is something that I counsel parents about when they call me, when they are concerned that their child has a blood lead higher than we would like to see. I tell them, yes,

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that's very important and we certainly want to prevent С С that lead exposure, but it's important to put it in the D D perspective of what else may be influencing how their child does, and I try to help them relax a little bit in Е Е this regard; that yes, we should prevent lead exposure, F F but it's also important to do these other things that parents do that maximise their child's endpoints. G G CHAIRMAN: Can I ask you a more basic question first: why is Η Η lead so toxic? Ι Ι

A. That's a good question. It works at a very general biological level, and so it impairs processes that are fundamental to many aspects of the way our bodies work. Chemically, it's what's called a divalent cation; it has a 2-plus charge, and many important things in the body like calcium have a 2-plus charge. So lead interferes with a lot of the biological processes that depend upon calcium, and many of our body processes do depend on calcium.

So how the nerve cells in our brain communicate with one another is dependent on calcium, so lead interferes with the communication between cells in the brain. It also interferes with processes that are important in long-term memory and storage of information. In fact, lead interferes with just about everything that anybody has looked at in the brain. So that explains his

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C		pervasive and widespread toxicity.	C
C	CH	AIRMAN: Thank you. So that's why you say the central	C
D		nervous system is considered to be the most vulnerable	D
E		organ among all the organs within our bodies?	E
	Α.	That's right, in particular the developing central	
F		nervous system. As a colleague of mine says, a child	F
G		gets only one chance to develop a brain, and so we want	G
ц		to prevent lead from interfering with the complex	
п		spatial and temporal choreography that's involved in	Н
Ι		putting a brain together, that involves billions of	Ι
J		nerve cells that have to be in the right place at the	J
		right time in order for a brain to be normal.	-
К	CH	AIRMAN: So when you say the central nervous systems, you	K
L		are not confining yourself to simply the brain; you are	L
		also talking about the nerve cells, the nerves that can	
M		be found in our bodies, the whole body as well?	Μ
Ν	Α.	Well, the central nervous system typically is used to	Ν
0		refer only to the brain and the spinal cord, and the	0
Ũ		connections of the central nervous system to, like, the	U
Р		hands and sensory organs in other parts of our bodies is	Р
Q		the peripheral nervous system. That is also sensitive	Q
		to lead but less so. Often the effects in the	-
R		peripheral nervous system are reversible, once exposure	R
S		stops. But we are concerned that the effects are more	S
т		persistent in the central nervous system.	т
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CHAIRMAN: Is that because the lead displaces the calcium in	С
the process of transmission of nerve messages; that	
actually adversely affects the development of children?	D
A. Yes, that's part of it. These chemicals that lead	E
interferes with are involved not just in the function,	
the transmission of information, but also they are	F
involved in the formation, the laying down of the	G
structure, the fine structure of the nervous system. So	
lead is both a developmental neurotoxicant and	Н
a functional neurotoxicant. That's why the developing	Ι
nervous system is of particular concern, because lead	I
can interfere with actual structural formation of the	J
brain.	K
CHAIRMAN: Thank you.	L
MR KHAW: Still at internal page 6, the last sentence is	
perhaps quite important:	Μ

"The details of this dose-effect relationship suggest a child with a blood lead level of 0 will, all other things being equal, have an IQ score about 5 points (1/3 standard deviation) higher than a child with a blood lead level of 10 [micrograms per decilitre]."

The reason why I ask you in relation to this particular sentence is since your report has been released, there has been some media coverage which has taken this sentence to mean that the IQ of a child with

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C a blood lead level of 10 micrograms per decilitre would be one-third lower than that of a child with zero blood D lead content, but in fact you are talking about one-third standard deviation here. Can you explain a bit more on the standard deviation point? F A. Yes, that would be an incorrect interpretation.

> Standard deviation is a property of a bell curve distribution. It refers to how much variability there is in a particular characteristic. So, for instance, with regard to IQ, we expect that the average person will have an IQ of 100, and the standard deviation of the IQ distribution is 15 points.

So this is just a way of saying how many people we expect to have IQ scores within certain ranges, so between the mean of 100 and plus 1 standard deviation, that is a score of 115, we would expect 34 per cent of the population to be between 100 and 115. Similarly, because the distribution is symmetrical, we would expect 34 per cent to have a score between 85 and 100.

So the one-third standard deviation just simply means that the effect that has been observed in studies that's attributable to lead, the effect on IQ, amounts to five points, for an increase in blood lead from 0 to 10, which is one-third of that standard deviation. It doesn't mean that the child with a blood lead of 10

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В			В
С		would have an IQ that's only one-third as large as the	С
		child with a score or a blood lead of 0.	
D	Q.	Thank you. In the next paragraph on the same page, you	D
Е		have referred to a series of neuroimaging studies of	Е
F		young adults, and those studies actually show some	_
r		structural or ischemic changes of various parts of the	F
G		brain, including the grey matter volume and also the	G
н		white matter volume.	н
		Can you just briefly explain the importance of these	
Ι		parts of our brain?	Ι
J	Α.	The grey matter is basically what we think with, so it's	J
		the cerebral cortex; we have a frontal lobe, occipital	
K		lobe, parietal lobe on both sides of our brain, and	К
L		that's where most of our thinking goes on; and there are	L
М		also some subcortical structures that are part of the	м
1 v1		grey matter that are also important, the basal ganglia	IVI
Ν		and so on.	Ν
0		The white matter are basically the information	0
		highways in our brain. The white matter tracts are	-
Р		quite long and they connect different parts of our	Р
Q		brain, so they are the way that our different parts	Q
D		communicate with one another.	_
K		So they are all important in terms of having	R
S		a healthy brain. We want both grey and white matter to	S
т		be functioning as they were intended.	т
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С	Q.	In these studies which actually show persistent changes	С
		in brain structure and function, are we talking about	
D		blood lead content which is quite high?	D
E	Α.	We are. The neuroimaging studies come from a particular	Е
		study that was conducted in the United States in	
F		Cincinnatti, among mostly minority African-American	F
G		children who were living in fairly dire situations of	G
		poverty; inner city, in poor housing, exposed to lots of	
Н		lead. They had blood leads that were most of the	Η
Ι		children in the study, there were about 250 children,	I
T		had at some point in their life a blood lead above 25,	Ŧ
J		and some of them had blood lead so high that they were	J
K		actually hospitalised and given chelation therapy to	K
L		reduce their lead burden.	L
		So these were children with exposures that were not	
Μ		that uncommon at that time this study was begun in	Μ

around 1980, in the US -- but fortunately they're fairly

rare these days, and it's uncertain the degree to which

levels. They are simply a lesson that lead is actually

these studies apply to children with lower blood lead

Q. Then the last paragraph on the same page, where you are

addressing the issue regarding children and teenagers

between 6 and 18 years. I think you have also referred

to various studies which provide evidence regarding the

doing observable damage to the brain.

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В			В
С		inverse association between early-life lead exposure and	С
		neurodevelopment.	
D		Then at page 8 you talk about the US National	D
Е		Toxicology Program evaluation, which concluded that the	Ε
F		evidence is sufficient for the association between blood	_
ľ		lead level under 10 micrograms per decilitre and both	F,
G		decreased hearing, delayed puberty, and reduced	G
н		postnatal growth.	п
п		Again, I just want to ask whether these studies	п
Ι		showed relatively high blood lead content?	Ι
J	Α.	Well, this conclusion pertains to a blood lead range of	Т
		less than 10 micrograms per decilitre. So, again, these	U
К		are findings that are relatively consistent across	К
L		studies, sufficiently consistent that the NTP was	L
		willing to consider that in aggregate the evidence was	
Μ		sufficient to draw this conclusion.	Μ
Ν		But again I would say that finding a statically	Ν
0		significant association is one thing, and finding	0
0		an association of a large magnitude in the effect is	0
Р		another thing.	Р
0	Q.	Yes.	0
τ.	Α.	So, for instance, this reduced postnatal growth	Y
R		association, it may be relatively modest and something	R
S		that you would not notice in an individual child, but if	S
		you are looking at large groups of children then you	
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В			В
С		might find that those children with higher blood lead	С
		within this range were a centimetre smaller than	
D		children with blood lead levels lower than this range.	D
Е		Statistically significant but not really very meaningful	Ε
F		for an individual child.	
ľ	Q.	Then in the next paragraph you talk about the	F
G		association between lead exposure and ADHD, attention	G
н		deficit hyperactivity disorder. Then you have referred	н
		to various studies in this respect.	п
Ι		May I just ask you how these studies were conducted,	Ι
J		regarding the association between lead exposure and	J
		ADHD?	_
К	Α.	A variety of study designs were used. In some of the	K
L		studies, which are called cross-sectional studies,	L
		a sample of children were recruited for participating in	
М		some large survey, and as part of the survey a blood	Μ
Ν		sample was taken, and that was measured for blood lead	Ν
0		content.	0
U		Then the parents were interviewed and asked, "Has	0
Р		a medical professional ever told you that your child has	Р
0		ADHD?" In other studies, the parents were given	0
Ľ		a structured interview that was linked to the criteria	×
R		for diagnosing ADHD, and in yet other kinds of studies,	R
S		called case control studies, two groups of children were	S
-		studied. One group had been identified and diagnosed	
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С		with ADHD, and the other had not, and then blood samples	С
		were collected to see whether or not the group carrying	-
D		the diagnosis of ADHD had a significantly higher blood	D
E		lead level than the group that did not.	Е
_	Q.	In the last paragraph on this page, you talk about	
F		various studies which show the association between	F
G		childhood lead exposure and propensity for violence and	G
ц		aggression. Then you went on to say that in fact these	
п		studies are difficult to conduct and they are subject to	н
Ι		a variety of biases. Why do you say that?	Ι
J	Α.	Well, in order to try to see if there's an association	J
		between early childhood lead exposure, which is the	0
K		primary concern, and the propensity to engage in these	K
L		kinds of behaviours 20 years later, it's very difficult	L
		to identify a situation in which you have those data.	
Μ		If you do the study by identifying individuals who	Μ
Ν		already have committed offences, it's difficult to look	Ν
0		back and get reliable information about their early	0
0		childhood lead exposure. Typically, you don't have	0
Р		access to those data. So one of the biases would be	Р
0		it's called a retrospective bias; whereas people or	0
C		parents of individuals who are offenders, as adults may	×
R		have different levels of recall. They may be more	R
S		likely to say, "Oh, yes, he was lead poisoned as	S
		a child" and you don't really know whether that's true	

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or not or if they are just looking for an explanation for their child's behaviour.

So it's difficult to find exactly the right situation in which you can address this question in a very compelling way.

The study that I mentioned where the neuroimaging was conducted, a study in Cincinnatti, has provided the G best evidence, in my mind, of this association, because Η they enrolled these children during pregnancy. As the children grew older, they collected periodically blood lead histories, and then they followed the children J until they reached their 20s, and they went to K administrative county records where these individuals now resided and obtained information from those L objective records as to the number of times these Μ participants had been arrested for some offence or another. Ν

So that study, which is very difficult to carry out over that period of time, is less subject to these biases because the blood lead information was collected prospectively, long before the offending occurred, and so there's no concern about bias there. Also because this study had collected a lot of information about factors that I mentioned earlier that are important to take account of -- family socioeconomic status,

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Α

B B nutrition, stimulating-ness of the home environment, and С С so on -- the associations that they saw between early D D childhood lead exposure and risk of offending and being arrested later in life I think are much more solid; they Е Е provide a much more compelling base of evidence for F F drawing a conclusion that lead is linked to a propensity for aggression and violence. G G But I would add, again, that participants in the Η Η study had lead exposures that were quite high by Ι Ι contemporary standards and many of these children actually got chelated because of their lead poisoning. J J Q. Then in relation to pregnant women, page 9, in the third K K line you mention that:

> "... the lead exposure of a foetus is essentially the same as that of the pregnant woman."

Then in the next paragraph you refer to research on the potential effects of lead exposure on the health of Ν pregnant women, in particular reproductive health, the 0 course of pregnancy, the health of the foetus at birth, Р et cetera. Then you have also referred to the US Centers for Disease Control, which "issued guidelines Q for the identification and management of lead exposure R in pregnant and lactating women. The literature review conducted evaluated the evidence regarding the S associations between lead exposure and a variety of Т

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health endpoints."

Then you go on to discuss various aspects regarding pregnant women, including fertility, hypertension, et cetera.

> In relation to gestational hypertension, at page 10, there's just one question I have. Here, you say:

"Cohort and case-control studies have shown that a greater concentration of lead in maternal blood during pregnancy or in cord blood is significantly associated with pregnancy hypertension and elevated blood pressure during pregnancy or at delivery. Although these associations are statistically significant, they are very modest in magnitude ... "

Just one question: would such limited magnitude affect the validity of the findings in those studies? Μ A. No, it doesn't affect the validity of the findings, because the findings have been reported in multiple studies. So I think that they are real. But the modest magnitude does affect the interpretation of the clinical significance.

> Again, as I indicate, the correlation, which is a measure of the degree of relatedness of blood pressure to blood lead, is quite small, meaning that most of the variation among pregnant women in their blood pressure or risk of hypertension is not due to lead, it's due to

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С		other factors. Again, we know how to prevent lead	С
		exposure and so it's worthwhile to do everything we can,	
D		but it won't solve the problem of pregnancy hypertension	D
Ε		entirely.	E
F	Q.	Then, in relation to spontaneous abortion, you first	_
F		mention that:	F
G		"Most studies evaluating the risk of spontaneous	G
п		abortion in relation to maternal lead exposure have not	
п		identified a significant relationship at blood lead	Н
Ι		levels below 30 [micrograms per decilitre]."	Ι
J		Then you refer to one high-quality prospective study	Ţ
		conducted in Mexico City which actually reported that	Ū
К		"the risk began to increase, and increased consistently	K
L		thereafter, when maternal blood lead level exceeded	L
		5 [micrograms per decilitre]".	
Μ		Are there any special features in this particular	Μ
Ν		study conducted in Mexico City which show this result?	Ν
0	A.	Well, I say it's high quality because of the care that	0
0		the investigators took to try to identify potential	0
Р		confounding factors that may also be related to risk of	Р
0		spontaneous abortion. As I say, this study did suggest	0
-		that the risk of spontaneous abortion begins to rise	x
R		once maternal blood lead exceeds 5 micrograms per	R
S		decilitre. I have no reason to think that the study is	S
_		wrong, but in this kind of work one never draws a strong	
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B B conclusion based on one epidemiological study, because С С it's always possible there's something unique about D D Mexico City and the women and their practices that may have contributed to this result. So it's always helpful Е Е to be able to have evidence that's been collected in F F multiple studies, that all point towards the same direction. G G So I think this study is important in telling us Η Η that there may be something, an important signal here, Ι Ι but until we have additional evidence I would be reticent to draw a very strong conclusion. J J Q. Then in relation to foetal growth, that is the next K K passage, you have mentioned that the evidence regarding the association between lead exposure and foetal growth L L is perhaps not that consistent. Μ Μ A. Right. Q. Can you explain a bit more on this? Ν Ν A. Well, I just mean that some studies find that increased 0 0 blood lead during pregnancy is associated with a reduced Р length of gestation. Other studies don't find that. Р The same with the other endpoints, the birth weight, Q Q head circumference, birth length. So I find it very R R difficult to know what the truth is. Until we get a heavier weight of evidence pointing in one direction, S S it's difficult to draw a strong conclusion, in my mind. Т Т

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С	CHAIRMAN: But logically, it should have a greater adverse	С
	effect on the baby's growth, because the baby's brain is	
D	developing at the time?	D
Ε	A. I'm sorry?	Ε
F	CHAIRMAN: Because the baby's brain is developing at the	F
F	time, so logically it should have a greater adverse	F.
G	effect on foetal growth?	G
н	A. Yes, you would think so. Interestingly, the evidence	н
	has not borne that out.	11
Ι	CHAIRMAN: I see.	Ι
J	A. And I don't have an explanation for it. It appears to	J
	be that the exposure of a postnatal child is a stronger	
K	predictor of their IQ and educational achievement than	K
L	is their prenatal exposure. It may be that there are	L
м	some protective features in the foetal unit that protect	
M	them, protect the foetal brain, from the lead.	М
Ν	It's an important question, and it is a little	Ν
0	counter-intuitive, but so far the evidence just doesn't	0
-	bear it out.	Ŭ
Р	CHAIRMAN: Thank you.	Р
Q	MR KHAW: Perhaps there is just one minor typo, in the last	Q
	paragraph on this page:	
R	"The NTP concluded that the evidence was"	R
S	I think the word "is" is perhaps redundant.	S
т	A. Yes. I apologise for that.	T
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С	Q. If we turn to the next page, in relation to lactating	С
	women, in the first paragraph, about the sixth line, you	
D	have mentioned:	D
Ε	" the concentration of lead in breastmilk is low,	E
Б	comparable to that in the plasma fraction of blood	_
F	(which accounts for only about 1 per cent of the lead in	F
G	whole blood). Thus, this pathway of exposure likely	G
н	contributes relatively little to an infant's lead	п
п	exposure."	п
Ι	Then you went on to say:	Ι
J	"Water can be a very important pathway of lead	Ţ
	exposure for infants who consume formula" milk	0
К	powder "made up with water that contains lead.	K
L	Balancing the known benefits of breastfeeding and the	L
	slight risks of substantial lead exposure from	
Μ	breastfeeding, the US CDC encourages mothers with	Μ
Ν	a blood lead level [not exceeding 40 micrograms per	Ν
0	decilitre] to breastfeed."	0
0	So I take it that so long as the blood lead level of	0
Р	the mother is not higher than 40 micrograms per	Р
0	decilitre, it is still safe for her to breastfeed. Is	0
C	that the case?	Y
R	A. That's correct.	R
S	Q. Regarding elderly people, we have the same discussion in	S
	relation to legacy lead, the old lead that accumulates	
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B B in the body. С С If we turn to page 12, internal page 12, you have D D mentioned one recent development in lead toxicology which is generating considerable interest. That is the Е Е study regarding the association between overexpression F F of genes involved in the production of a protein, which is a constituent of the plaques that are found in the G G brains of patients with Alzheimer's Disease with lead Η Η exposure. Ι Ι Can you explain a bit more on this study, on whether it is applicable to human beings? J J A. Well, the simple answer is we don't know. The studies K K have only been done in rodents and monkeys at this point. This is another case where it's very difficult L L to do this study in humans because the finding in the Μ Μ animals is that it's the exposure to lead in very early life that predicts this late overexpression of these Ν Ν

To do this study in humans, we would have to have P a prospective cohort that we had early-life lead exposure measures on, and follow them up to age 60 and beyond, and unfortunately that's very difficult to do R and usual people have to take advantage of other data that had been collected, in which this question can be asked. But there are relatively smaller opportunities

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genes involved in neurodegeneration.

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B to do that. С There is one study in humans that I was involved in D where, at age 30, we looked to see whether, on children for whom we did have good lead exposure histories, we Е looked to see whether or not there was a relationship to F the level of expression of genes that are involved in this amyloid protein synthesis pathway. G Now, what we are really concerned about is whether Η Ι

or not the genes are being over-expressed in the brain, but we obviously can't do that, so we were limited to seeing whether they were over-expressed in the blood, and we did see some suggestive relationships between K gene expression of individuals around 30 years of age in relation to actually their cord blood lead levels. L That's the only study that we have in humans at the Μ moment.

> So this hypothesis remains highly speculative, but it is of concern because the current elderly population grew up in a time when we were exposed to much more lead than our current cohorts of children, and so we do know that the incidence of Alzheimer's Disease is rapidly increasing as our population ages, so it's reasonably -and it's biologically plausible to think that lead might be involved in this process, but again it's too soon to draw very strong conclusions.

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Q. Thank you. С С Further down this page, at 1h, you talk about D D long-term patients with chronic illnesses. Then you have referred to kidney function, cardiovascular Е Е function and also cognitive function. F F There's just one aspect regarding cognitive function that I would like you to elaborate. That is, in the G G middle of this particular passage regarding cognitive Η Η function, internal page 13, you have mentioned at Ι Ι line 4: "One study of individuals exposed to lead J J occupationally suggested that the inverse associations K K between an index of lifetime lead exposure and scores on neuropsychological tests were greater in individuals who L L had 'low cognitive reserve' operationalised as poorer Μ Μ reading achievement, an outcome that presumably pre-dated the onset of occupational exposure to lead." Ν Ν Can I just ask you to explain a bit about the low 0 0 cognitive reserve point that you have mentioned here? Р A. Yes. That's a concept that pertains to how readily Р an individual can be protected from an adverse effect of Q Q an exposure such as lead. It's thought that if R R an individual who is cognitively functioning at a higher level, as reflected in a higher reading achievement or S S other scholastic achievement, may be less affected by Т Т

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С	a given exposure, such as lead, and so show fewer
	decrements in performance as a result. So, basically,
D	they are buffered, and it's people whose cognitive
E	performance is more fragile who may suffer a greater
	impact.
F	

- Q. Then, regarding the WHO standards that we have talked about very often at this Inquiry, you first discussed the lead content in tap water and then you have gone through the changes in relation to the WHO Guidelines.
 I May I just first ask you this: can you briefly let us know your personal participation in the formulation of the WHO Guidelines over the years?
- K A. I have not been involved in the guidelines pertaining to water lead. I currently chair a committee at the WHO L that's developing guidelines for the diagnosis and Μ treatment and prevention of lead poisoning in children and adults. I've been involved in the lead evaluations Ν for the WHO/FAO joint expert committee on food additives 0 and contaminants that has set provisional tolerable Р weekly intake for lead, that is the basis for the water lead guidelines. Then I have also been involved in the Q Foodborne Disease Epidemiology Reference Group, which is R developing estimates of the global burden of foodborne disease, and I have been involved in the chemical aspect S of that process and lead is one of the chemicals that we

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B B have developed estimates for. С С Q. Thank you. We all know that the current reference value D D regarding lead in water is 10 micrograms per litre. At internal page 14, the first paragraph, perhaps the last Е Е six or seven lines of this particular paragraph, you F F have mentioned that: "... this is designated as 'provisional' on the G G basis of treatment performance and analytical Η Η achievability." Ι Ι Then you went on to say: "The WHO further stated that, ' ... lead is J J exceptional, in that most lead in drinking water arises K K from plumbing in buildings, and the remedy consists principally of removing plumbing and fittings containing L L lead, which requires much time and money. It is Μ Μ therefore emphasised that all other practical measures to reduce total exposure to lead, including corrosion Ν Ν control, should be implemented." 0 0 Do you have anything further to add in this respect? Р A. Not really. Unlike many chemicals which are present in Р the source water, where you can take measures at that Q Q point in the system, lead is different, in that it is R R introduced into the system at places closer to the point of consumption. So I think the WHO is recognising that S S to remove plumbing and fittings is costly, and so they Т Т U U V V - 35 -Transcript by DTI Corporation Asia, Limited

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С	recommend that as a first preliminary step, to take	С
	measures to reduce corrosivity of the water it, to	
D	reduce leaching of lead, and presumably they would	D
Ε	endorse, if that doesn't work, then to take the more	Е
Б	costly step of replacing the fittings.	_
F	CHAIRMAN: So does that mean that that was known to the WHO	F
G	back even in 1958, when they first developed the	G
Н	allowable limit?	п
	A. I don't know the answer, what they knew back in 1958.	н
I	Certainly lead in water and the contribution of lead in	Ι
J	plumbing and actually the use of lead to make pipes was	т
	known back then. But I don't have specific knowledge of	J
K	that.	K
L	CHAIRMAN: But certainly it was known back in 1974, when the	L
	United States passed this Safe Drinking Water Act	
Μ	(1974)?	Μ
Ν	A. Again, that was before my time. I don't know what	Ν
0	the	
	CHAIRMAN: Okay. Thank you.	0
Р	MR KHAW: In relation to blood lead content, we know that	Р
Q	the current reference values are 5 micrograms per	0
	decilitre for children and 10 for adults. You have also	Q
R	mentioned at internal page 15	R
S	CHAIRMAN: Before you move to page 15, I note on page 14 the	S
	United States adopts sort of a higher value,	, , , , , , , , , , , , , , , , , , ,
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С	15 micrograms. Is there a rationale behind that?	С
	A. Well, that's not the only respect in which the EPA's	
D	guideline is different than the WHO's, because the EPA	D
E	does allow up to 10 per cent of violation, of 15, before	Е
E.	some action is mandated.	_
F	CHAIRMAN: I see.	F
G	A. They will allow up to 10 per cent to be above	G
н	CHAIRMAN: So 16.5?	TT
11	A. Yes. So all of these guidelines really try to balance	п
Ι	health-based considerations with practicality, and	Ι
J	I think, you know, that's why they are all provisional,	J
-	because the health information and the technologies	0
K	improve, and so over time permit the implementation of	K
L	more stringent guidelines. But this is where they are	L
	at the moment for the EPA.	
Μ	CHAIRMAN: I understand the ideal value of course is zero.	Μ
Ν	Does that mean that 16.5 is still acceptable?	N
0	A. According to the EPA	
0	CHAIRMAN: But what about according to you?	0
Р	A. You know, it's hard to take one number out of context.	Р
0	CHAIRMAN: Right.	0
Q	A. It would depend upon because, as I've said, lead is	Q
R	a multimedia pollutant, so we have to take a look at the	R
S	entire profile of exposure sources the paint, the	S
	air, the soil, the diet, hobbies, occupations. For some	5
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В		В
С	people, having a 16.5 might be relatively trivial	С
	because they are not exposed to lead in any other	
D	aspects of their life, but for other people, who have	D
Ε	a higher baseline exposure, that may be enough to put	Ε
_	them into a range where we need to be concerned.	
F	So I think it really is hard to give one answer.	F
G	CHAIRMAN: I see, that's what you mean. So it's the blood	G
и	lead level that matters, rather than the lead in water?	
п	A. In my view, that's what we use to make decisions,	Н
Ι	management decisions, as to whether or not we need to	Ι
Л	help an individual reduce their exposure. It's what's	Т
U	in their body, that to me is the index of likelihood of	0
K	an adverse effect.	К
L	CHAIRMAN: Thank you.	L
	MR KHAW: In relation to the blood lead level, you have come	
Μ	to a conclusion at internal page 16 that the reference	Μ
Ν	values selected by the Hong Kong government for	Ν
0	prioritising individuals for follow-up based on blood	
0	lead level are appropriate and consistent with those	0
Р	identified by the international bodies.	Р
0	A. That's right.	0
×	Q. You can confirm that?	Q
R	A. Yes, I do.	R
S	Q. If we then take a look at the recommendations for	S
	follow-up actions in respect of both children and	
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adults, as suggested by the CDC of the United States, at internal page 17. If we talk about children first, the first table, we can see in the left-hand column, blood lead concentration less than 5 micrograms per decilitre, and then we can see that the recommendations for follow-up actions are more limited. They consist of lead education, environmental assessment, and then follow-up blood lead monitoring.

In the next column, if we are talking about blood I lead concentration which is in the range of 5 to J 45 micrograms per decilitre, then there have been more recommendations for follow-up actions. For example, we K have things like environmental investigation, lead L hazard reduction, neurodevelopmental monitoring, abdominal X-ray.

M First of all, in relation to environmental
N investigation, and neurodevelopmental monitoring, can
you tell us what steps are needed for these follow-up
actions?

A. Yes. Usually, the environmental investigation would involve querying a parent about possible lead sources in the environment, finding out where a child spends time, in addition to the home. That of course would be age-dependent. Then, depending on the blood lead level, actually going into the home to collect samples of

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different media that the child might come in contact С with, such as collecting air samples or dust samples, D samples of the soil outside the home, the paint, and noting whether or not the paint is chipping, and asking Е the parent whether or not they have seen the child put F things in their mouth, the child put things in their mouth that are not food. In the extreme it's called G pica; asking about occupations of the parents, whether Η they might be involved in an occupation that involves Ι exposure to lead and so may bring lead home on work clothes; asking whether the parents engage in hobbies J that might involve the use of lead and so could K contaminate the home environment; asking about foods that the family eats, the medicines they take, whether L they take herbal medicines, which unfortunately have Μ been reported, in some instances, to have fairly high lead content; looking at the materials that the family Ν use to prepare food and to serve food -- sometimes, at 0 least in the United States, they are glazed with lead Р glaze which can leach lead and so get into the food and be consumed -- looking at the toys the child plays with Q and the furniture, whether it's painted with potentially R lead paint. Really, it's taking a comprehensive look at the S environment that the child lives in, to identify

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С		potential sources, because it can be very hard to tell.	С
	Q.	What about neurodevelopmental monitoring?	
D	A.	This could vary in intensity as well, depending upon	D
Ε		a child's blood lead concentration. It could be as	Ε
_		simple as asking the parent about a child's	
F.		developmental milestones, when they first sat unaided,	F
G		when they first took their first step, said their first	G
н		word, said their first sentence; or it could involve	т
		an in-person assessment using a screening tool by	п
Ι		a medical professional; or, if there are red flags that	Ι
J		are raised by any of these screening methods, actual	J
		administration of more comprehensive neurodevelopmental	_
К		assessments for diagnostic purposes.	К
L		So it really is based on the level of lead exposure	L
		and a clinical indication.	
Μ	Q.	Thank you.	Μ
Ν		In relation to adults, that is the last table on the	Ν
0		same page, we can see that for blood lead concentration	0
0		which is in the range of 10 to 29 micrograms per	0
Р		decilitre, then various follow-up actions are	Р
Q		recommended.	0
		Then we can see things like exposure assessment.	C
R		I take it that that is similar to the environmental	R
S		investigation that you have just mentioned?	S
_	Α.	That's correct, yes.	
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B B Q. Thank you. С С Then, talking about the test results that we have D D got here in Hong Kong, the next part of your report actually addresses the adequacy of the care plan as Е Е devised by the Department of Health. Before you talk F F about the adequacy of the care plan, you have provided a summary of the results, and I understand that at the G G fifth line you have mentioned that the results of repeat Η Η blood lead tests are reported for 28 individuals. Ι Ι I understand that at the time when you were compiling the report, the information set out here was J J based on the first list of test results that you K K gathered at the time? A. That's right, the 22 October 2015 line listing. L L Q. Because in fact subsequently there have been two updated Μ Μ lists, one dated 19 November 2015, and also the latest one is as of 3 December 2015. Ν Ν I think now you have had a chance to look at those 0 0 two updated lists, and just for reference sake, the Р second list, as of 19 November this year, can be found Р at E2/770 to 773, and the latest one is at E2/850 to Q Q 853. R R I understand, Professor, that you have had a chance to now look at these updated lists of blood test S S results. Do you have anything to add to your original Т Т

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B			В
С		summary of the test results?	С
	A.	Well, I didn't have a chance to carry out the same	
D		calculations that I carried out on the 22 October list.	D
Ε		I do note that there is one additional follow-up	E
		test on a pregnant woman.	
F.	Q.	Yes.	F
G	A.	I reported on the four pregnant women, so there are now	G
п		five. I had calculated an average change, a decrease in	
п		blood lead level, over the one month follow-up interval,	Н
Ι		of 13.7 per cent for those four women for whom I had the	Ι
т		data at the time.	т
J		The fifth woman had a decline of 14.3 per cent	J
K		between her initial and follow-up blood test. So her	K
L		data are very consistent with those that I saw for the	L
		other four.	
Μ		Looking at non-pregnant individuals, I think what	Μ
Ν		I had seen in the initial group of 24 non-pregnant	Ν
0		individuals was a decline between the baseline or first	
0		blood test and the follow-up blood test of about	0
Р		30 per cent. Without having carried out the	Р
0		calculations, by just estimation, it looks like the	0
×.		additional data that are now represented in the line	Q
R		listing are quite consistent with that.	R
S		There is one individual that was of some concern to	S
		me: a two-year-old female whose first blood test was	
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B B 6.48 micrograms per decilitre, and her follow-up three С С months later was 27.32 micrograms per decilitre, and D D then a blood lead conducted one month after that, it was 21.37, and three weeks after that it was 15.3. Е Е So I'm very happy to see that this child was F F followed up so assiduously and it's good that her blood lead was coming down. It does suggest, however, that G G there was something in her environment, certainly not Η Η the water because that had been stopped, but she was Ι Ι exposed to something between the first and the follow-up -- first follow-up blood lead -- that led to J J quite a spike in her blood lead level. K K But apart from her, everyone else seems to be a nice decline in their blood lead; as I say, averaging about L L 30 per cent. Μ Μ Q. Thank you. Just for record purposes, the two-year-old girl that Ν Ν you have just mentioned, I think the result of her blood 0 0 test can be shown at page 851 of E2. I think her result Р is the one just above the middle of this page. The Р first follow-up blood test result, it's about 27.32. Q Q I will now move on to discuss your recommendations

in relation to the care plan devised by the Department of Health.

I am just wondering if this is an appropriate time

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В		В
С	for a break?	С
	CHAIRMAN: Yes. Let's first take a 20-minute coffee break	
D	and then resume later. Thank you.	D
E	(11.28 am)	Ε
	(A short adjournment)	
F	(11.49 am)	F
G	MR KHAW: Regarding the care plan which is discussed at	G
н	internal page 19 of your report, you have provided your	п
п	opinion that "the general components of the care plan	п
I	proposed for the residents are appropriate, although	Ι
J	some are not described in detail".	J
	Then you go on to say:	
K	" while the plan to conduct an 'exposure	K
L	assessment' is sound, no information is provided about	L
	what this assessment will include and what methods will	
M	be used. In general, such an assessment involves	Μ
Ν	consideration of lead hazards in an individual's home	Ν
0	environment outside activities [et cetera]"	0
U	Then you have also mentioned that:	0
Р	"The care plan also stipulates a 'health evaluation'	Р
Q	for individuals with a blood lead level of 5 [to] 44 $$	0
	and a 'medical assessment' for individuals with	C
R	a blood lead level [exceeding] 44. What will be	R
S	included in these activities, and whether the clinicians	S
T	performing them will be experienced in assessing	_
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Clead-exposed individuals are not described. Whether the
'developmental assessment' will involve use of screeningCDtools, parent questionnaires, or in-person clinicalDEevaluations is not described."E

So there you talk about what is actually lacking or what was then lacking in the care plan that you saw at that time.

Now, I understand that the lawyers representing the Department of Health issued a letter to us yesterday, providing more information regarding the care plan. Perhaps we can take a look at such information and then I'll probably ask for your views on whether you find those plans, those existing plans, adequate or not.

If we can first take a look at E2, tab 71, at page 846. Page 846 talks about the updated tables and also the updated blood test results. I think we have just clarified that point earlier.

Then if we can focus on the next page, that is page 847. Again, we have dealt with the issues arising from the first paragraph, regarding the difference between 28 individuals and 29 individuals, because according to the first list there were 28 individuals, as mentioned in your report, and if we look at the updated list, there are actually 29 individuals.

If we can then move on to look at the second

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B B paragraph, from the second paragraph onwards it says: С С "As for the 'exposure assessment' mentioned in D D page 19 of [your report], a lead exposure assessment ... is conducted by a nurse of the Department of Health ... Е Е for every individual with elevated blood lead level. F F For selected circumstances, [lead exposure assessment] will be supplemented by a home visit. Relevant G G documents including the questionnaire and reference Η Η materials used for conducting lead exposure assessments, Ι protocol and flowchart for home visits of cases with Ι elevated blood lead level are included in the J J above-mentioned updated 'Master List of documents K K published'." If we can now perhaps take a quick look at the issue L L of the home visit, at page 870. In fact, this is Μ Μ

a document entitled, "Investigation protocol for elevated blood lead level", published by the Department of Health. If we take a look at "Home visit", page 870, paragraph 13, it says:

"Home visit provides a good opportunity for health education to the case and household members. Also, any probable source(s) of lead exposure of the case may be identified through home visit so as to guide risk reduction measures. The visiting team should take photo(s) of any highly suspicious item(s) in the

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В		В
С	household and discuss with the Government Laboratory for	С
	the standard and the methodology of analysis prior to	
D	collection of any specimen(s).	D
Ε	14. Home visit should be conducted under the	E
	following circumstances:	
F	Single venous [blood lead level exceeding or	F
G	equal to 20 micrograms per decilitre]; or	G
ц	Any suspicious source(s) of lead exposure is	
11	identified	н
Ι	Follow-up BLL(s) is persistently elevated"	Ι
J	So these are the circumstances which call for home	J
	visits, according to the measures now taken by the	U
K	Department of Health.	K
L	Do you find this suggestion for home visit	L
	sufficient for this specified category of residents?	
M A.	I do. I am very impressed, actually. I particularly	Μ
Ν	like the second bullet point, "Any suspicious source(s)	N
0	of lead exposure is identified", as cause for a home	0
0	visit.	0
Р	Now, I assume it's identified by means of an initial	Р
Q	interview and survey of the informant about what	0
	potential sources in the home might be. The reason	x
R	I like this very much is because it really focuses on	R
S	prevention. It doesn't require that someone be exposed	S
τ.	before the home visit is done to reduce exposure and it	_
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holds the potential of actually preventing the exposure.

Health, page 847, there are a few more suggestions here.

So I think this is very well thought-out, yes.

Q. If we go back to the letter from the Department of

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If we take a look at the third paragraph, starting from the words: "Regarding the 'developmental assessment' mentioned in page 19 of the expert report, all children with elevated blood lead level will receive preliminary

Ι Ι developmental assessment at [Department of Health's] Child Assessment Centres ... or Student Health Service J J Special Assessment Centres ... by a developmental K K surveillance team composed of [doctors] and nurses. The developmental assessment covers major developmental L L areas including gross and fine motor, language and Μ Μ communication, cognition, learning, behaviour and emotion, self-care, vision and hearing. This is Ν Ν conducted through history taking (including birth, 0 0 developmental and medical history, daily and school Р functioning and parents concern on development and Р behaviour), reviewing school reports and school work, Q Q physical examination (including soft neurological R R signs), clinical observation and use of questionnaires and assessment tools." S S Then finally it says:

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"Children identified with developmental or С behavioural problems will have follow-up evaluation at D Child Assessment Service according to individual needs. Children with largely normal development would receive Е continuous monitoring through enhanced developmental F surveillance at Maternal and Child Health Centres ... during pre-school years and annual health visits at G student health centres during school years. Parents are Η provided with anticipatory developmental guidance and Ι information on children's development in the form of pamphlets." J

If we can then take a look at the table which I think basically describes the details of this particular plan, at page 871, we can see various -- the table under paragraph 17, we can see various care plans devised for different groups of people with different ranges of blood lead results.

Basically, it summarises what has been set out in the letter that we have seen.

Also, I take it that you have had a chance to look at the checklist, at page 873, which contains all the items that need to be examined during the home visit.

Now you have had a chance to see the details of such care plans, are you happy with these suggestions now, or do you have any further comments on the adequacy of the

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B B care plan? С С A. Again, I am very impressed with the level of detail and D D the thought that's been invested in the different contingencies. Е Е What I particularly like about the clinical F F management or developmental assessment plan is that children with blood lead levels of 5 to 20 will receive G G a preliminary developmental assessment by the Child Н Η Assessment Centre or the Maternal and Child Health Ι Ι Centre or the Student Health Services. I like that because it actually is more -- it's providing more J J services than the US CDC developmental management K K quidelines provide, which suggests that only children with levels above 20 be surveilled in this way. But L L I think this is going to provide an opportunity to Μ Μ identify problems that children may be experiencing that have nothing to do with lead, but a child would benefit Ν Ν from receiving some kind of supportive services. 0 0 So I think this is generally even beyond the scope Р of responding to the water lead issue, this is going to Р benefit children and parents. Q Q I also had a chance to look at the lead exposure R R assessment questionnaire that will be administered. That's page 877 and beyond. I find that it covers all S S

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of the topics that I listed in my report that would be

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important to include in an exposure assessment.

So, again, I am very pleased to see this level of detail. I think it's going to serve the purpose for which it was designed.

Q. Thank you. I think finally, we have come to the last question that you have answered in your report, ie the efficacy and suitability of the acceptance criteria laid down by the Water Supplies Department for heavy metals, Η and if necessary to make recommendations. That's internal page 19, paragraph (5). I think here, apart from lead, you have also discussed the acceptance criteria in relation to three other heavy metals, ie cadmium, chromium and nickel. I think you have come to the conclusion that the acceptance criteria specified by the Water Supplies Department are based on sound Μ reasoning. Can I just for the purposes of general understanding of these heavy metals -- I am sure that you have a lot of experience in dealing with heavy metal poisoning. If we are talking about heavy metals such as cadmium, chromium and nickel, what are the general harm that they can do to human beings?

> A. Well, it differs from metal to metal. Cadmium is primarily a renal toxicant. It damages renal function, it reduces the ability to kidneys to filter out poisons in the body. So it can lead to chronic renal failure

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		occupationalists, people who encounter cadmium working	
D		in their jobs.	D
Ε		Chromium is a little more complicated, because there	Е
_		are different forms of chromium. Trivalent chromium or	
F		chromium (III) is actually an essential nutrient, so we	F
G		need a little bit of that. Chromium (VI), hexavalent	G
н		chromium, is one of the most toxic chemicals known, and	п
11		it's well known, it's recognised by the International	п
Ι		Agency for Research on Cancer as a human carcinogen.	Ι
Л		Nickel, there's actually not that much evidence	Л
-		about nickel. Nickel is, like chromium (III),	U
K		essential, but too much is thought to be an irritant.	K
L		So that's the reason for establishing exposure limits	L
		for nickel.	
Μ	Q.	In general, how can these heavy metals we're talking	М
Ν		about cadmium, chromium and nickel how can they	N
0		actually enter water?	0
0	A.	Sometimes they are just in the groundwater. They are	0
Р		natural constituents of the earth's crust. So,	Р
0		depending upon where an aquifer from which drinking	0
C		water is taken, they may be naturally present, or they	X
R		could be present as a contaminant. Cadmium is used	R
S		industrially a lot. Hexavalent chromium is also	S
		an industrial pollutant. And so, depending on the care	
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and require transplant, at very high doses, mainly

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taken in its disposal, it could contaminate water supplies.

D Q. Thank you very much. That leads us to your conclusion at page 22. If I may just quote what you have said here, "Summary of conclusions":

F F "Lead serves no biological purpose in the body. There is no 'safe' level of lead, as adverse effects in G G different organ systems, particularly the central Η Η nervous system, have been observed at blood lead levels Ι Ι less than 5 micrograms per decilitre. Therefore, the ideal blood lead concentration for a human is 0 ... J J Because of the ubiquity of lead in the contemporary K K environment, this will not be achievable in the near term. All lead exposure is preventable, however. The L L goal, therefore, must be to reduce exposure as much as Μ Μ is feasible. The many sources and pathways of lead exposure complicate the path to achieving this goal. Ν Ν Removing one pathway/source might produce only a modest 0 0 reduction in blood lead level. That lead is Р an accumulative toxicant stored in multiple pools in the Р body besides blood introduces an additional Q Q complication. The partial data available demonstrating R R an average reduction of approximately 30 per cent in the blood lead levels of residents of the affected public S S housing estates following interruption of the water Т Т

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pathway suggests to me that lead in the drinking water С С was, indeed, contributing to the exposure of the D D residents. I would anticipate that, over time, the residents' blood lead levels will re-equilibrate and Е Е reach a new steady state that reflects their lead F F exposure from other (non-water) sources and their endogenous lead sources reflecting past exposures. The G G blood lead concentrations achieved will therefore depend Η Η on what other sources/pathways contribute to Ι Ι an individual's lead exposure, as well as the magnitude of the individual's historical lead exposure." J J Just as a sort of general comment, now you've had

Ka chance to look at all the blood test results of theLresidents involved and the updated test results -- justMstudies and comparative angle, in view of the otherMstudies and cases that you have seen in other countries,Nwhat is your observation about the magnitude of thisOparticular incident, in view of the test results that we

- A. As I say, certainly the fact that once the residents were not drinking the lead-contaminated water their blood lead levels came down -- they were being exposed, there's no question about that, and as I say, it is prudent to interrupt any pathways of exposure that one feasibly can. I do look at incidents such as this in
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terms of the context of other scenarios that I have been С С involved in. When I first got involved in lead work, D D this was back in the late 1970s, at that time the mean blood lead level of US pre-school children was Е Е 15 micrograms per decilitre, and 90 per cent, it was F F 88 per cent, of children had a blood lead level above 10 micrograms per decilitre. G G

I was thrilled at that time when my two sons had blood lead levels of 6 micrograms per decilitre. In the context looking back now, even that's too high, but at the time it was pretty good.

Looking at the 3 December line listing, I see there were only two individuals who had a blood lead level above 15. One was a 89-year-old who had a 16.7 -- it perhaps may have been an occupational exposure at some point in the past -- and the other was a 15.8 in a one-year-old.

So from that perspective, these levels don't seem very high. They are certainly higher than we would like to see, and it's good that they are coming down.

Another episode that I was just dealing with at WHO was an episode of lead poisoning in Zamfara, Nigeria, where more than 400 children died from lead poisoning and one child had a blood lead level of 700 micrograms per decilitre.

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So there are certainly still cases where children are very, very seriously poisoned, and I don't think that's the case here. I don't think any children are going to be showing signs or symptoms of lead toxicity. On a population basis, I think we can conclude that there probably will be some shifts, minor shifts, in mean level of performance, shifts that you would never probably notice at the level of the individual child.

So my overall position is that this is a very
I unfortunate situation; I don't think the health
G consequences are going to be terribly serious, and
I think that the authorities are taking totally
K appropriate steps to support the affected people and
L taking steps to make sure that exposure from water is
not a major contributor to the overall exposure.

Q. Thank you. Finally, may I just confirm a few things with you, just as a matter of formality. May I just ask you to confirm that all the facts and matters that you have set out in your report and you have discussed today, which are within your personal knowledge, are true and correct? Can you confirm that?
A. Yes, I do.

Q. You also confirm that the opinions expressed in your report and also expressed today at the hearing are honestly held?

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В			В
С	Α.	Yes, they are.	С
	Q.	Can you please also confirm that the contents of your	
D		declaration as an expert, as attached to your report,	D
Ε		and also your CV attached to your report, are true and	E
Б		correct?	
ľ	Α.	Correct, yes.	F
G	Q.	You are willing to adopt what you have set out in your	G
н		report and what you have discussed orally at this	н
		hearing today as your expert evidence?	11
Ι	Α.	Yes.	Ι
J	MR	KHAW: Thank you very much.	J
	CH	AIRMAN: Thank you. Anyone wants to ask any questions?	
K		Yes, Mr Pennicott.	K
L	MR	PENNICOTT: I think there are others as well, but I am	L
м		happy to go first if nobody else wants to go first.	
IVI		Cross-examination by MR PENNICOTT	М
Ν	Q.	Prof Bellinger, I represent one of the contractors who	Ν
0		was responsible for building two of the eleven affected	0
0		estates. One of those affected estates is an estate	U
Р		called Kai Ching, and as it happens it is Kai Ching in	Р
Q		respect of which we have most information in relation	Q
		to, amongst other things, blood lead levels, and	
R		I expect you have picked that up during the course of	R
S		your reading of the materials for the purposes of your	S
т		report.	
I			Т
U			U

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А

н	

В			В
С		You will know, if you have read that material, that	С
		Kai Ching Estate comprises of six separate residential	
D		blocks. Is that something you are aware of?	D
Е	Α.	I wasn't aware of that level of detail.	Ε
	Q.	It is six residential blocks. There are 5,204	
Ł		individual units within those six blocks, and what	F
G		I want to do, I hope fairly briefly, is ask you some	G
н		questions about the various matters you have been	п
11		discussing with Mr Khaw, but specifically in relation to	Н
Ι		the Kai Ching Estate, if I may.	Ι
J		Before I do that, I am going to hand you some	I
-		documents in a moment that are going help me and	U
K		hopefully help you as well.	K
L		Can I ask you this: so far as the blood lead level	L
		tests are concerned, have you established how those	
Μ		tests were actually carried out on the individuals who	М
Ν		went for those tests?	Ν
0	A.	Only indirectly. I notice that some of the values are	0
0		reported as less than 3.3 micrograms per decilitre,	0
Р		which leads me to think that a portable LeadCare	Р
0		analyser instrument was used.	0
	Q.	Right, and do you know how the blood was taken? Have	×
R		you made an assumption as to whether it was a venous	R
S		approach or just a prick on the end of a thumb or	S
		a finger?	
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В			В
С	A.	You can use either type of sample with the LeadCare	С
		analyser, and I don't know whether venous or capillary	
D		blood was used. If the sampling protocol is adequate,	D
E		it shouldn't matter very much.	Ε
	Q.	That leads me to ask you this: if you are going blood	
F		lead level tests in a laboratory, is there any margin	F
G		for error that you would impose, or are they sort of	G
н		absolute figures?	
н	A.	Oh, absolutely, it does the different methods that	Н
I		are used do have different levels of precision.	Ι
T	Q.	Can you explain what level of precision, for example,	т
J		there is on a venous approach?	ե
K	A.	Well, the precision would be more specific to the	K
L		method, whether it's isotope dilution mass spectrometry	L
		or atomic absorption spectrometry or anodic stripping	
Μ		voltammetry. It's not so much whether it's capillary or	Μ
Ν		venous blood that's collected. The same level of	Ν
		precision would apply depending upon which analytical	
0		method is used, not the sample collection method.	0
Р	Q.	Can you give an approximation as to the margin of error?	Р
0	A.	Well, for the ICP-MS method, it can be plus or minus	0
Q		only a half of a microgram per decilitre or even	Q
R		a tenth. Yet for the atomic absorption, it may be plus	R
S		or minus 1 or 2 micrograms per decilitre. Again, it	S
		depends on whose hands are applying the method.	5
Т			Т
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В			В
С	Q.	Right, the skill of the operator?	С
	A.	Right. The US CDC was resisting lowering the action	
D		level from 10 to 5 because they were claiming that many	D
Ε		labs didn't have the ability to get closer than several	Е
Б		micrograms per decilitre in their measurement.	_
F	Q.	Prof Bellinger, one point that you discussed briefly	F
G		with Mr Khaw earlier arises on page 58, internal	G
н		page 14, of your report. It's the last sentence of the	н
		paragraph, headed "USA Environmental Protection Agency",	п
Ι		and it's this point about "If more than 10 per cent of	Ι
J		the tap water samples collected exceed the action level	J
		of 0.015 [micrograms per litre] (15 [micrograms per	
K		litre]), a water system is required to take steps such	K
L		as corrosion control treatments", and so forth.	L
		If the percentage is less than 10 per cent let's	
M		say, for example, 7.5 per cent, just by way of	М
Ν		example is there anything to be done in those	Ν
0		circumstances, or does this only kick in when you get to	0
0		10 per cent?	0
Р	Α.	Yes, my understanding is it only kicks in when you get	Р
Q		to 10 per cent. But there are some I'm no water	0
		expert, I have to say that right upfront. I believe	C
R		that if a water system is supplying more than some	R
S		number of individuals or units, they are required to	S
T		take appropriate steps to reduce corrosion. And this	
T			Т
U			U

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В			В
С		10 per cent applies to I think smaller systems, that are	С
		providing service to a smaller number of units.	
D	Q.	Have you, for the purposes of your report, studied in	D
Ε		any detail the water tests that have been done in	Ε
Б		relation to the various affected estates?	_
F	Α.	No. I have focused on the health side of things.	F
G	Q.	So you haven't looked at them at all, the results, the	G
н		test results?	п
11	Α.	Not in detail, no.	п
Ι	Q.	Okay. We will come to it a little bit in a moment.	Ι
J		I wonder if I could now hand out some documents that	J
		are going to help me to ask a few questions. I hope it	
K		won't take too long. (Handed).	K
L		If everybody has those, Prof Bellinger, for the	L
		first document, it's titled "Table A". You will recall,	
М		in your discussion with Mr Khaw earlier, you had	Μ
Ν		identified I think 24 results as at 22 October 2015.	Ν
0	A.	Right.	0
0	Q.	Where there were in fact 28 results, you have taken off	0
Р		four pregnant women and then got an average of	Р
0		30.8 per cent, I think.	0
C	Α.	(Nodded head).	×
R	Q.	What we see on table A is in fact 25 results, so similar	R
S		to you, what we have done is we have taken out the four	S
_		pregnant women but we have added back the one result	
Т			Т
U			U
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		- 02 -	v

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r	r

В		В
С	that you didn't have, so we've now got 25 rather than	С
	24. As you can see, we have calculated the average and	
D	it's changed very marginally to 30.27.	D
Ε	Can I ask you this first: this table includes two	E
_	women, lactating women. Why do you think you would	
F	include those rather than exclude them for this purpose?	F
G	You have taken out the pregnant women, I understand, and	G
ц	we see the reasons for that, but why do you include	
11	lactating women?	н
Ι	A. Well, to be honest, I didn't notice that. It probably	Ι
J	would have been better to calculate the average change	I
	including and excluding them. Again, because during	U
K	lactation, bone is still being mobilised to provide	K
L	calcium, it does complicate the kinetics a bit.	L
	Q. I just wonder whether there was a particular reason for	
Μ	it. I am not pressing you, I just wanted to know	М
Ν	whether there was a particular reason for it.	Ν
0	A. Which two were lactating?	0
U	Q. If I am using the references on the left-hand column,	0
Р	about halfway down there's a reference "KC00190"; do you	Р
Q	see that?	0
C	A. Yes.	×
R	Q. The 32-year-and-10-month-old lady and the	R
S	cross-reference for anybody who is interested is E1/542,	S
Ŧ	where we will pick up that there's a Y in the lactating	
Т		Т
U		U
V	- 63 -	V

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В			В
С		column on that page the other one is KC00257,	С
		a little bit further down the page. And similarly, it's	
D		the same page where we pick up the reference.	D
E		I am not pressing. I just want to know that there	Ε
_		was a reason that there is one calculation with and one	
F		calculation without?	F
G	Α.	Yes. I see they both declined about 18 per cent, and	G
		I would have predicted that they would decline a little	
н		bit less than non-lactating individuals. So that would	Н
Ι		probably boost up the 30 per cent drop a bit.	Ι
T	Q.	It would clearly push it up?	т
0	Α.	It would.	J
K	Q.	The other thing on this page, table A, Prof Bellinger,	К
L		that I just want to ask you a couple of questions	L
		about we have highlighted the two extremes in the	
М		right-hand column which I think you draw attention to in	Μ
Ν		your report. That is the most dramatic percentage	Ν
		change is in the fourth reference down, of minus	
0		55.54 per cent.	0
Р	Α.	Mm-hmm.	Р
0	Q.	And the smallest change appears to be in the fifth	0
Q		reference up, of minus 2.74 per cent.	Ų
R	Α.	(Nodded head).	R
S	Q.	Presumably you would agree with me, that's a rather	S
		large range for this type of exercise?	5
Τ			Т
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V		- 64 -	V

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В			B
С	A.	It's hard to say. I mean, it is a large range, but	С
		whether it's larger than one would see elsewhere,	-
D		I can't say.	D
E	Q.	What I am quite interested in, Prof Bellinger, is really	Е
		whether taking an average of all these percentages	
F		actually tells us anything? Is it very meaningful,	F
G		given the wide range that we have here, just to say	G
п		30 per cent?	
п	A.	Well, it is one way of summarising the evidence. As	н
Ι		I mentioned in my report, there is a statistical	Ι
J		phenomenon known as regression to the mean, which means	J
-		that if you take repeat measurements of some biological	U
K		function, or any function, usually those who are most	K
L		extreme on the first test will regress towards the mean.	L
		If they are high on the first test, they will be closer	
Μ		to the mean on the second test because they will	Μ
Ν		decrease. If they are very low on the first test, on	N
0		the second test they will probably increase towards the	0
0		mean.	0
Р		I did show that the mean the percentage decline	Р
0		between the first and the repeat blood test was larger	0
τ.		among people whose first blood test result was higher.	Y

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Now, that does suggest to me that there was some

regression to the mean going on. But we can't know how

much regression there was unless we also tested people

Α

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В			В
С		whose did repeat testing on people whose first blood	С
		test did not exceed the reference value. That would	
D		give us a sense.	D
Ε	Q.	Yes.	Ε
	Α.	But there are biological reasons why we would expect	
F		there to be variability among people in the difference	F
G		between their first and second blood test. Their age	G
н		would be one thing.	т
п	Q.	Yes.	п
Ι	A.	Because the older people would have more lead in their	Ι
J		bones.	I
-		It also depends upon what the other exposure, lead	0
K		exposure sources are for an individual. An individual	K
L		who's exposed to whose exposure is primarily from	L
		non-water sources is not going to show much of a decline	
Μ		once the water pathway is eliminated.	Μ
Ν		So, you know, for all of those reasons, it's	Ν
0		impossible in my mind to draw any conclusion from the	0
0		variability in the per cent change, without having lots	0
Р		more information.	Р
0	Q.	Yes. That's a very fair answer. But just to point out	0
τ.		that to really underline the point that you have just	Y
R		made the two extremes, the 55 per cent and the	R
S		2.74 per cent the first one appears to be a female	S
		child of 10 months old, that's the 55.54 per cent, and	
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Α

B the other one -- and I should emphasise, for a reason we С will come to in a moment, resides in Yuet Ching House --D we will come to the reason or the relevance for that in a moment. At the other end of the scale, as it were, Е the 2.74 per cent, is another child, a female of one F year and four months old. So you've got two children of not great difference in age showing a huge difference in G the readings between the first and second blood test. Η Does that tell you anything? Ι A. It tells me that water lead was probably a much more significant portion of the first child's -- the ten J month old child's overall lead exposure than it was the Κ other child, and that's why you would see a larger drop in the blood lead after the water pathway has been L remediated. Μ Q. Just looking at these percentages and the drops, if you like, in levels, again the passage that Mr Khaw read out Ν to you -- I don't want to go back to it again; 0 I certainly don't want to read it out again -- it's in the passage where you refer to the half-life and you had Р lengthy exposure and acute exposure, and you explain Q

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what the differences are and the implications of that.

Can you apply those principles to these results?

because the half-life has a very narrow applicability,

A. Not really, and for the reasons that I suggested:

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B and how it will play out for an individual will depend С С upon the other sources of exposure and how much past D D exposure an individual has had. The half-life of 30 days was actually identified by studies where adults had Е Е radioactively labelled lead injected into their blood. F F A known amount was injected and then measurements were made of the amount of radioactively labelled lead that G G came out in the urine and the faeces, through the bile. Η Η That's how it was arrived at, 30 days, and it's tied to Ι Ι the life cycle of the erythrocyte, the red blood cell, to which 95 per cent of the lead is bound. J J O. Yes. K K A. So while that is true, 30 days is the half-life of a labelled atom of lead, for the same reason that the L L study I mentioned in my report about children who had Μ Μ a blood lead between 25 and 29, it took years for their blood lead to fall by half because of these other Ν Ν toxicokinetic factors that go well beyond the half-life 0 0 of lead. Р Q. With regard to the 10-month-old child referable to Р 55 per cent reduction in percentage terms -- so we know Q Q the child lived for ten months when she had the first R R blood test, no doubt a few more months older when she had the second blood test -- from your experience, that S S exposure to lead at the levels we have seen, is that Т Т U U

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В			В
С		likely to have any long-term effect, do you think, on	С
		the child?	
D	Α.	Well, you know, again, it's hard to say without knowing	D
Ε		more information. If this 10-month-old child was nursed	Е
		for eight months and then had two months of exposure to	
F		formula made up with water that contained lead, then	F
G		that child probably didn't have much lead in the body,	G
U		and so that's probably that would explain a big drop	
п		two months later, once the water lead was remediated.	н
Ι		So, you know, under that scenario, I wouldn't anticipate	Ι
J		very serious impact on the child's life.	J
-	Q.	Again, I make the point, Prof Bellinger, just simply	U
K		because it seems to us that this is very much a sort of	K
L		micro-analysis that one needs to do on a very much	L
		individual-by-individual basis, and therefore taking	
Μ		these broad percentages doesn't really assist the	Μ
Ν		analysis a great deal. Do you agree?	Ν
0	Α.	Well, I agree that things are always complicated. This	0
0		is one way of organising the data. Certainly a mean can	0
Р		be misleading. I didn't calculate a median, you know,	Р
0		where it's a 50 per cent value. I suspect that it would	0
X		not be that much different than 30 per cent.	Q
R		But yes, these are if you are talking about	R
S		individual management of a child, then an average is	S
		meaningless.	
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U			U

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Α

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Α

B B Q. Yes. С С A. But if you are trying to capture an overall impact, D D I think it's reasonable, with appropriate caveats. Q. Okay. Can I then ask you please to go to what I hope is Е Е called table B, the next chart. Whereas the previous F F table just listed out all of those people who had been tested and re-tested, what we have done here, G G Prof Bellinger, is we have just focused on what I would Η Η call abnormal, still abnormal, tests. So you will see, Ι in the box on the left-hand side, we have simply again Ι just replicated the abnormal results first test and J J those that were still abnormal after the second test, so K K you can see what we have done here. Just to explain the blank at number 19 on the top L L graph and indeed the bottom graph: that's the Μ Μ two-year-old child that you referred to, when you were discussing the matter with Mr Khaw earlier, the one who Ν Ν started at 6.83, went up to 21.32 and then dropped back 0 0 a little bit on the third test, and then we have seen

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as it were.

A. I agree.

Q. You agree?

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more recently dropped back a little bit further to 15 on

the fourth test. We thought it appropriate just to take

that particular person, the child, out of the equation,

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В			В
С	Α.	Yes.	С
_	Q.	Okay. We see, if we're just comparing abnormal to	
D		abnormal, as it were, the average we get is just under	D
Ε		20 per cent. Do you see that?	Е
Б	Α.	Yes.	_
r	Q.	What we see in the bottom graph is in fact, at items 12	F.
G		and 16, some increases in blood lead levels. Had you	G
н		spotted those?	п
п	Α.	Yes.	п
Ι	Q.	Any comment about those particular ones, the increases?	Ι
J	Α.	The only conclusion I would draw was that water was not	Ţ
-		a particularly important pathway for those individuals	Ū
К		and that there were other sources in the environment	K
L		that would have remained the same after the water	L
		pathway was interrupted. So they continued to be	
Μ		exposed to those sources and had slight increases in	Μ
Ν		blood lead because of it.	Ν
0	Q.	Okay. Then if you go to the next table, table C	0
0		again, this is just referable to Kai Ching. And what we	0
Р		now know, leaving aside the results that I think were	Р
0		only received, certainly by us, yesterday or the last	0
~		couple of days, that on Kai Ching there have been	×
R		59 individuals who have been tested and re-tested. And	R
S		what we have done here is, if you look at the box in	S
		yellow on the left-hand side, those above the line, that	
Т			Т

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В			B
С		is between references 388 and 324, are the ones we saw	С
		on the previous table, the normal to abnormal, save that	
D		this time we have included, as it were, the rogue item.	D
E	Α.	321 per cent.	E
	Q.	Yes. Those below the line are, as it were, abnormal but	
F.		now normal. So this depicts the whole range so far as	F
G		Kai Ching is concerned, and we see that the average is	G
н		22 per cent.	
п		So, again, not miles off the 30 per cent exercise	п
I		that we saw earlier.	Ι
J		But then over the page to a table I hope called D,	J
		this is exactly the same as the previous table, but this	Ū
K		time we have taken out the two-year-old child that we	K
L		were discussing earlier.	L
	Α.	Yes.	
Μ	Q.	One sees what a dramatic effect that can have on the	Μ
Ν		average percentage.	N
0	Α.	Yes.	0
0	Q.	Lastly, if I could ask you to go to table E. I hope you	0
Р		can read it, because it's a bit small at the top, but	Р
0		again this is a breakdown of a number of statistics,	0
C		a number of details, that we have in relation to	×
R		Kai Ching Estate. You see listed across the top the	R
S		names of the six blocks and then some totals at the far	S
		end. Okay?	
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В			В
С	A.	(Nodded head).	С
	Q.	So taking the first one as an example, Hong Ching House,	
D		there were 165 blood lead level tests done, 149 of which	D
E		were normal and 16 which were abnormal. Do you see	Ε
F		that?	-
г	A.	Yes.	F
G	Q.	So that's now 9.7 per cent, for what that's worth.	G
н		If we then go down to the next items in the table,	TT
11		we can see how the normal and the abnormal break down.	п
Ι		So there were 12 children of the 16 abnormal, 12 were	Ι
J		children under 6, one between 6 and 8, none between 8	т
0		and 18, and then three people between 18 and 65. Do you	J
К		see that?	K
L	A.	Yes.	L
	Q.	Can I then just ask you to look at Yuet Ching House,	
Μ		which is the one on the far right-hand side before you	М
Ν		get to the "Totals" column, and there, there were 147	Ν
0		sorry, there were 150 total tests; do you see that?	0
0	A.	Yes.	0
Р	Q.	Of which three were abnormal; do you see that?	Р
0	A.	Yes.	0
×	Q.	Underneath all the details regarding the blood lead	Q
R		level tests, we have put some details of the water	R
S		sample tests. Do you see that?	S
	A.	I'm sorry, where are those?	
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		- / J -	•

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Q.	Under this first table, there's just a little table with	С
	two lines.	
A.	Yes, I'm sorry.	D
Q.	It says on the left-hand side, "Water samples taken"; do	E
	you see that?	
A.	Yes.	F
Q.	We can see on the far right-hand side of that little	G
	table that there were 93 water samples taken from the	
	5,204 units that exist on Kai Ching, of which seven	Н
	showed excessive lead in water, out of 93.	Ι
	However, if you look at Yuet Ching House, there were	J

J	
	no samples that exceeded the criteria, the 10 micrograms
К	per litre criteria that was being used. Do you see
L	that?

A. Yes.

Q. So, on one view, Yuet Ching, so far as water samples was concerned, was clear, or in the clear, and that was the same for another block, Yan Ching House as well?

A. Yes.

- Q. Can I ask you this, Prof Bellinger, by way of introduction: if one assumes, for the sake of argument, that the level or the degree of testing that was done on Yuet Ching House was valid and reliable, doesn't that raise a serious question as to whether or not any high lead levels in blood from the tests is related to the
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V

A

В			В
С		water?	C
D	Α.	No.	D
D	Q.	Why do you say that?	D
Ε	A.	Because there's nothing magic about 10 micrograms per	Ε
F		litre, except that it's a standard. If it were 9 or 8	Б
Г		or 7 or 6, there's still lead in the water and it still	F
G		could be getting into people and be responsible for some	G
н		fraction of the lead that's measured in the blood. Just	п
		because the water lead level doesn't exceed 10 doesn't	11
Ι		mean that the water lead isn't contributing at all to	Ι
J		an individual's exposure. It just means it doesn't	J
-		exceed the regulatory standard.	U
K	Q.	But the problem one issue about that, and this is	K
L		a point that you fairly mention in your conclusion, is	L
		that it's a contributing factor or may be a contributing	
Μ		factor, but you simply can't apportion the contribution,	Μ
Ν		can you?	Ν
0	Α.	Well, you could if you actually did the study where you	
0		went in and measured all of the other potential	0
Р		contributing factors; it would be possible to come up	Р
0		with a per cent of exposure that you attribute to water.	0
Q		That's been done in many, many studies. That wasn't	Q
R		done in this case.	R
S		But the fact that we see the declines in blood lead	S
		following the interruption of the water pathway, what	~
Т			Т
U			U

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other explanation is there, other than that water was no С longer contributing to blood lead and the blood lead is D coming down? Unless you assume that because of the publicity, people were going out and learning about all Е the pathways of exposure to lead and taking steps to F reduce their overall exposure.

Q. Understood.

Just finally then, can I ask this. I know, and you Η have already said once, you are not a water expert, you are a medical expert, and of course I accept that. Would you expect there to be a correlation, however, between the water sampling on the one hand and the blood K lead levels on the other?

A. In general, yes, other things being equal. But if everybody had the same non-water contributions to their blood lead, but water lead concentration varied among people, yes, you would expect a very high correlation and water lead would explain all of the variability in people's blood lead.

Р But of course all other things are not equal, and so water will contribute different percentages across Q individuals of their total exposure to lead, which is R why I would expect to see variability in the per cent decline once water lead is eliminated. S MR PENNICOTT: All right. Thank you very much, Professor.

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2015年12月15日

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2015年12月15日

Α

B

С	Α.	I could hazard a guess but it's just a guess.	С
	Q.	If I tell you that there have actually been published	
D		theses in Hong Kong written on lead poisoning, that	D
Ε		would not surprise you?	Е
	Α.	No.	
F	Q.	I am going to ask you in due course to have a look at	F
G		one of those published theses, and it examines the many	G
п		causes and effects of lead poisoning in Hong Kong.	
п		In fact, I could ask even now that it be put up on	Н
Ι		the screen, with permission. It's G3, item 88.	Ι
J		This is a thesis in the faculty of science at	т
•		Hong Kong University. It's slightly dated it's April	9
K		1987, and I noted that it doesn't actually refer to any	K
L		of your works, but other Hong Kong publications which	L
		I will take you to do and it's written in the	
Μ		department of chemistry at Hong Kong University.	Μ
Ν		You can see the abstract. On (i) if you roll	Ν
0		over one or two pages, please, past the	0
0		acknowledgments keep going, please.	0
Р	Α.	Yes.	Р
0	Q.	The next one. Exactly.	0
×		The abstract, of course, is the summary of the	Q
R		academic conclusions. I won't read them all out, but	R
S		the author shows that lead is detrimental, especially to	S
		children, and he identifies some reasons why that is	
Т			Т
U			U
X 7			
V		- 78 -	V

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2015年12月15日

Α

В			В
С		particularly so, not different from what you have said	С
		to the Commission of Inquiry.	
D		He points out that petroleum so this was 1987	D
Ε		gasoline perhaps in your language, was a major	Ε
F		contributor, and also that there was lead in consumer	_
F		products available in Hong Kong.	F
G		Consumer products include, plainly, food and items	G
н		like paint, for example.	п
	A.	(Nodded head).	п
Ι	Q.	The methodology of the thesis was to actually examine	Ι
J		the lead content inside 6,065 Hong Kong schoolchildren.	J
-		You will see that in the second paragraph, commencing,	0
K		"In this survey, the massive screening programmes"	K
L		It was a study of, as I said, of over 6,000 children	L
		in Hong Kong, aged from 6 to 17.	
Μ		If we come down, please, to the next paragraph:	Μ
Ν		"In the scheme III screening, 700 primary	Ν
0		schoolchildren aged from 6 to 16 years old were studied.	
0		The mean blood lead level \ldots of them was found to be 14	0
Р		[plus or minus 5.1 micrograms]. The spread of [blood	Р
0		lead level] was from 3.7 to 45 [micrograms]. The blood	0
×.		lead levels of Hong Kong children are similar to or	Q
R		lower than those in large cities. They [are] found to	R
S		conform to the EEC guidelines on the criteria of undue	S
_		lead absorption."	
Т			Т
U			U

U

V

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v

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食水含鉛超標調查委員會

A

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Α

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В			B
С		Now, the EEC guidelines that the author is referral	С
		to, are you able to comment as to whether that	
D		conclusion is sound; that, for example, levels like	D
Ε		45 micrograms conform to the EEC guidelines in 1987?	E
	Α.	Well, I'm not sure actually what the author means by	
F		saying they conform, whether that is intended to mean	F
G		that all levels were below whatever criteria the EEC was	G
и		using at that time. I personally don't recall what the	
11		EEC guidelines were in 1987.	н
Ι	Q.	Sorry, I wasn't trying to make it a test of absolute	Ι
I		memory. But we will read on and perhaps it will become	т
U C		clear.	0
K		The conclusions are:	K
L		"[There is an] association of some personal, family,	L
		behavioural and environmental factors with blood lead	
Μ		levels of children [when] analysed. It was found that	Μ
Ν		sex, mouthing habit, parents' occupation, floor level of	N
0		residence as well as the time spent on street(s) do have	
0		positive association with [lead] levels in children."	0
Р		Would you agree with that as a generality,	Р
0		Prof Bellinger?	0
¥	A.	Certainly there are studies that indicate that all of	Q
R		those, under certain circumstances, can contribute to	R
S		children's lead exposure, yes.	S
	Q.	Yes. Then we read on:	
Т			Т
U			U

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2015年12月15日

食水含鉛超標調查委員會

Α

B

Α

B

С		with the use of concrotted rearson correlation	С
		Analysis, it was discovered that the more direct	
D		personal factors, namely the occupation of parents and	D
E		mouthing habits, are more important than the	E
		environmental factors such as floor level of residence	
F		and the time spent on the street."	F
G		Then there was a special reference in the thesis to	G
н		the risk of fishermen's children, a study at Aberdeen,	н
		one of the ports on Hong Kong Island, where the children	п
I		were often literally handling lead weights and there was	Ι
J		an ingestion through the body.	J
		Would that surprise you that that generated	
K		an obvious risk of potential excess lead?	K
L	A.	No. That's been reported numerous times.	L
м	Q.	I am obviously not going to go through all of this	м
111		thesis, but there are some matters that I would like to	IVI
Ν		raise with you for your comment which may be of	Ν
0		assistance to the Commission of Inquiry.	0
		If we come firstly to page 105, please. This is	Ū
Р		really near the end of the thesis. You find	Р
Q		a conclusion it's chapter 4, page 105 about	Q
		30 per cent of the way down the page, you see the words,	
R		"Australia et cetera", full stop. Then this:	R
S		"Also the increase in use of copper pipings in	S
т		domestic water supply system should be carefully	т
1			1
U			U
V		- 81 -	V
	Transc	ript by DTI Corporation Asia, Limited	·

"With the use of controlled Pearson Correlation

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V

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В			B
С		monitored because the leaching of lead from the solders	C
D		has been reported to be the source of undue lead	р
D		absorption."	U
Ε		That's a well documented empirical fact; I assume	Е
F		you would agree with that?	Б
Ľ	A.	Yes, if the pipes have been connected by solder that	Г
G		contains lead.	G
н	Q.	Yes, exactly.	н
		The author in particular identifies a large number	11
Ι		of environmental factors that can contribute to lead.	Ι
J		Now, in America, what is the current greatest	J
		contributor of lead in the environment?	
K	A.	It's the lead in dust, house dust.	K
L	Q.	The lead in house dust?	L
	Α.	That's usually the strongest predictor of a child's	
Μ		blood lead level.	М
Ν	Q.	And it seems naive but how does the house dust get to	N
0		contain lead?	
0	A.	Well, in numerous ways, and that's why it's	0
Р		a significant predictor. It could be lead-based paint	Р
0		that is chipping and crumbling into fine particles that	0
¥.		contribute to the dust. It could be people tracking in	Q
R		soil from outside that may contain lead, because of	R
S		atmospheric deposition or the deterioration of exterior	S
		lead-based paint that gets into the soil. It could be	~
Τ			Т
U			U

2015年12月15日

食水含鉛超標調查委員會

A

A

В		В
С	lead blowing in through the windows; back in the days	С
	when lead was added to gasoline, that was a major, major	
D	problem. It also could be in the air because of the	D
Ε	child's house being proximate to a point source such as	E
Б	an industry that uses lead. It could be because people	_
F	are carrying out activities in the home that involve	F
G	lead, and little particles get into the dust.	G
н	So it integrates lead from many different sources,	п
п	and we think that's why it's usually the best predictor.	п
Ι	DR McCOY: Yes.	Ι
J	Is that a convenient time?	Т
Ū	CHAIRMAN: Let's take the lunch break first. We will resume	U
K	at 2.30. Thank you.	K
L	(1.00 pm)	L
	(The luncheon adjournment)	
М	(2.35 pm)	Μ
Ν	CHAIRMAN: Yes, Mr McCoy.	Ν
0	DR McCOY: Good afternoon, Prof Bellinger.	0
U	A. Good afternoon.	0
Р	Q. Just before we broke, I had asked you to confirm what is	Р
0	the number one source in America of lead in the	0
	environment, in the free environment, and you indicated	×
R	that it was basically household dust, or dust?	R
S	A. Correct.	S
m	Q. That is simply a product of other processes, as opposed	
Т		Т
U		U
V	- 83 -	v

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Α 食水含鉛超標調查委員會 2015年12月15日 Α B B to it being naturally occurring, I assume? С С A. Yes. It's not a source in itself. It's a pathway. D D Q. That's right. I see from your very lengthy bibliography that you Е Е have written widely, and you have studied, for example, F F the problem of excess lead with children in India --A. Yes. G G Q. -- Bangladesh, Mexico, Palestine, to name just a few of Η Η the places. Ι Ι Have you ever yourself studied the incidence of excessive lead in any part of Asia? J J A. Well, Bangladesh and India. Κ K Q. They may be for FIFA. A. What? L L Q. They may be in terms of football classification, but say Μ Μ east of India, have you ever studied any of those Asian regions, including Hong Kong, China, Japan, Malaysia? Ν Ν A. No, I haven't. 0 0 Q. You haven't? The reason I ask that question is whether Р there are any well-understood regional differences Р throughout the world in terms of ordinary background Q Q lead standards in daily life. R R A. By "lead standards" do you mean regulatory exposure standards? S S Q. Yes, first of all regulatory, and then second, as Т Т U U

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Α

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B B a matter of fact, the incidence of lead. С С A. Well, I'm not familiar with the lead standards used in D D each country. I know many do refer to the WHO standard of 5. Е Е In terms of background incidence of lead exposure, F F yes, there are very large differences, mostly between developed and developing countries. The WHO, in G G an analysis they published in 2003, estimated that about Н Η 10 per cent of the world's children have a blood lead Ι Ι level greater than 20 micrograms per decilitre, and 99 per cent of them reside in developing countries. So J J the success we have seen in reducing population lead K K exposures in developed countries over the last 30 years have not seen the same benefit in developing countries. L L So they do have more -- continue to have more of Μ Μ a problem with lead. Q. Lead does not degrade as such, being an element, Ν Ν does it? 0 0 A. That's correct. Р Q. And you can't transmute it into anything else, unless Р you believe in alchemy, I suppose? Q Q A. That's correct. R R Q. So once the lead has entered the total environment, it remains, unless dispersed by air or water? S S A. That's correct. Т Т U U V

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V

2015年12月15日

В			В
С	Q.	So it would be important in understanding the background	С
		levels of lead, in any urban environment, to understand	
D		the history of that land before its current usage?	D
Ε	A.	That can be important, yes.	Е
Б	Q.	You see, I will show you in due course that there are	_
F		well-documented peer-reviewed academic studies in	F
G		Hong Kong that because certain parts of Hong Kong had	G
н		been heavily industrialised in the past, the lead	п
		effectively has sunk into the land and remains. Does	п
I		that seem a logical proposition, if the assumption is	Ι
J		correct about the prior industrialisation?	J
	A.	Yes. There have been similar studies in Massachusetts,	-
K		where I live, actually, where people have looked at	K
L		historical land use and identified higher blood lead	L
		levels among children living in regions which formerly	
Μ		had industries that used lead.	Μ
Ν		So, yes, that's a well-described phenomenon.	Ν
0	Q.	So if you are living in an area that has previously been	0
0		relatively heavily industrialised, is there a likelihood	0
Р		that the dust in that area will be significantly higher	Р
0		in lead content than otherwise?	0
C C	A.	I would say I would presume yes. It would remain to	¥
R		be confirmed, but it's a very reasonable hypothesis. It	R
S		would add to the background risk and perhaps raise the	S
		background blood lead level against which other sources	
Т			Т
U			U

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V

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Α

В		В
С	would add.	С
	Q. And the human ingests lead by, what, touch, inhalation,	
D	consumption; every method possible?	D
Е	A. Except for skin absorption, yes. Inorganic lead is not	E
Б	absorbed on the skin. But ingestion and inhalation are	_
F	the main routes of exposure.	F
G	Q. Can I ask you to come now to page 1 of the thesis that	G
н	I have partly shown you this morning. Page 1. I see	п
	you have a hard copy now.	п
Ι	75 per cent of the way down the page, it says:	Ι
J	"There are many routes by which lead can enter the	I
_	air, water and soil as a result of the wide use of lead	U
К	and its compounds."	K
L	I won't read all of this out, but in particular the	L
	combustion of coal is identified as a source of lead	
Μ	entering the environment.	Μ
Ν	Are you familiar with that as a contributing factor	Ν
0	to environmental lead?	0
0	A. No, actually. That's a new one. Mercury I know is	0
Р	a problem with coal combustion, but it's new to me that	Р
0	lead may also be released.	0
C	Q. Again if we can just move down to the last two lines on	Y
R	that page:	R
S	"The lead level in the food chain (plant, fish,	S
	vegetable, poultry et cetera) is also increased by	
Т		Τ
U		U
V		
v	- 87 - Transcript by DTI Corporation Asia, Limited	V

A

В			В
С		several orders of magnitude."	С
		Then this:	
D		"The daily intake of lead of the average person in	D
E		[the United Kingdom]" and (2) is the scientific	E
-		reference for it "and USA (3)" ditto "is	
Ł		estimated to be 18 [micrograms per day and 175	F
G		micrograms per day] respectively."	G
ц		Are you familiar with those figures?	
11	A.	Yes. These are quite old numbers, and the estimates for	н
Ι		today are much, much less, in the order of 20 or	Ι
J		25 micrograms per day, because of all the reductions in	J
		the last 20 to 30 years and dispersion of lead into the	U
K		environment.	K
L	Q.	Then if you come down, please, on page 4 to the first	L
		full paragraph, and the last two sentences:	
Μ		"Lead has a very slow turnover rate in the body."	Μ
Ν		What dictates that turnover rate?	Ν
0	A.	Well, I assume that means the excretion of lead from the	0
0		body. I had earlier talked about the different pools in	0
Р		the body in which lead resides. Each pool has	Р
0		a different turnover rate, so you can't assign one	0
·		single number. So lead that's in the type of bone	×
R		that's hard and compact, like the tibia, has a half-life	R
S		of maybe decades, three decades, whereas the lead in	S
_		soft, spongy bone, the trabecular bone that is in	
Т			Т
U			U

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A

2015年12月15日

A	

В			В
С		contact with circulation has a half-life of years to	С
		a decade, and in soft tissues will be somewhat less, and	
D		as I mentioned, in blood it's 30 days.	D
E		Certainly in bone there's a very slow turnover rate.	E
Б		It's not so slow in the blood.	_
r	Q.	Halfway down that page, there's a historical reference	F
G		to lead poisoning from Roman times. It's probably	G
н		plumbum, being the chemical name for lead, and plumber	п
		going together.	11
Ι	Α.	Exactly.	Ι
J	Q.	Plumbers carry lead.	J
	Α.	Right.	
K	Q.	If you turn the page, please, to page 6, you see the	K
L		first reported environmental exposure from lead was in	L
		Queensland in Australia in 1892. That was paint.	
М		Then an issue the chairman raised with you this	М
N		morning, the issue about young children. The author	Ν
0		here states:	0
U		"Young children are widely held to be more	U
Р		susceptible to lead poisoning in the environment than	Р
Q		adults for the following reasons.	Q
		1. Young children have a higher metabolic rate than	
R		adults, so that their intake of food and drink, and	R
S		hence lead, is greater relative to their body weight	S
т		than that of an adult."	т
1			Т
U			U
v		- 89 -	V

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Δ
1 1

B			В
С		Do you agree with that?	С
	A.	Yes.	
D	Q.	"2. Young children may absorb and retain more lead from	D
Ε		the gut than adults."	Е
	A.	Yes.	
F	Q.	Thank you.	F
G		"3. Young children may have a greater biologically	G
		active lead burden than adults."	
п		Do you agree with that?	н
I	Α.	I am not exactly sure what the author means. If he	Ι
J		means that a greater or a lesser fraction of lead is in	Ţ
		the bone in children than in adults, so it's more	Ū
K		available to interact with cellular targets, then yes,	K
L		I would say I agree with that interpretation of the	L
		phrase.	
Μ	Q.	"4. The opportunity for oral intake of significant	Μ
Ν		amounts of lead from non-food sources is higher in young	Ν
0		children than in adults due to mouthing habits."	0
Ū		I think that's pica, the obscure word P-I-C-A, the	U
Р		non-nutritive intake by children, eating things that	Р
Q		they shouldn't be eating.	0
	Α.	Right, although even children in whom the behaviour is	c
R		not as extreme to warrant the application of the term	R
S		pica still typically, developing children explore	S
т		their environment with their hands and their mouth,	T
1			Т
U			U
V		- 90 -	V

Α

		В
	so	C
Q.	And the fifth one:	_
	"Deficiencies in nutritional status may also be of	D
	greater consequence in the enhancement of absorption of	Ε
	lead in young children."	
	Do you agree with that?	F
Α.	Yes. Children are more likely than adults to be	G
	deficient in iron and calcium, and those promote	н
	absorption of lead in the gut.	n
Q.	So the conclusion is children are more susceptible to	Ι
	lead poisoning. But can I now ask you: are they more	J
	likely, because of the nature and size of their bones,	
	to excrete or eliminate that ingested lead than	К
	a comparator adult?	L
A.	I am not familiar with evidence that that's the case,	
	that the excretion rate is not different from adults.	Μ
Q.	There's no difference at all?	Ν
Α.	Not that I am aware of.	
Q.	Then perhaps if I could ask you to come across to	0
	page 8, and I am certainly not going to go through all	Р
	of this, but there are just a few highlights. If you	0
	come to page 8, please, 10 per cent down the page:	Q
	"However the public awareness of this problem"	R
	that's the problem of excessive lead "has increased	S
	since early 1980s."	
		Т
		U
	Q. A. Q. A. Q.	

V

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A

2015年12月15日

Α

В			В
С		And several factors are set out. I won't read all	С
		those factors out, but we have at number 4 a reference	
D		to the Hong Kong Consumer Council, a prestigious body	D
Е		that by its very name looks after consumer interests.	Ε
Б		It was reported by the Hong Kong Consumer Council that	_
F		the lead in petroleum in 1980 was at 0.84 grams per	F
G		litre, six times more than in the United States. This	G
н		was staged down to 0.15 grams in January 1987.	п
п		Now, the lead from the petroleum, it enters the	п
Ι		environment. It stays, I think we agree, unless it is	I
J		literally blown away out of Hong Kong.	I
-	A.	Correct.	
K	Q.	So, in a small, dense, compact society like Hong Kong,	K
L		when lead in petroleum was available, the probability is	L
		it remains adjacent to where the vehicle burnt the lead,	
Μ		the petrol?	Μ
Ν	A.	Yes, it is emitted in the area proximal to the roadways.	Ν
0		So the farther you go from the roadway, the	0
0		concentration of lead declines.	0
Р	Q.	If you come over to page 10, please, at number 8:	Р
0		"High level of lead at kerbside soil was reported.	0
C		Mean concentration of lead was 2,974 [plus or minus] 408	×
R		[micrograms] and the range was from 271 to 19,073	R
S		[micrograms]."	S
-		Extreme readings.	
Т			Т
U			U
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V

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Р

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Α

		В
Α.	It's quite high.	С
Q.	Then at 9:	
	"Approximately 7.5 per cent of 1,135 adult blood	D
	lead levels were found to exceed generally accepted	Е
	reference value of 35 [micrograms] in a survey carried	
	out in Hong Kong."	F
	And the reference is to 60 in the bibliography.	G
	"The findings suggested that the group studied did	и
	not conform to the EEC guidelines."	п
	Now, with the revised limits, they would be well	Ι
	over, would they not?	J
Α.	Correct.	_
Q.	Then 10 and I would like you just to go to page 113	К
	briefly. At item 61, because D Barltrop and I Thornton	L
	in Hong Kong in 1982 wrote a book, "Lead Pollution in	
	Hong Kong Report to the Special Committee on Air	М
	Pollution", so that's the source material that the	Ν
	author is referring to.	0
	If you come back then to page 10, at paragraph or	U

item 10:

"A report on 'Lead pollution in Hong Kong' prepared by two experts from UK was published. It stated that a comprehensive evaluation of lead in the environment and its impact on the population were required."

Was there comparable efforts, say, in the

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В			В
С		United States at that time?	С
	Α.	Comparable efforts to?	
D	Q.	To publish a comprehensive evaluation of lead in the	D
Е		environment.	E
Б	Α.	Yes.	_
F	Q.	And in the United Kingdom?	F
G	Α.	I am not as familiar with	G
н	Q.	Have you seen what these two experts in 1982 recommended	п
		to the government should happen? Have you seen the	п
Ι		outcome?	Ι
J	Α.	No, I haven't.	J
	Q.	Nor have I.	
K		Now, this thesis involves, as I said, the screening	K
L		of over 6,000 Hong Kong children. If you turn over, at	L
14		page 12 I won't spend time on this for the	
М		non-chemists but at page 12 you find the interference	М
Ν		with the biosynthesis of the haem, the haemoglobin, and	Ν
0		that's set out in diagrammatic form.	0
U		The author, at page 11, 80 per cent down, is	0
Р		identifying zinc protoporphyrin. You would be familiar	Р
Q		with that as a metabolite.	0
	Α.	It's not really a metabolite but I am familiar with it.	C
R	Q.	So the author of this thesis, he examined ZPP, as I will	R
S		more conveniently call it. You see the chemistry at 13.	S
_		We can go past that.	
Т			Т
U			U
V			X 7
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B B Then at page 16 you see what was achieved. He went С С to government or subsidised Hong Kong schools. The D D children were all of Chinese race and aged from 6 to 17, and the distribution of schools covered the three major Е Е areas of Hong Kong: the Island, which we are now on; F F Kowloon Peninsula; and New Territories together with the Outlying Islands. Are you generally familiar with the G G geography? Η Η A. Generally, yes. Ι Ι Q. We can avoid now much of this, but we come to page 20. The blood sample from each of these children was taken J J from the finger, from a capillary. Now, this morning, K K Mr Pennicott, senior counsel, did ask you a question

directed at whether there was a margin of error between capillary blood and venous blood for the purposes of determination of excessive lead, and you, would I be right, were hesitant in accepting that there was a difference, or is that unfair?

A. No, no. There should not be a difference if adequate cleaning protocol is done. The problem with capillary samples is that there's sometimes lead dust on the finger, and when you lance and get a drop of blood, it takes up some of that lead on the finger, if you haven't cleaned it properly, and so it can give you a false high reading.

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В			В
С		But if you follow accepted practices for the	С
		cleaning of the finger before you stick, the capillary	
D		blood lead level should be very close to the venous	D
Ε		blood lead level.	E
F	Q.	If I suggest to you that a recent peer-reviewed study	_
F		actually shows that even with proper cleaning, there is	F
G		a 10 per cent false positive risk with capillary taking	G
н		of blood for the testing of lead, would that surprise	п
		you?	п
Ι	Α.	Well, what exactly is is it 10 per cent	Ι
J	Q.	I can produce the paper.	J
	Α.	Is it a 10 per cent difference in the blood lead level	-
K		or a 10 per cent difference in	K
L	Q.	In false positives.	L
	Α.	That doesn't mean anything to me.	
Μ	Q.	All right.	Μ
Ν	Α.	I would have to see the paper.	Ν
0	Q.	I am happy to do that and I will do it soon.	0
0	Α.	But I have seen other papers where the difference	0
Р		between the venous and the capillary levels were exactly	Р
0		the same. So I don't know how this study would differ	0
C C		from those.	¥
R	Q.	Now, could we then please move way through much of this	R
S		and come to page 54. The author notes, 30 per cent down	S
		the page, that ZPP, the metabolite, as I'm calling it,	
Т			Т
U			U

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Α 食水含鉛超標調查委員會 2015年12月15日 Α B B "is firmly bound with haem and persists there for the С С life span of the red blood cell (about 120 days)." D D You agree with that? A. Yes. Е Е Q. So that's relevant to a 30-day cycle in your 25 per cent F F equation, the cycle of re-testing the blood every 30 days? G G A. Yes. Η Η Q. If we come much further across towards the end -- just Ι Ι give me a moment, please -- the author of this thesis concluded that there is a statistical correlation J J between the lead levels in children and the occupation K K of their parents. Is that something you have seen in any other study? L L A. Yes. It's quite well described that parents involved in Μ Μ occupations involving lead can bring it home and those children will have higher blood lead levels than Ν Ν children of parents who don't work with lead. 0 0 Q. May I ask you to please leave that document, and I would Р like to look at a study that refers to one of your own Р works, with appropriate approval, I should add. Q Q Could you come please to item G3/90, please. That's R R right, "Home sweet home? A case study of household dust contamination in Hong Kong", from the University of S S Cincinnatti and the Chinese University of Hong Kong in Т Т U U

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B B March 2000. С С If we just look at the abstract: D D "It is well recognised that many heavy metals have chronic effects ... particularly to young children ... " Е Е I will leave words out in the interests of time. F F "... house dust ... This research aims at quantifying the concentrations of heavy metals within G G the home environment in Hong Kong and their Н Η relationships with environmental factors. The results Ι of this study seem to suggest that traffic and the age Ι of the building and neighbourhood are more important J J factors than the types of industry and socioeconomic K K status in affecting household dust contamination. The metal burdens in Kwun Tong ..." L L Now, that's a particular district in Kowloon. Μ Μ "... an old area with heavy traffic, are significantly higher than other districts." Ν Ν If we just move past that and come to a second 0 0 document, and this is the next one, G3/92, called, "The Р study of metal contamination in urban soils of Р Hong Kong". This is written between Imperial College Q Q London, the Department of Civil and Structural R R Engineering at Hong Kong Polytechnic University, and the Department of Land Surveying and Geo-informatics at the S S Hong Kong Polytechnic University, in September 2003. Т Т U U

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If we	e again	look	at 1	the	abstract,	it	refers	to	the
highly u	rhanised	1 Kow	loor) ar	••				

"A significant spatial relationship was found for [nickel, copper, lead and zinc] in the soils using a GIS-based analysis, suggesting that these metal contaminants in the soils of Kowloon ... had common sources. Several hot-spot areas of metal contamination were identified from the composite metal geochemical map, mainly in the old industrial and residential areas ... The [lead] isotope composition of the contaminated soils showed clear anthropogenic origins."

> I will try to deconstruct some of that with you very briefly, and I won't spend long on this, I promise you.

If you come to the second page of this article, at page 114, five or six lines down -- first of all, you can see your own name there, Prof Bellinger, and immediately after that:

"The heavy metal concentrations of soils have been widely studied in Hong Kong ..."

And here a list of Hong Kong academics, from 1978, 1982, 1987, 1996, 1997 and 2001, who have all studied them.

According to a survey conducted in 1981 by Lau and Wong ... in which the heavy metals in soils of different sectors (recreational, commercial, industrial and minor

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С		agricultural) were studied, the highest [cadmium]	С
		concentration in Hong Kong was found in a recreational	
D		area (Chung Pui), where 54 [micrograms per kilo of	D
Ε		cadmium] was found in roadside soils. The highest	Е
Б		copper concentration was found in an industrial area	_
r		(Aberdeen). The highest [lead] and [zinc]	F
G		concentrations in Hong Kong were found in	G
Н		an agricultural area (Man Uk Pin)."	н
		That's up near the border, Sha Tau Kok area, for	
Ι		those more familiar.	Ι
J		Then please coming over to the conclusion, you'll	J
		see at page 116 the results and discussion, and at	
K		page 116, the right-hand column, about three lines down	К
L		into the last paragraph:	L
м		"It has been shown that the concentration of [lead]	м
171		in Hong Kong is related to Hong Kong's high traffic	IVI
Ν		volumes Although [lead] has been banned in petrol	Ν
0		for a number of years, the concentration of [lead] in	0
		urban soils still reflects the significant degree of	-
Р		historical [lead] contamination nation and the long	Р
Q		half-life of [lead] in soils."	Q
D		That would be consistent with your own experience?	_
ĸ	Α.	Yes.	R
S	Q.	If we turn over, at 119, the left column, halfway down:	S
Т		"Several hot-spots [of very high levels] are	т
•			I
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В		В
С	identified from the composite geochemical map,	С
	including" and these will make more sense to others	
D	in the room like than yourself "Lai Keng,	D
Ε	Cheung Sha Wan, Shek Kip Mei, Kowloon City,	Е
Б	Ngau Chi Wan, To Kwa Wan, Ho Man Tin. These are mainly	-
r	old industrial and residential areas in Kowloon.	F
G	Therefore, the history of an urban site can contribute	G
н	to heavy metals in soils."	н
	Page 119, in the right-hand column, it is pointed	11
Ι	out that "soils in the hot-spot areas were generally	Ι
J	about 2.5 times more contaminated than the rest of the	J
	urban area". There's even a reference to the fact that	
К	"the hot-spot areas were generally found at the	K
L	northeast or east side of a major road", because of the	L
N.	diffusion of pollutants by the prevailing wind in	
Μ	Hong Kong, which is from the southwest.	Μ
Ν	One last point. At page 120, the left column, five	Ν
0	lines from the bottom:	0
0	"3.3.3. The effects of buildings and landscapes on	U
Р	heavy metal dispersion.	Р
Q	It has been shown that high-rise buildings can	0
	obstruct air movements, and prevent the particulates in	C
R	air from dissipating."	R
S	Have you seen this conclusion reached before,	S
	Prof Bellinger?	
Т		Т
U		U

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Α

В			В
С	Α.	No, I haven't.	С
	Q.	That's a study by Taiwanese academics, under their own	
D		regime.	D
Е		If we turn over, the effect of it is that the shape,	Ε
F		height, density and configuration of buildings disallows	
Г		the lead particulates to ever leave the area where they	F
G		originally had been, so they simply stay and remain.	G
Н		Does that appear at first blush to be a logical	н
		conclusion? In a sense, they are trapped where they got	
Ι		to?	Ι
J	Α.	Oh, it does yes. If something prevents the	J
		particulates from becoming airborne and carried by the	
K		prevailing winds, then it's likely to continue to reside	K
L		in the soils.	L
М	Q.	So if we have a combination of what had been in the past	м
141		a heavily or medium heavy industrialised areas, and they	IVI
Ν		have now been built upon in a dense way, high buildings,	Ν
0		the logical inference is that what was originally in the	0
		soil and has now become dust will therefore remain in	
Р		that area; it can't escape?	Р
Q	Α.	That's correct.	Q
D	Q.	There's more I won't go through them all, but there	
ĸ		are more to the effect other studies. In fact, there	R
S		are a large number of Hong Kong studies on these issues.	S
т		Now, Prof Bellinger, perhaps I could bring these	т
•			I
U			U

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В			В
С		points, as it were, to a head. At page 49 of your	С
		expert report, the bottom right-hand corner of page 5,	
D		also marked with a large 49. The first full paragraph:	D
Е		"Lead is often characterised as a 'multimedia'	E
F		pollutant because of the diverse ways in which human	-
r		exposure can occur. The major classes of	F
G		sources/pathways of exposure to inorganic lead (the form	G
н		of lead in solder) include food, air, soil, paint, and	
11		water, although exposure can also occur as a result of	п
Ι		many other activities"	Ι
J		And you make a reference to herbal medicine; here,	J
-		of course, it would be Chinese medicine.	U
K		Now, lead in food, and I see you have studied, for	К
L		example, the effect of lead in turmeric, I think was it	L
		in Bangladesh or India. It's a root vegetable. Do root	
М		vegetables take in the lead?	Μ
Ν	Α.	To a certain extent, yes, and leafy greens will	Ν
0		accumulate lead that's in the air or in soil and then	0
0		becomes entrained as air as soil is worked. Then also	0
Р		in the past there have been some lead-based pesticides	Р
0		used in agriculture lead arsenic, a great combination	0
x		of lead and arsenic.	Y
R		Then lead is also introduced along the way as food	R
S		is processed and packaged. Lead-soldered cans used to	S
		be a big problem.	
Т			Т
U			U

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В			В
С		So it's possible at a number of points in the	С
		production system for lead to get into food.	C C
D	Q.	What about seafood?	D
E	A.	To my knowledge, lead was not a major problem in	E
		seafood, although I can imagine, if there are local	
F.		hot-spots near discharge points from industry, seafood,	F
G		especially shell fish, that are feeding in that area on	G
н		the bottom where lead may settle into the sediments,	п
11		that may be a problem locally. I am not familiar with	п
Ι		it being a problem globally.	Ι
J	Q.	Now, the next one you have is air. Hong Kong is	J
		positioned adjacent or part of the Pearl River Delta,	Ū
K		which is on any view reasonably heavily industrialised.	K
L		What is the effect of air pollution coming from those	L
		sources? It transports lead or it may do so?	
М	A.	Well, it depends on what those transports burn, if they	Μ
Ν		are still using leaded petrol, which I don't think they	Ν
0		are. Then, if lead is used in any of the industrial	0
0		processes that go on in those locales, and it's not	0
Р		within my area of expertise, I don't know I don't	Р
0		know if there have been recent measurements of air-lead	0
-		concentrations in Hong Kong.	× ×
R	Q.	So you've identified for the Commission there are	R
S		a number of sources of lead which can have contributed	S
_		to the aggregate total of lead inside an individual's	
Т			Т
U			U
V		- 104 -	v

Α

В			В
С		body?	C
	Α.	That's correct.	
D	Q.	And on the face of it, the lead in any solder that has	D
Ε		been used is a potential source of some of that lead?	Е
Б	Α.	Presumably, yes.	
F	Q.	The outcomes that Mr Pennicott showed you this morning	F
G		and the variations and the differences, is that likely	G
ч		to be attributable to any particular factor in any	н
н		particular individual? Is there any predetermined	
Ι		allocation that you can say is due to lead solder?	Ι
J	Α.	No. I presume you are referring to the per cent decline	Л
		in blood lead observed?	J
K	Q.	Yes.	K
L	Α.	As I said, every individual differs in terms of what	L
		they are exposed to from all these different potential	М
M		sources, in terms of how frequently they come in contact	
Ν		with it, what foods they eat, whether they play outside	Ν
0		in contaminated soil. So my first hypothesis would be	0
0		that it's the mix of the contributions of these	
Р		different pathways and sources differs from one	Р
0		individual to the next, and as a result of that you	0
C C		would expect to see some variation among individuals in	×
R		the per cent decline when one of these pathways,	R
S		specifically water, is interrupted and no longer	S
_		contributing.	
Т			Т

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B			В
С	Q.	Yes, because even the difference in an individual's diet	С
		could well be material?	
D	Α.	Absolutely.	D
Е	Q.	I indicated I would show you the materials relating to	E
F		the protocol for taking of blood. Could I have this	_
		given to you, please. (Handed). This is a document	F.
G		called "Pediatric lead toxicity work-up", and it is	G
		published on 6 September 2015.	
11		I also have, incidentally, a document from the	н
Ι		Oregon Department of Human Services, the Oregon Lead	Ι
J		Poisoning Prevention Program, which I would like you to	т
U		look at, but please look at the first document.	J
K		One can see, under the cross-heading "Whole blood	K
L		<pre>lead level":</pre>	L
		"Whole blood lead level is the criterion	
Μ		standard for confirming the diagnosis of lead poisoning.	Μ
N		For convenience, a finger-stick capillary lead level has	Ν
0		been used for screening. Properly collected capillary	
		samples have a 10 per cent false-positive rate. Once	0
Р		an elevated lead level is detected, a venous lead level	Р
0		is assessed for confirmation."	0
X	Α.	Yes, that's absolutely right. In fact last week, at the	Q
R		meeting of the guideline work group, producing	R
S		guidelines for the diagnosis and treatment of lead	S
		poisoning in Geneva, this is an important part of our	
Τ			Т
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В			В
С		document, that capillary samples are fine for screening	С
		but you don't make treatment decisions based on them;	
D		you get a confirmatory venous blood lead level. But	D
Е		that's when you are contemplating clinical management.	Ε
F	Q.	Do you know, for the Hong Kong results, whether they	
		were obtained by capillary or venous method?	F
G	A.	I don't know, no.	G
T	Q.	So it is important because if it was capillary, but had	T
11		not been audited by a venous test, then there is	Н
Ι		significant intrinsic doubt as to the reliability of the	Ι
J		original capillary reading?	I
-	A.	But the pattern of findings over time, in the	U
К		individuals that were identified as having a result	K
L		above the reference level, are so coherent in terms of	L
		the distribution of declines, I think that's very, very	
Μ		unlikely, that there was contamination of the original	Μ
Ν		blood lead levels.	Ν
0		Usually, when there's a contamination from	0
U		a capillary sample, the value is greatly elevated,	0
Р		because a microgram of lead is microscopic, and much	Р
Q		more than that is on the finger from contamination. So,	0
-		when that gets in the blood, you are going to see	x
R		a blood lead level that is much higher than 6 or 7.	R
S	Q.	Can I ask you a likely different matter for a moment.	S
		Do you agree that lead absorption in children is	_
T			Т
U			U
V		- 107 -	V

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В			В
С		increased when there is insufficient calcium in the	C
		child's diet?	
D	Α.	There are epidemiological studies showing that children	D
Е		whose diets are insufficient in calcium do have higher	E
F		blood lead levels, and it's based on the underlying	_
Г		biology. The inference is that the absorption of lead	F
G		is higher in those children. I don't know of any	G
н		experimental evidence to back that up, but it makes	н
		sense in terms of the known biology.	11
Ι	Q.	If I can just ask you the same question but changing the	Ι
J		variable. Instead of an insufficiency of calcium, if	J
		there was an insufficiency of iron in the diet, is that	
К		also likely to lead to increased lead absorption in	K
L		children?	L
	Α.	Yes.	
Μ	Q.	Why is that?	Μ
Ν	A.	Well, lead and iron also look very similar to they	Ν
0		look similar to one another chemically, just as lead	0
U		looks similar to calcium, so they compete for binding	0
Р		sites in the gut. So if iron is not present, then lead	Р
0		will preferentially be attached to those binding sites	0
×		and be absorbed into the gut and then into the blood.	×
R	DR	McCOY: I have no further questions. Thank you, sir.	R
S		Thank you, Prof Bellinger.	S
	CH	AIRMAN: Anybody else? Mr Ho.	
Т			Т
U			U
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食水含鉛超標調查委員會

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В			В
С		Cross-examination by MR HO	С
D	MR	HO: I just have one or two very minor questions.	-
D		Prof Bellinger, I am representing the Housing	D
Ε		Authority. I have just got one or two minor questions	Ε
F		for you.	F
-		When you were answering my learned friend Mr McCoy's	r
G		question, he showed you a paper which I think was in	G
Н		1987, and there were some figures about food intake, and	н
		you said those are outdated because now, normally, the	
I		intake of lead from food is much lower. Do you remember	Ι
J		that?	J
	Α.	Yes. Was that I thought that was total lead intake,	
K		not intake just from food.	K
L	Q.	Right.	L
м		May I just ask you to look at a background paper to	
IVI		the WHO Guidelines for Drinking-water, which is a paper	M
Ν		that's been referred to in this Inquiry, and that is at	Ν
0		A1. Page 403 is the cover page. Perhaps you can have	0
0		a look at that first.	0
Р		You see the title. This is a background document.	Р
Q		If you look at the next page, you will see the date of	Q
		this paper is 2011; do you see that?	-
R	Α.	Yes.	R
S	Q.	Are you familiar with this paper?	S
T	A.	Yes.	_
Т			Т
U			U

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В			B
С	Q.	You are?	C
	Α.	Yes.	
D	Q.	Did you have a hand in the preparation of this paper?	D
Ε	Α.	No. I had a hand in the process that this was based	E
F		on	F
	Q.	I see. Thank you very much.	Г
G	Α.	And the JECFA re-evaluation of lead earlier in 2011.	G
Н	Q.	If I may ask you to go to page 2, which is at page 410,	н
		please.	
Ι		Paragraph 2 of course you see, I believe, these	Ι
J		are the sort of pathways that you identified and	J
		explained to us earlier: air; 2.2 is water; 2.3, we see	
K		food; 2.4, which is over the page, we see "Other routes	K
L		of exposure", and that refers to household dust as being	L
м		one of the significant sources.	м
111		If I may ask you to come back to food, at 2.3. At	M
Ν		the bottom of that page, do you see it gives examples of	Ν
0		the daily dietary lead intake from various countries,	0
Ũ		for example, like Sweden, and over the page, do you see	U
Р		66 micrograms for Finland; 23 micrograms for the USA;	Р
Q		and further down the page we see a figure for England;	Q
		we also see Canada, which is 53.8 micrograms per day;	-
R		Belgium, 90 micrograms per day; Sweden has a lower	R
S		figure, 24; Mexico has, amongst these countries, the	S
(T)		highest, 177. Do you see that?	
Т			Т

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В			В
С	Α.	Yes.	С
	Q.	So there is a great variety of the daily dietary intake	
D		of lead between the countries?	D
Е	Α.	Right. One caution I would interject here is that it is	E
Б		important to look at the dates that these figures were	_
F		taken from, because, looking very quickly at the	F
G		references, I see that the Finnish number comes from	G
н		a 1980 study, the USA from 1982 to 1984, and Sweden from	н
		1985. So these are quite outdated numbers.	11
Ι	Q.	Right.	Ι
J	A.	They are much lower now.	J
	Q.	Right. But even amongst what we call the developed	
K		countries, for example some of the European countries	K
L		and even Canada, the daily intake from diet could be	L
		much higher than what you said, 20 to 25?	
M	A.	They could be. You do have to be careful about dietary	М
Ν		estimates, because it depends a lot about how you survey	Ν
0		the diet.	0
0	Q.	Certainly.	0
Р	A.	There's a lot of variability of individuals within the	Р
Q		same country and what their diet is. So you just have	0
		to be careful to not put too much stock in any single	C C
R		number unless you know exactly how the data were	R
S	Q.	Exactly. So there can be different variants which may	S
T.		contribute to a higher figure or a lower figure, even	_
Т			Т
U			U
V		- 111 -	V

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В			В
С		amongst developed countries on the one side and	С
		developing countries on the other side?	-
D	A.	It's very hard to be certain here.	D
Е	Q.	You can't just generalise, as it were?	E
_	Α.	You can, but at your own peril.	
F.	Q.	All right. Interestingly, the last sentence of that	F
G		paragraph talks about even you get lead from drinking	G
н		wine.	п
n		I know quite a lot of my colleagues here drink wine,	п
Ι		so do be careful.	I
J		Moving down the page to 2.5, you see there is	J
		a sentence that starts:	-
K		"More than 80 per cent of the daily intake of lead	K
L		is derived from the ingestion of food, dirt and dust."	L
		From water, that is a relatively small proportion of	
Μ		total intake. That's still true, isn't it?	Μ
Ν	Α.	I think on average that's a fair statement, but it will	Ν
0		vary from setting to setting.	0
0	Q.	In fact, the same point is made, if we go to the end of	0
Р		this document at page 423. The last paragraph on that	Р
Q		page, if we start with the second sentence of the last	0
		paragraph:	C
R		"Nevertheless, because lead exposure arises from	R
S		a range of sources, of which water is frequently a minor	S
T.		one, as it is extremely difficult to achieve	
Т			Т
U			U
V		- 112 -	V

Α

食水含鉛超標調查委員會

2015年12月15日

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B			В
С		a concentration lower than 10"	С
		Again, I believe that's in fact a sentence that is	
D		lifted and becomes part of your report, so that must be	D
Ε		correct?	Ε
Е	A.	Yes, as far as I know.	
F	Q.	Thank you very much.	F.
G		I see that apart from what is stated here air,	G
н		water, food, household dust, and so on in your own	п
		report at page 63 of the bundle, you also identify	п
I		children's toys as a potential source of lead intake.	Ι
J	A.	(Nodded head).	Ţ
	Q.	Is that, in your experience, a general problem with lead	Ū
K		in children's toys?	K
L	A.	In the US, it is a problem with toys imported from	L
		certain areas. Mainland China is one of the areas of	
Μ		great concern.	Μ
Ν	Q.	Sorry to say.	Ν
0	A.	Sorry to say, yes.	
0	Q.	Yes, in mainland China there is a danger or a risk, at	0
Р		least, of producing toys that may contain lead content.	Р
0	A.	Yes, but it's true for toys imported from other areas as	0
x		well. The surveillance is not really what we would like	Y
R		to see, and if a child is mouthing a toy that's painted	R
S		with lead-based paint, that can lead to very high	S
		exposures.	
Т			Т
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V			T 7
v		- 113 -	v

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В			В
С	Q.	Of course let's put your report into perspective. You	С
		are telling us generally about the effect of lead on	
D		various groups of people, but of course, in any	D
Е		individual case, if we want to see the effect of lead on	Ε
F		a particular individual, we have to do a lot more study,	
F		examination and so on in order to find out the cause; is	F
G		that correct?	G
н	Α.	What do you mean by particular effects on an individual?	п
11	Q.	For example, if we isolate one particular person in	п
Ι		question, then what you are doing in your report	Ι
J		wouldn't give the answer?	I
	Α.	What I said in my report applies to groups of	Ū
K		individuals, and the associations that have been	K
L		observed are population statistics.	L
	Q.	Yes.	
Μ	Α.	It can be difficult to identify effects in any	Μ
Ν		individual child. All we can say is that, on average,	Ν
0		children with higher blood lead levels or adults with	
U		higher blood lead levels have this health adversity.	0
Р	Q.	Yes. Thank you. This is a sort of statistical general	Р
0		observation?	0
C	Α.	Right. We can't say with certainty. We might be able	×.
R		to say more likely than not a child's problems are due	R
S		to lead.	S
	Q.	Thank you. But in order to find out as referring to	
Т			Т
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С		a particular individual, we have to study a lot more, we
		have to have a lot more information about his
D		background, his living environment and so on?
Е	A.	I see what you mean. Yes, in order to identify the
		potential contributors to blood lead level.
F	MR	HO: Yes. Thank you, Professor.
G		Cross-examination by MS WONG
н	MS	WONG: Prof Bellinger, if I may ask a few questions.
		This morning, Mr Chairman has raised the issue of
Ι		the rationale as to why the US was adopting a higher
J		value of 15 micrograms. I wonder if I may assist by
		producing or showing you a document. (Handed).
К		Prof Bellinger, I think this is a meeting note dated
L		11 January 2006, by National Drinking Water Advisory
		Committee.
Μ		Is it correct that this is a federal advisory
Ν		committee that supports the EPA in implementing its
0		duties and responsibilities?
0	A.	That's my understanding, yes.
Р	Q.	We can look at page 2. We see from that table, there
0		are three different contaminants commonly found in
C C		drinking water; correct?
R	A.	Yes.
S	Q.	They include the distribution before water enters the
		distribution system; the second one is at the end of the
Т		
U		

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В			В
С		filtration process, before distribution system; and	С
		lastly, at the consumer's tap.	
D		I can see there are three different regulatory	D
Е		approaches; correct? Different EPA regulatory	E
_		standards, in that table.	
F	A.	Three approaches, one for each of the contaminants?	F
G	Q.	Yes, for each contaminant.	G
п		Can you explain why we have three different	
п		standards for the three different sources?	Н
Ι	Α.	A different standard for arsenic and cryptosporidium and	Ι
J		lead?	T
Ū	Q.	Yes.	J
K	Α.	Because there's a conclusion that we need to worry about	K
L		different levels of contamination for each of the three,	L
		that they can't all be the same the same standard	
Μ		would not be appropriate for all three. They need to	Μ
Ν		have their specific standard, based on the hazard	Ν
0		identification process and the whole risk assessment	0
0		that underlies the setting of standards.	0
Р	Q.	And the purpose is of course to eliminate the lead in	Р
0		each of these possible sources, so that you could	0
τ.		achieve the so-called lead offset zero in drinking	¥
R		water?	R
S	A.	Well, I think the EPA says that it's not really feasible	S
		to achieve a level of zero.	
Т			Т
U			U
V		116	V
		- 110 -	•

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В			В
С	Q.	Yes.	С
	Α.	So they set a standard that they hope will be protective	-
D		of the most vulnerable subgroup of the population.	D
Е	Q.	Yes, and if we turn to page 3, which appears to explain	E
-		why this 15 micrograms was arrived at if we look at	
F		paragraph 2, it states:	F
G		"To establish the action level, EPA reviewed	G
н		information from representative water systems, efficacy	п
11		of different treatment technologies, and	н
Ι		cost-effectiveness of these technologies."	Ι
J		And it referred to footnote 1, which states:	I
-		"EPA gathered data from 39 medium-sized water	U
K		systems. Approximately 96 per cent of these systems	K
L		were able to keep in the 90th percentile in the range of	L
		10-20 [micrograms per litre]. Thus, EPA concluded that	
Μ		15 [micrograms per litre] represented the feasible level	Μ
Ν		for public water systems."	Ν
0		It appears why they have chosen this particular	
0		figure. Do you accept that, Professor?	0
Р	Α.	Yes, it's not strictly health-based but it takes into	Р
0		account the feasibility as well. It's a risk management	0
C		standard, not necessarily a health-based standard.	Y
R	Q.	Yes. Thank you. It refers to an action level. This is	R
S		my last question. So is it correct that this action	S
		level is simply a screening tool for determining whether	
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V		117	V
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В			В
С		certain treatment technique actions are required?	С
	Α.	That's my understanding, yes.	
D	Q.	Thank you.	D
Е	MS	WONG: Thank you, Professor.	Е
		Cross-examination by MR LEE	
Е,	MR	LEE: Yes, Professor. You have said that a child gets	F
G		one chance to develop his brain, something like that.	G
н		If he misses that chance, presumably, when the child	и
		grows older, his IQ level would not compare as well as	п
Ι		his peers; is that right?	Ι
J	Α.	Could you say the last part, may not compare?	J
	Q.	May not compare as well as his peers.	
K	Α.	Not as well as it would have been had the child not been	K
L		exposed to lead. It may still be higher than his peers.	L
	Q.	But he has one chance to develop the brain, and if he	
M		misses that chance, can he ever catch up?	Μ
Ν	Α.	Unfortunately, with brain development, it may not be	N
0		possible to catch up. As I mentioned, a variety of	0
0		processes need to happen at the right time, and putting	U
Р		cells in the right place, and if that chance is lost	Р
Q		then there may be permanent effects that cannot be	0
		overcome. The effects may be reduced if the child has	c
R		certain advantages after that point, but the brain	R
S		cannot go back and rewire itself.	S
т	Q.	But if the lead content, say from whatever source, gets	-
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2015年12月15日

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into the blood, then presumably it could reach the С brain? D A. Unfortunately, yes. There is -- as adults, we have a nice system called the blood-brain barrier that has Е very tight junctions between the endothelial cells and F it limits the size of molecules that can pass into the brain. G In children, those adjunctions are not so tight, Η they are kind of leaky, for the first couple of years. Ι So things like lead can get into the brain more easily in a young child than in an adult. That's why the J central nervous system is more vulnerable in a child K than the peripheral nervous system in an adult. Q. When the lead gets into the brain, does it settle there? L A. Yes. Unfortunately, it has an easier time getting in Μ Μ than getting out. Q. Ah. So what effect would it be on that child? Ν A. Well, it depends on the dose, how much lead. What we 0 now think is that there are certain areas of the brain that are more vulnerable to the effects of lead than Р other areas. One of the primary areas is the frontal Q lobe, the prefrontal cortex, which is where what are R called executive functions tend to lie, and those are things like the ability to do long-term planning and S organisation, to develop strategies and to adapt the Т U V - 119 -Transcript by DTI Corporation Asia, Limited

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strategies in the face of new information, the ability to delay gratification. This is why we think that children with too much lead are more prone to ADHD and behavioural problems, because executive functions are the major underlying deficit of children with ADHD.

We also know that lead is particularly dangerous to a small area of the brain called the hippocampus which is where learning and memory take place, a process called long-term potentiation, which is dependent upon the glutamate system of the brain, which is a neurotransmitter, and lead interferes with the function of that.

So this is a child who may have trouble keeping up in school, may get into behavioural difficulties, and those I think also underlie the propensity I mentioned to aggression and getting into trouble and violence, because they can't delay gratification, don't have as much success in school and so drop out and start making poor choices because of executive function problems.

So I think these issues compound as a child get older and play out in ways that are very disadvantageous.

- Q. So once the lead gets into the brain, and supposing the cause of the lead in the brain is actually from lead in the water -- let's assume that -- will the child improve
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- after he moves away from that source?
- A. Well, it's always good if exposure is reduced. So if the child is no longer taking in lead from that source, that's certainly of benefit.

In the literature on lead, you do see that the early F deficits associated with childhood exposure are permanent. Personally, I don't believe that. I think G it's too pessimistic. I think there are studies -- the Η prospective studies that have followed children do show that the deficits persist, but usually children remain in the same environment, and so they are continually exposed.

My feeling, and there is actually some animal evidence to support this, is if you raise an animal in an enriched environment, which for a rat means a bigger cage, a cage that includes toys to jump around on and other rats to interact with, that actually can prevent some lead-associated cognitive problems.

- Q. Provided there is no lead in the toys?
- A. No lead in the toys, correct. But we don't know -- we don't have good studies to indicate whether that's true for children, and I believe that it probably is, but we just haven't done those studies.
 - Q. But would you agree with me that once lead gets into the brain, it might or it might not be permanent? Would you
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В			В
С		accept that?	С
	Α.	It might not. There are animal studies that show	C
D		that that have sacrificed the animals and measured	D
Ε		the actual concentration of lead in different areas of	E
Б		the brain, and those studies have shown that if you	
F.		put if you expose an animal, their blood lead goes	F
G		up, eventually their brain lead goes up. You take the	G
н		animal out of that, you stop the exposure, their blood	н
		lead comes down, but for the foreseeable future the	п
Ι		brain lead remains elevated. But the animals have been	Ι
J		sacrificed. If they let the animals live forever,	J
		perhaps brain lead would come down, but so far, it	
К		doesn't look like that.	К
L	Q.	Let me come back to lead in the brain of a child. Can	L
м		you get rid of the lead once it gets into the brain?	
IVI	Α.	As far as we know, the chelating drugs that are used	М
Ν		when a blood lead level in a child gets above 45	Ν
0		primarily takes the lead out of the blood and to	0
Ū		a lesser extent some of the soft tissues. But the brain	0
Р		doesn't seem to be one of those soft tissues, and	Р
Q		I think it's because the chelating agent is too large	Q
		a molecule and even it can't cross the blood-brain	
R		barrier. So the answer is, as far as we know, no.	R
S	Q.	So the chelation treatment, is it an intrusive form of	S
т		treatment?	-
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U			U

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Α

В			В
С	A.	Certainly it has to be considered	С
	Q.	How would it affect the child, say?	
D	Α.	Well, there are different options among chelation.	D
E		Until about a decade and a half ago, the chelation	Е
_		required hospitalisation and giving the child very	
F		painful intramuscular injections or IV injections of	F
G		chelating agents.	G
н	Q.	How frequent would the injections with?	п
11	Α.	Well, for the most common course of chelation, it's	п
Ι		a 19-day course of treatment, and then you stop and let	Ι
J		the re-equilibration process that I talked about go on.	J
		Usually what happens is the child's blood lead drops	
K		precipitously when you start chelation, but then a week	К
L		or so after you compete it, it comes back up because of	L
		the re-equilibration, and so it's necessary to give	
Μ		another course of chelation.	Μ
Ν	Q.	So how many courses of 19 days each?	Ν
0	Α.	As many as needed. In the Zamfara episode, where	0
0		children had blood lead levels of several hundred	0
Р		I talked to the paediatrician who did the chelation and	Р
Q		one child required 68 courses of chelation, and the	0
		blood lead still was elevated.	C
R		There are now oral chelators, dimercaptosuccinic	R
S		acid, that can be given on an out-patient basis, which	S
T		is much less intrusive and more acceptable to parents	
Т			Т
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Α

В			В
С		and children.	С
	Q.	Is it also more effective?	
D	Α.	It is not effective in reducing the cognitive deficits.	D
Ε		It does reduce the blood lead and the soft tissue lead,	E
F		but there was a randomised trial where children of blood	
F.		lead levels of 20 to 44 were randomised to receive	F
G		chelation with oral succimer or placebo, no treatment,	G
н		and the children were followed up after treatment was	н
		completed and there was absolutely no difference in the	11
Ι		cognitive outcomes of the children.	Ι
J		So waiting for the child to become poisoned, it's	J
		too late, apparently, to prevent the adverse effects of	
K		lead on the brain.	K
L	Q.	Professor, you mentioned chelation. Are there other	L
		methods of treatment?	
Μ	A.	That's the first choice. But as I say, chelation is	Μ
Ν		only indicated when a child's blood lead is above 45.	Ν
0	Q.	That's very high.	0
0	A.	Yes. For blood lead levels 44 and below, the	0
Р		interventions are the environmental investigation, to	Р
Q		identify an ongoing source, the nutritional counselling,	0
		to make sure that the diet is adequate. But	C
R		unfortunately there's really not much else to offer.	R
S		The chelation is counter-productive in a child with	S
T		a blood lead below 44 because it chelates not only lead	_
1			Т
U			U

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Α

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В			В
С		but chemicals that look like lead, and the calcium and	С
D		the zinc that we talked about earlier, and there is some	р
2		renal toxicity. So it's not performed below 45.	D
Е	Q.	I move on to another topic. You have been asked many	Ε
F		questions by other counsel about other sources of lead	F
		getting into the body, apart from lead in the water;	-
G		soil, air, dust and all this. Let me pose a number of	G
н		questions to you.	н
		I will use two examples, scenario A and scenario B.	
Ι		Before I go to those examples, is there any relationship	I
J		between the level of lead in water and the level of lead	J
		in the blood?	_
K	A.	Yes.	K
L	Q.	Scenario A: if the lead content in water is low, like	L
		2 micrograms per litre, but the lead content in the	
М		blood is relatively high, say 20 micrograms per	М
Ν		decilitre, would you say in this example that the excess	Ν
0		of lead in the water is an important contributing factor	0
0		to the rather high presence of lead in the blood?	0
Р	A.	I would say it's unlikely. It's more likely that	Р
0		there's some other source that's of primary importance	0
C		for that one child.	×
R		When I said there is a relationship between water	R
S		lead and blood lead, that again is looking at a large	S
		population, where those sorts of unusual circumstances	
Т			Т
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В			В
С		would even out.	C
-	Q.	So I come to scenario B. Now, this time there's also	C
D		high lead content in the water, say 50 micrograms per	D
E		litre in the water, and on the blood side it's also	Ε
		high, say also 50 micrograms per decilitre. In	
F		scenario B, would you say the lead content, high lead	F
G		content in the water, is an important contributing	G
п		factor to the lead in the blood?	
п	A.	Probably, but again I would want to know what the other	Н
I		potential sources are, and I would want to know if the	Ι
I		child was actually drinking the water.	т
0	Q.	Of course, or the baby drinking milk powder where leaded	J
K		water was used.	K
L	Α.	Yes.	L
	Q.	But of course I forgot to mention that if you assume the	
М		other factors were equal in scenario A and scenario B	Μ
N		do you follow me?	Ν
0	A.	(Nodded head).	
0	Q.	Otherwise, if the other factors are totally different,	0
Р		then you cannot make a comparison. So you have to make	Р
0		a comparison on the basis that the other factors were	0
L.		equal in scenario A and scenario B?	×
R	A.	I agree.	R
S	Q.	So, if that is the case, then if the presence of lead in	S
		the water is high and the presence of lead in the blood	
Т			Т
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В			В
С		is also high, then you would say the water is	С
		an important contributory factor?	
D	Α.	More likely than not, and you might want to interrupt	D
E		the water pathway to see what happens to the blood lead	E
Б		and see if it drops.	_
г	Q.	Yes. Thank you.	F.
G		Now, you have in your report made some importance on	G
н		the age of a child: 0 to 1 and then 1 to 6, and then 6 $$	и
		to 18. I think this is more or less what you are	11
Ι		directed to do by the Commission.	Ι
J	Α.	Yes.	J
	Q.	But six years is a rational age; is that right?	
K	Α.	A threshold?	K
L	Q.	The threshold of six.	L
	Α.	What do you mean by "threshold"?	
M	Q.	Because I see in your own report, at page 7, internal	М
Ν		pagination, that is page 51, the first complete	Ν
0		paragraph:	0
0		"A series of neuroimaging studies of young adults	U
Р		(mean age 20 years) in whom detailed histories of lead	Р
Q		exposure prior to the age of 6 years were available	0
		provides evidence that early-life exposure produces	C
R		persistent changes in brain structure and function."	R
S		There, you use six years; is that right?	S
	Α.	Well, in this study, they measured blood lead quarterly	
Т			Т
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Α

В		В
С	in these children for the first few years of life, and	С
	then up to six years of age, but levels beyond that were	
D	not available until they became adults.	D
Е	Q. I see. So you say this: if you call that a threshold at	E
Б	all of six years, it's really optional? You could put	_
r	it up to eight years or seven years?	F
G	A. I was just describing the data that were presented in	G
н	this paper. They didn't have blood leads at eight.	н
	Q. But the Commission then designated six years as the	п
Ι	threshold?	Ι
J	A. Yes, and I think that's because, for instance, the	J
	US CDC says that children up to six are the most	
K	vulnerable group. There is no bright line.	K
L	Q. But there is logic in it?	L
	A. There's what?	
М	Q. There's logic in six years, is there; you agree?	Μ
Ν	A. Well, I agree that the risk is greater among young	Ν
0	children, but I don't think there's a bright line. For	0
Ū	pragmatic reasons, we have to choose a cut-off, and six	0
Р	is the one that people generally use. But, you know,	Р
Q	lead isn't good for anybody.	0
	Q. And it should be zero?	
R	A. That would be great. I would love to see that.	R
S	Q. Yes.	S
т	Now, looking at your report, at page 17, the	
1		Т
U		U
V	- 128 -	V

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А

2015年12月15日

A

B			В
С		internal pagination it's the care plan, is that	С
		right, that has been used in the US?	
D	Α.	Correct.	D
E	Q.	For children, what is the age of those children? What	E
F		is the threshold there?	
F	Α.	This is children under six.	F
G	Q.	Also six?	G
н	Α.	Yes.	п
	Q.	Very well. You see on the left-hand side, it's "Blood	п
Ι		lead concentration [less than 5 micrograms per	Ι
J		decilitre]". Then you have a number of things: lead	I
		education, dietary and environmental, and then	Ū
K		environmental assessment for pre-1978 housing.	K
L		That's old housing; right?	L
	Α.	Yes. That's when leaded paint for interior use was	
Μ		banned in the United States. So it's a useful screening	Μ
Ν		criterion.	Ν
0	Q.	Then follow-up blood lead monitoring. If you look at	0
U		that and compare it to Hong Kong it's bundle E2,	0
Р		page 871. I think you just got these documents	Р
Q		yesterday or today. It should be there.	0
		We can see the chart. The first one, 1, then it's	· · ·
R		less than 5 micrograms per decilitre; "Reassurance and	R
S		no further follow-up".	S
т		So, in other words, as far as the Hong Kong	
T			Т
U			U
V		- 129 -	v

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А

2015年12月15日

A

В			В
С		government is concerned, when the lead content in the	С
		blood is less than 5 micrograms, then they don't do	
D		anything about the child, it would appear? Do you	D
E		understand that?	Ε
Б	Α.	Yes.	-
r	Q.	But in the United States, there were these four things	F
G		that I have mentioned to you three things; right?	G
н	Α.	I'm sorry, could you repeat that?	ц
	Q.	I referred to your own chart just now. So, even less	11
Ι		than 5 micrograms, there are three things done in the	Ι
J		United States?	J
	Α.	Well, I think I actually made an error here, because if	_
K		you look down the table, for the schedule for follow-up	K
L		testing, the first	L
	Q.	Your table or the Hong Kong government's table? You say	
М		there's a mistake. Mistake in	Μ
N	Α.	In my table.	Ν
0	Q.	Okay.	0
U	Α.	Yes. There isn't a schedule for following up a blood	0
Р		lead level of a child whose concentration is less than	Р
0		5 micrograms per decilitre. You can see it's only when	0
x		it's between 5 and 10, the recommendation is to have	Q
R		a follow-up between two and four months after the	R
S		initial value, and then, if the blood lead is declining,	S
		only after six to nine months.	
Т			Т
U			U

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Α

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食水含鉛超標調查委員會

Α

B

So, in the United States, there is not any universal С С screening of children for blood lead. There's targeted D D screening if the child has some risk factors, if someone suspects that they may be exposed to too much lead. Е Е In my own State, there is mandated screening to F F age 4, but then thereafter only if there are circumstances that make the paediatrician suspicious. G G Q. When there are certain symptoms; is that right? Η Η A. Well, not symptoms of lead toxicity, but if the child Ι Ι has risk factors, so that if the child is living in a pre-1978 home, or if a sibling has been lead poisoned, J J or if it's known the parent is occupationally exposed to Κ K lead; factors such as those. Q. Now, the Hong Kong government set the threshold at eight L L years old instead of six. Μ Μ A. Six? That's prudent. It's conservative. Q. That's more prudent, because instead of six it's now Ν Ν eight? 0 0 A. Right. Р Q. But these are only children in the affected public Р estate, as far as the Hong Kong government is concerned, Q Q right, not generally? R R A. That's right. Actually, they include children under 12, so that's even more prudent. S S Q. But the trouble is, if a child lives in a certain public Т Т U U

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A

2015年12月15日

A

В			В
С		housing estate which is affected by lead in the water,	С
		and he has been living there for a number of years, but	
D		there was no discovery of excess of lead in water yet,	D
Ε		and then he moves out, and then say he becomes nine or	Ε
F		ten years of age, then he goes above the threshold of	F
Г		eight years, and so he will miss out from the	F
G		government's plan. Do you follow me? Because the	G
н		government only looks at children under eight years old.	н
	A.	I don't know that that's the case.	
Ι	Q.	But if that is the case, what do you think about it?	Ι
J	A.	Well, they are doing screening of all individuals who	J
		live in the estates.	
К	Q.	You understand that the Hong Kong government does	K
L		screening for all children in these estates which are	L
		affected? Is that your understanding?	
M	A.	That was my understanding, yes. And I would hope that	Μ
Ν		there is a system in place to continue tracking these	Ν
0		individuals over time. So, in the scenario you	0
0		mentioned of a child moving out of the estates, if that	U
Р		child still has an elevated blood lead, no matter where	Р
Q		that child is, they should be in the case management	Q
		system until the blood lead falls below the reference	-
R		value.	R
S	Q.	But the problem is, if a child is already nine or ten	S
T		when the whole of Hong Kong knew about this excess of	_
Т			Т
U			U

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Α

2015年12月15日

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В	
С	lead in water, then he is already too old for the
	threshold of eight.
D	A. Well, looking at the line listing that I have been
Е	provided, there are individuals above the age of eight
_	who are being followed and, if they have a blood lead
F	level above the reference, they are being re-tested.
G	So your scenario doesn't accord with my
н	understanding of the data that I have been given.
11	Q. Perhaps I should show you a document which we got from
Ι	the internet, a government document. It is from the
J	Centre for Health Protection, and the title is "Incident
	of lead in drinking water". (Handed).
K	These are what's called the frequently asked
L	questions, and then the government providing the
	answers. The question is, "When can we arrange for
М	a blood test?"
Ν	"For residents of the affected public estates who
0	are children under eight years old, pregnant women and
0	lactating women, they can make arrangements for blood
Р	testing via the hotline The hotline will operate
Q	[between certain hours]. It will be diverted to the
	Government hotline after operating hours."
R	So it only caters to children under eight years old
S	and pregnant or lactating women. So if the children are

over eight years old, then they have to consult their

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- Т
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A

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Α

	В
own laboratory or whatever.	С
That is why, if a child had lived in one of these	
estates affected by excess lead in the water but then	D
moved out, and is now nine or ten, then there's no such	E
facility provided to this child.	_
A. I see what you are saying, yes. It appears so.	F
Q. Is that satisfactory?	G
A. Well, in the ideal world, no. This document does say,	п
in this particular situation, we need to channel limited	п
resources to children under eight, pregnant women and	Ι
lactating women. If I were forced to make a choice	I
about which groups to focus on, I would make the same	U
choice.	K
But I agree, in an ideal world, the coverage would	L
include other subgroups as well.	
Q. But would you not mention somewhere, maybe in a footnote	Μ
or whatever, that if the children have been living in	Ν
these estates for a number of years but now they are	0
over the age of eight, then also ring the hotline or at	0
least get their parents to ring the hotline?	Р
A. That's a very point.	0
Q. Thank you. Now, if the government sets the threshold at	x
eight years, which you say is prudent, more prudent than	R
six, but they should treat it as a reference point only,	S
or should they treat it as at a reference level or	
	Т
	U
- 134 -	v
	

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2015年12月15日

A

		В
	an action level? Do you see the difference between	С
	reference level and action level?	C
A.	I don't. In the care plan, they do recommend or mandate	D
	certain follow-up activities, if a child's level exceeds	E
	the reference value. So it looks to me as if action and	
	reference levels are being interpreted as one and the	F
	same.	G
2.	Now, I want you to look at the letter from the	п
	government which you have been looking at. This is	п
	page 846 of E2. You have been looking at this letter	Ι
	already, right, earlier?	J
A.	Yes.	
Q.	You are familiar with this letter.	K
	Go to the next page, towards the bottom of the page,	L
	847. The last paragraph says:	
	"Children identified with developmental or	Μ
	behavioural problems"	Ν
	Perhaps I should go sorry, I want to read the	0
	paragraph above that, beginning with "Regarding":	0
	"Regarding the 'developmental assessment' mentioned	Р
	in page 19 of the expert report"	0
	That is your report; right?	x
A.	Yes.	R
Q.	" all children with elevated blood lead level will	S
	receive preliminary developmental assessment at DH's	
		Т
		U

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2015年12月15日

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B Child Assessment Centres" -- that's Department of С Health -- "(for pre-school children below 6 years) or D Student Health Service Special Assessment Centres (for schoolchildren 6 to 12 years) by a developmental Ε surveillance team composed of paediatricians and F nurses." Then it talks about what the development assessment G covers. Then the last paragraph: Η "Children identified with developmental or behavioural problems will have follow-up evaluation at Ι Child Assessment Service according to individual needs." J So once a child is identified to have these K problems, developmental or behavioural, then there will be follow-up. Then: L "Children with largely normal development would Μ receive continuous monitoring through enhanced developmental surveillance at Maternal and Child Health Ν Centres ... during pre-school years and annual health 0 visits at Student Health Centres during school years." So two types, those who are identified with Р behavioural or developmental problems, there will be Q follow-up; those with largely normal development would R still have enhanced developmental surveillance. Then: "Parents are provided with anticipatory S developmental guidance and information on children's Т U

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A

2015年12月15日

Α

В		В
С	development in the form of pamphlets. These pamphlets	C
_	are available online at [so and so]. Due to the large	
D	volume of these documents, hard copies will be provided	D
Ε	upon [the Commission of Inquiry's] request."	Ε
Б	Do you see that? Have you actually gone online to	
r	take a look at these pamphlets?	F,
G	A. No, I didn't.	G
н	MR LEE: Can I have some indulgence? I want to discuss with	т
	my junior, because it does say if you want hard copies,	п
I	it's only upon your request. We couldn't get a copy	Ι
J	ourselves.	I
	CHAIRMAN: Do you want a copy?	
K	MR LEE: Yes.	К
L	CHAIRMAN: Have you ever seen this document first?	L
	MR LEE: Online, yes. Because to us, they are totally	
Μ	unimportant. Nothing to do with this case.	Μ
Ν	CHAIRMAN: So you want a copy?	Ν
0	MR LEE: I want to show you and the members	
0	CHAIRMAN: Why don't you show me online first?	0
Р	MR LEE: Okay, online. Can we do it here? I don't know	Р
0	whether we can do it now, because we do not have	0
x	CHAIRMAN: Let me make this suggestion, since now it's	Q
R	almost 4.15. Why don't you or your junior go back to	R
S	your chambers and look at the relevant paragraphs and	S
	identify the relevant paragraphs, and then I don't think	
Т		Т
U		U

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A

2015年12月15日

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	В
you really need to print an entire copy of these	С
documents. So print the relevant paragraphs or pages,	D
or indicate to us which particular paragraph or pages	D
that you want, then we can print it ourselves.	Ε
MR LEE: My junior read them. Perhaps I can consult with	F
ner.	
CHAIRMAN: Yes. Or you can tell me now, actually.	G
MR LEE: It may be possible for us not to go into these	Н
pamphlets, but I would like to discuss with the team in	
the meantime.	Ι
CHAIRMAN: All right. So if	J
MR LEE: I won't be long, but I would like to have some time	
to make sure I won't be long.	K
CHAIRMAN: I will give you the evening to prepare your case.	L
So if you think a particular paragraph or pages are	М
relevant to our hearing, then inform my secretaries and	N
the other legal teams.	Ν
MR LEE: Yes, we will do that.	0
CHAIRMAN: So that's it for the day, Prof Bellinger.	0
I would be grateful if you could come back at 10 o'clock	Р
tomorrow morning.	0
WITNESS: Certainly.	×
CHAIRMAN: Thank you.	R
(4.15 pm)	S
(The hearing adjourned until 10.00 am the following day)	
	Т
	U
	 you really need to print an entire copy of these documents. So print the relevant paragraphs or pages, or indicate to us which particular paragraph or pages that you want, then we can print it ourselves. MR LEE: My junior read them. Perhaps I can consult with her. CHAIRMAN: Yes. Or you can tell me now, actually. MR LEE: It may be possible for us not to go into these pamphlets, but I would like to discuss with the team in the meantime. CHAIRMAN: All right. So if: MR LEE: I won't be long, but I would like to have some time to make sure I won't be long. CHAIRMAN: I will give you the evening to prepare your case. So if you think a particular paragraph or pages are relevant to our hearing, then inform my secretaries and the other legal teams. MR LEE: Yes, we will do that. CHAIRMAN: So that's it for the day, Prof Bellinger. I would be grateful if you could come back at 10 o'clock tomorrow morning. WITNESS: Certainly. CHAIRMAN: Thank you. (4.15 pm) (115 pm)

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	Tuesday, 15 December 2015	С
	(10.05 am)	C
D	MR KHAW: (Via interpreter) Good morning, Chairman. Before	D
Е	the professor gives evidence, earlier on there was	E
	a witness, Mr Chan Siu Wah, a former employee of	
F	Ho Biu Kee. We issued a letter to him, asking for	F
G	a witness statement, and at that time, there was no	G
п	reply. Then, around about the 7th or the 8th of this	
п	month, we issued a witness summons and Mr Chan has now	Н
Ι	arrived to attend our Inquiry.	I
J	CHAIRMAN: (Via interpreter) Mr Chairman, good morning.	т
0	I am the chairman of the Commission of Inquiry,	J
K	Justice Chan.	K
L	Earlier on, we have issued a witness summons for	L
	you.	
Μ	MR CHAN SIU WAH: (Via interpreter) Yes.	Μ
Ν	CHAIRMAN: (Via interpreter) This is because in relation to	Ν
0	the Inquiry, we do have some questions for you.	
0	MR CHAN SIU WAH: (Via interpreter) Yes.	0
Р	CHAIRMAN: (Via interpreter) You are not represented by any	Р
0	lawyers; right?	0
×	MR CHAN SIU WAH: (Via interpreter) No.	Q
R	CHAIRMAN: (Via interpreter) It doesn't matter. It's fine	R
S	for you to represent yourself. Basically, we would like	S
	to ask you some questions, and that's in relation to the	
Т		Т
U		U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	time when you were working for Ho Biu Kee, in particular	С
	in relation to the purchase of solder materials. Do you	
D	understand?	D
E	MR CHAN SIU WAH: (Via interpreter) Yes.	E
-	CHAIRMAN: (Via interpreter) For the witness summons, you	
F	have been asked to attend the hearing today. You are	F
G	asked to attend but then you haven't been told as to	G
ц	when you should give evidence. First of all, our	
11	lawyers' team will make an appointment with you, either	н
Ι	today or sometime later, at your convenience. We would	Ι
J	like to meet with you so we can get a witness statement	I
-	from you. Do you understand?	U
K	MR CHAN SIU WAH: (Via interpreter) Yes, I do.	K
L	CHAIRMAN: (Via interpreter) In other words, it will be at	L
	a time convenient to both parties. After you have given	
Μ	the witness statement, then later on you will be asked	Μ
Ν	to attend the hearing as a witness.	Ν
0	As to exactly which day, which month, we don't know,	
0	but of course we don't want you to be here waiting all	0
Р	the time, so later on, when we do know when you will be	Р
0	called, then we will give you notice a few days before	0
τ.	the date of attendance. Is that fine?	×
R	MR CHAN SIU WAH: (Via interpreter) Yes.	R
S	CHAIRMAN: (Via interpreter) Thank you. You may now be	S
	excused, and our team of lawyers will make	
Т		Т
U		U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Commission of Inquiry into Excess Lead Found in Drinking Water	Day 27	B
С	an appointment with you, when you are outside, so as toget a statement from you.	to	C
D	MR CHAN SIU WAH: (Via interpreter) All right. Thank you		D
E	very much.		E
	MR KHAW: (Via interpreter) I now invite Prof Bellinger.		
F	CHAIRMAN: (Via interpreter) Thank you.		F
G	PROF DAVID CHUDLEIGH BELLINGER (sworn)		G
н	(All questions and answers were in English)		т
11	CHAIRMAN: Thank you. Take a seat please, Professor.		п
I	Examination-in-chief by MR KHAW		Ι
J	MR KHAW: Prof Bellinger, first of all, thank you very mu	ch	J
	for coming all the way to Hong Kong to provide		-
K	assistance, as an expert appointed by this Commission		K
L	for the purpose of this Inquiry.		L
	We understand that you have prepared a report, dat	ed	
Μ	1 December this year. This report can actually be for	ind	Μ
Ν	in our e-bundle at V1. It is now shown on the screen.		N
0	Your report has also been downloaded to the website of	£	0
0	this Commission, so that in fact the public could have	9	U
Р	access to the same.		Р
Q	I don't intend to read out the contents of your		0
-	report verbatim, as I don't think people here can bea:	r	Ľ
R	my voice for so long. Instead, I will try to go throu	ıgh	R
S	and summarise most of the issues that you have address	sed	S
-	in your report.		
Т			Т

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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J

Unlike the chairman, my science knowledge is rather С С limited, so perhaps, in the course of going through your D D report, I will ask you to further explain some of the matters which might call for further discussion. Е Ε If I may now first turn to internal page 3 of your F F report, page 47 of the bundle, where you have set out the areas on which you have been instructed to provide G G your opinion for the purpose of this Inquiry. Perhaps Η Η I will just go through those items: Ι "(1) to explain the short, medium and/or long-term health effect(s) ... of elevated blood lead level on J human beings in general, and in particular on (a) K K infants; (b) children under six years of age; (c) children/teenagers between six and eighteen years of L L age; (d) pregnant women; (e) lactating mothers; (f) М Μ elderly persons; (g) immunocompromised patients; and (h) long-term patients with chronic illnesses; Ν Ν (2) to explain the internationally accepted or 0 0 recognised guidelines and/or parameters (and their Р rationales), particularly those adopted by the ... Р ('WHO') on the content of lead in (a) tap water and (b) Q Q blood in human beings; R R (3) if the guidelines and parameters considered in (2) above have changed/evolved over time, to explain the S

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reasons for such changes;

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Day 27

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	(4) to opine on the adequacy and suitability of the	С
	reference values for blood lead level and the care plan	
D	published or followed by the Hong Kong Special	D
E	Administrative Region Government;	E
Б	(5) to opine on the adequacy and suitability of the	
F	acceptance criteria laid down by the Water Supplies	F
G	Department for heavy metals and make	G
п	recommendations, if necessary."	
п	If we first look at the introductory part of your	Н
Ι	report, at internal page 4, page 48 of this bundle	Ι
J	I think here, before you deal with the first question	Л
	that we have just seen, you have provided some	_
K	introductory comments on the availability of information	K
L	on the adverse effects of lead on human health. It	L
м	seems that you have come to a conclusion, at I think	
M	around the fifth line under "Introductory comments",	Μ
Ν	that:	Ν
0	" the evidence base permits robust inferences	0
0	about the range of effects of exposure to lead, as well	0
Р	as the characteristics of the dose-response and	Р
Q	dose-effect relationships that describe the levels of	Q
	exposure associated with increased risk."	-
R	May I just ask you to briefly explain what you mean	R
S	by "dose-response and dose-effect relationships"?	S
T	A. Yes. That's a distinction made in toxicology, referring	_
1		Т

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B to how an adverse effect is related to exposure. С С A dose-response relationship, if one exists, means that D D the higher the dose an individual is exposed to, the greater the risk of some adverse effect such as cancer. Е Е And a dose-effect relationship pertains to an outcome F F that is not dichotomous, such as do you have cancer or don't you have cancer, but something like G G an intelligence quotient score. So a dose-effect Η Η relationship would mean that the higher the dose of some Ι chemical an individual is exposed to, the IQ goes down, Ι as dose increases. J J Q. Thank you. Then you go on to say: K K "In my response to the queries" -- ie the questions set out above -- "I focus on the so-called 'subclinical' L L health effects of chronic exposure to lead, that is, at Μ Μ levels of exposure that do not cause clinical signs and symptoms, as the likelihood that clinical lead poisoning Ν Ν would occur from consuming water with the lead 0 0 concentrations measured in the Hong Kong estates is very Р low." Р If I may just ask you to explain this observation. Q Q A. My understanding is that the highest water lead R R concentration that was measured in the Hong Kong estates was 83 micrograms per litre, but most of the levels were S S in the range of 10 to 20 micrograms per litre. Т Т

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation Α Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B According to our current knowledge, regularly consuming С С water with water lead in the concentration of 10 to 20 D D would be unlikely to give a large enough dose that someone would show clinical signs of lead toxicity, Е Е which tend to occur at much higher blood lead levels, in F F the range of -- it varies from individual to individual, but it's rare to see clinical symptoms in someone with G G a blood lead below 40, 45 micrograms per decilitre, and Н Η higher than the blood lead levels observed in the Ι Ι residents of those estates. Q. Under the same paragraph, you then continue to talk J J about the overt signs of acute intoxication. K K CHAIRMAN: Before you ask that question, can I ask you, Prof Bellinger, how long can one be regarded as L L chronically exposed? Μ Μ A. That's a very difficult question to answer. It typically refers to a period of months to years, would Ν Ν be chronic exposure. Anything else shorter would be 0 0 considered more of an acute exposure. Р CHAIRMAN: Thank you. Р MR KHAW: Under the same paragraph, you then continue to Q Q talk about the acute -- the overt signs of acute R R intoxication, acute lead intoxication, and also chronic lead exposure. S S Then, if we turn to internal page 5, the second Т Т U U

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

Α

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paragraph, about the second sentence, you mention that: "The major classes and sources/pathways of exposure to inorganic lead (the form of lead in solder) include food, air, soil, paint, and water, although exposure can also occur as a result of many other activities ([including the] use of contaminated folk or herbal medicines)."

HThen further down, in about the middle, you talkHabout the places in a person's body where lead resides.II think, in short, just to summarise what you have setJout here, in adults lead in bone accounts for about90 per cent of the total body burden, whereas inKchildren, lead in bone accounts for about 70 per cent ofLthe total body burden, because in the case of childrenMthe changes in bone structure.

Then there is a discussion regarding re-equilibration process. If I may just quote what you have stated here, about the last ten lines on this page, starting from the word "Therefore" -- can you see that?

"Therefore, the blood lead level measure for an individual at any time reflects the equilibrium between an individual's current exposure to 'new' lead and the 'legacy' lead" -- ie the old lead which has accumulated in our body for a relatively long period of

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Day 27

Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	on
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Α

Comm	ission of Inqu	iry into
Excess	Lead Found i	in Drinking V

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В	Excess	s Lead Found in Drinking Water	Day 27	B
С		time from past exposures. The half-life of lead i	in	С
		blood is approximately 30 days, meaning that if two		
D		atoms of lead enter the blood, in a month's time only	У	D
Е		one will remain there, and the other one either excr	eted	E
		from the body or moved to storage in hard or soft		
F		tissue. Because of the re-equilibration processes, t	che	F
G		half-life of 30 days does not mean that an individua	l's	G
н		blood lead level will fall by half in a month's time	if	п
11		major exposure sources/pathways are removed. The		п
I		greater an individual's past exposures to lead, the		Ι
J		harder it will be to reduce blood lead by		J
		an intervention"		0
K		May I just ask you to elaborate a bit more on the	2	K
L		re-equilibration process that you have just mentioned	d	L
		here.		
Μ	A.	Certainly. Over time, the lead that is distributed	into	Μ
Ν		the three major compartments, the mineralised tissue	1	N
0		the soft tissue by which I mean organs such as the	e	0
U		brain, kidneys and the liver and the blood is the		0
Р		third compartment, will come to a balance that refle	cts	Р

the amount of lead someone is taking in and the amount that they are excreting.

Now, if there's some intervention that changes an individual's exposure at a given time, such as removing exposure to water lead or administering -- in

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation Α Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B cases of much more severe exposure, giving drugs that С С bind to the lead and promote its excretion from the D D body -- then the amount of lead that's distributed in those three major compartments will find a new balance. Е Е And what happens is if blood lead is reduced because of F F cutting off an exposure pathway, blood lead will decline reflecting that, but lead from the other two G G compartments, the hard and the soft tissue, will come Н Η into the blood compartment and a new balance will be Ι Ι achieved between those three compartments. How long that takes will reflect how much the J J exposure is decreased and how much past lead K K an individual has been exposed to and is storing in those other compartments. L L Q. Thank you. Then you continue to talk about a study, one Μ Μ study of children -- at internal page 6, page 50 of the bundle -- who had a blood lead level of 25 to Ν Ν 29 micrograms per decilitre and were placed in a case 0 0 management system; it took an average of two years for Р the blood lead to drop below 10. Р Can you provide any reasons for this slow drop in Q Q that study? R R A. Yes. That's because children who had a blood lead of 25 to 29, in this particular study were living in homes S S that had deteriorated lead paint, and they had been Т Т U U

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water A

B

Day 27

living there for some time, so they had been С С continuously exposed and had built up a considerable D D amount of lead in their bones and in their soft tissues, so that when the children were removed from those homes Е Е and placed into the case management system, which means F F that their current exposure was drastically reduced, because they were removed from the hazardous environment G G they had been in, then their blood lead fell quite Η Η slowly, because of this equilibration process, because Ι Ι they had been exposed to so much lead in the past that during the re-equilibration it was being drawn out of J J the hard tissues and the soft tissues into the blood, so K K that the blood lead fell very, very slowly, certainly longer you would expect from the simple fact of L L a half-life of lead being 30 days. That's why you can't Μ Μ expect blood lead to drop by a half in 30 days. It depends on the entire exposure history of an individual. Ν Ν Q. Thank you. 0 0 I think most people would be interested in the next Р topic, because that goes to the IQ score of children. Р Most parents want their children to obtain a high IQ Q Q score and they would like to see whether the lead R R content in water --CHAIRMAN: You have to speak up, Mr Khaw. S S MR KHAW: Sorry. I think most parents want their children Т Т U U

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Commission of Inquiry into Excess Lead Found in Drinking Water

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to achieve a high IQ score, and they also want to know the effect of lead content in water on this particular aspect.

You have started your discussion by saying that young children are considered to be most vulnerable subgroup of the population. Then you went on to say that children with blood lead levels below 25 micrograms per decilitre generally do not show any signs or symptoms that bring them to medical attention. But studies also show that children with such levels are at increased risk of a variety of cognitive and behavioural adversities that are persistent and affect many aspects of an individual's health and wellbeing.

Then you talk about what you call the most complete and compelling evidence in respect of children. That is I think the last ten lines on this page:

"The most complete and compelling evidence available pertains to children's intelligence. A set of analyses in which the data from 7 prospective studies were pooled (a sample size of 1,333 children) found that the inverse association between children's IQ scores and their blood lead concentrations had a supra-linear form, such that the slope of the association (the rate of decline in IQ per [microgram per decilitre] increase in blood lead concentration), was steeper over the range below 10 ...

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	B
С		than it was over the range between 10 and 30 \dots		С
		Although the biological mechanism of this is not know	vn,	
D		the finding has now been replicated in several		D
E		independent studies."		E
-		Professor, just one question here. We all know th	nat	
F		children's IQ score may be affected by various		F
G		factors environmental factors, behavioural factors	5,	G
ц		et cetera so to what extent can these studies on]	Lead	п
11		content demonstrate the extent of the impact of lead	on	н
Ι		children's IQ scores?		Ι
J	Α.	That's a very important question, and it's always		J
-		whether or not investigators have addressed and measu	ıred	U
K		and taken adequately into account the other factors t	chat	K
L		influence a child's IQ is always the major point of		L
		contention in interpreting a study such as lead, beca	ause	
Μ		we can't do an experimental study with children like	we	М
Ν		can with animals. We have to observe samples of		N
0		children who are exposed to different amounts of lead	1	0
0		and see if we can see an association with their		0
Р		cognitive outcomes.		Р
0		So in each study and as I say, it's very		0
C		important to measure the parents' socioeconomic statu	15,	×
R		their education, if possible the parents' IQ, because	5	R
S		that's very strongly predictive of a child's IQ. It'	S	S
		important to take account of a child's nutrition, how	J	
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Commission of Inquiry into Excess Lead Found in Drinking Water

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stimulating the home environment is, whether they are exposed to other things that can pose a threat to their cognition.

So the statistical models that have to be implemented in these studies can be quite sophisticated and very detailed. And what we find is if we take account of all of these other factors to the best that we can, is there still a relationship between lead and children's IQ, and what these studies indicate is yes, there is.

We can also get a sense of how important lead is in the context of all these other factors by asking what per cent of the variability in children's IQ scores can be explained by their lead exposure. Typically, what we find is that it's a relatively small amount. It's statistically significant and consistent across studies, but it explains usually less than 5 per cent of the variation in children's IQ, whereas something like socioeconomic status captures about 30 per cent of the variation in children's IQ.

> So lead is important but it's not the most important predictor of children's outcomes, and this is something that I counsel parents about when they call me, when they are concerned that their child has a blood lead higher than we would like to see. I tell them, yes,

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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С	that's very important and we certainly want to prevent	С
	that lead exposure, but it's important to put it in the	
D	perspective of what else may be influencing how their	D
Е	child does, and I try to help them relax a little bit in	E
F	this regard; that yes, we should prevent lead exposure,	Б
Г	but it's also important to do these other things that	F
G	parents do that maximise their child's endpoints.	G
н	CHAIRMAN: Can I ask you a more basic question first: why is	н
	lead so toxic?	11

A. That's a good question. It works at a very general biological level, and so it impairs processes that are fundamental to many aspects of the way our bodies work. Chemically, it's what's called a divalent cation; it has a 2-plus charge, and many important things in the body like calcium have a 2-plus charge. So lead interferes with a lot of the biological processes that depend upon calcium, and many of our body processes do depend on calcium.

So how the nerve cells in our brain communicate with one another is dependent on calcium, so lead interferes with the communication between cells in the brain. It also interferes with processes that are important in long-term memory and storage of information. In fact, lead interferes with just about everything that anybody has looked at in the brain. So that explains his

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Day 27

Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation Α Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B pervasive and widespread toxicity. С С CHAIRMAN: Thank you. So that's why you say the central D D nervous system is considered to be the most vulnerable organ among all the organs within our bodies? Е Ε A. That's right, in particular the developing central F F nervous system. As a colleague of mine says, a child gets only one chance to develop a brain, and so we want G G to prevent lead from interfering with the complex Н Η spatial and temporal choreography that's involved in Ι Ι putting a brain together, that involves billions of nerve cells that have to be in the right place at the J J right time in order for a brain to be normal. K Κ CHAIRMAN: So when you say the central nervous systems, you are not confining yourself to simply the brain; you are L L also talking about the nerve cells, the nerves that can Μ Μ be found in our bodies, the whole body as well? A. Well, the central nervous system typically is used to Ν Ν refer only to the brain and the spinal cord, and the 0 0 connections of the central nervous system to, like, the Р hands and sensory organs in other parts of our bodies is Р the peripheral nervous system. That is also sensitive Q Q to lead but less so. Often the effects in the R R peripheral nervous system are reversible, once exposure stops. But we are concerned that the effects are more S S persistent in the central nervous system. Т Т

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	CHAIRMAN: Is that because the lead displaces the calcium in	С
D	the process of transmission of nerve messages; that actually adversely affects the development of children?	D
Ε	A. Yes, that's part of it. These chemicals that lead	Ε
	interferes with are involved not just in the function,	
F	the transmission of information, but also they are	F
G	involved in the formation, the laying down of the	G
н	structure, the fine structure of the nervous system. So	п
11	lead is both a developmental neurotoxicant and	п
I	a functional neurotoxicant. That's why the developing	Ι
J	nervous system is of particular concern, because lead	J
	can interfere with actual structural formation of the	
K	brain.	K
L	CHAIRMAN: Thank you.	L
	MR KHAW: Still at internal page 6, the last sentence is	
Μ	perhaps quite important:	Μ
Ν	"The details of this dose-effect relationship	Ν
0	suggest a child with a blood lead level of 0 will, all	0
0	other things being equal, have an IQ score about 5	0
Р	points (1/3 standard deviation) higher than a child with	Р
0	a blood lead level of 10 [micrograms per decilitre]."	0
-	The reason why I ask you in relation to this	×
R	particular sentence is since your report has been	R
S	released, there has been some media coverage which has	S
T	taken this sentence to mean that the IQ of a child with	_
T		Т
U		U

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

a blood lead level of 10 micrograms per decilitre would be one-third lower than that of a child with zero blood lead content, but in fact you are talking about one-third standard deviation here. Can you explain a bit more on the standard deviation point?

A. Yes, that would be an incorrect interpretation.

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Standard deviation is a property of a bell curve distribution. It refers to how much variability there is in a particular characteristic. So, for instance, with regard to IQ, we expect that the average person will have an IQ of 100, and the standard deviation of the IQ distribution is 15 points.

So this is just a way of saying how many people we expect to have IQ scores within certain ranges, so between the mean of 100 and plus 1 standard deviation, that is a score of 115, we would expect 34 per cent of the population to be between 100 and 115. Similarly, because the distribution is symmetrical, we would expect 34 per cent to have a score between 85 and 100.

So the one-third standard deviation just simply means that the effect that has been observed in studies that's attributable to lead, the effect on IQ, amounts to five points, for an increase in blood lead from 0 to 10, which is one-third of that standard deviation. It doesn't mean that the child with a blood lead of 10

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Day 27

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		would have an IQ that's only one-third as large as the	le	С
		child with a score or a blood lead of 0.		
D	Q.	Thank you. In the next paragraph on the same page, y	<u>7</u> 0U	D
E		have referred to a series of neuroimaging studies of		E
F		young adults, and those studies actually show some		
F.		structural or ischemic changes of various parts of the	le	F
G		brain, including the grey matter volume and also the		G
ч		white matter volume.		TT
п		Can you just briefly explain the importance of the	ese	п
Ι		parts of our brain?		Ι
J	A.	The grey matter is basically what we think with, so	it's	J
-		the cerebral cortex; we have a frontal lobe, occipita	1]	Ū
K		lobe, parietal lobe on both sides of our brain, and		K
L		that's where most of our thinking goes on; and there	are	L
		also some subcortical structures that are part of the	2	
Μ		grey matter that are also important, the basal gangli	_a	Μ
Ν		and so on.		N
0		The white matter are basically the information		•
0		highways in our brain. The white matter tracts are		0
Р		quite long and they connect different parts of our		Р
0		brain, so they are the way that our different parts		0
τ.		communicate with one another.		Y
R		So they are all important in terms of having		R
S		a healthy brain. We want both grey and white matter	to	S
		be functioning as they were intended.		
Т				Т
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A	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С	Q.	In these studies which actually show persistent chan	ges	С
		in brain structure and function, are we talking about	-	C
D		blood lead content which is quite high?		D
E	A.	We are. The neuroimaging studies come from a particu	ılar	E
-		study that was conducted in the United States in		
F		Cincinnatti, among mostly minority African-American		F
G		children who were living in fairly dire situations of	E	G
н		poverty; inner city, in poor housing, exposed to lots	s of	TT
11		lead. They had blood leads that were most of the		п
I		children in the study, there were about 250 children,	,	I
J		had at some point in their life a blood lead above 2	5,	I
		and some of them had blood lead so high that they we	re	
K		actually hospitalised and given chelation therapy to		K
L		reduce their lead burden.		L
		So these were children with exposures that were n	ot	
Μ		that uncommon at that time this study was begun in	1 a	Μ
Ν		around 1980, in the US but fortunately they're fa	irly	N
0		rare these days, and it's uncertain the degree to what	ich	0
0		these studies apply to children with lower blood lead	ł	0
Р		levels. They are simply a lesson that lead is actual	.ly	Р
0		doing observable damage to the brain.		0
C	Q.	Then the last paragraph on the same page, where you	are	¥
R		addressing the issue regarding children and teenagers	3	R
S		between 6 and 18 years. I think you have also referr	ed	S
		to various studies which provide evidence regarding t	the	
Т				Т
U				U

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		inverse association between early-life lead exposure	and	С
D		neurodevelopment. Then at page 8 you talk about the US National		D
E		Toxicology Program evaluation, which concluded that	the	E
		evidence is sufficient for the association between b	lood	
F		lead level under 10 micrograms per decilitre and bot	n	F
G		decreased hearing, delayed puberty, and reduced		G
		postnatal growth.		
H		Again, I just want to ask whether these studies		H
I		showed relatively high blood lead content?		Ι
т	Α.	Well, this conclusion pertains to a blood lead range	of	т
J		less than 10 micrograms per decilitre. So, again, th	lese	J
K		are findings that are relatively consistent across		K
L		studies, sufficiently consistent that the NTP was		L
		willing to consider that in aggregate the evidence w	as	
Μ		sufficient to draw this conclusion.		Μ
Ν		But again I would say that finding a statically		N
0		significant association is one thing, and finding		
0		an association of a large magnitude in the effect is		0
Р		another thing.		Р
0	Q.	Yes.		0
×.	A.	So, for instance, this reduced postnatal growth		Q
R		association, it may be relatively modest and somethin	ng	R
S		that you would not notice in an individual child, bu	t if	S
		you are looking at large groups of children then you		
Т				Т
U				U
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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	В
С		might find that those children with higher blood lead	1	С
		within this range were a centimetre smaller than		
D		children with blood lead levels lower than this range	2.	D
Ε		Statistically significant but not really very meaning	ful	E
F		for an individual child.		F
r	Q.	Then in the next paragraph you talk about the		r
G		association between lead exposure and ADHD, attention	1	G
н		deficit hyperactivity disorder. Then you have referr	ed	п
		to various studies in this respect.		п
Ι		May I just ask you how these studies were conducte	ed,	Ι
J		regarding the association between lead exposure and		J
-		ADHD?		U
K	Α.	A variety of study designs were used. In some of the	2	K
L		studies, which are called cross-sectional studies,		L
		a sample of children were recruited for participating	; in	
Μ		some large survey, and as part of the survey a blood		Μ
Ν		sample was taken, and that was measured for blood lea	id	N
0		content.		0
0		Then the parents were interviewed and asked, "Has		U
Р		a medical professional ever told you that your child	has	Р
0		ADHD?" In other studies, the parents were given		0
		a structured interview that was linked to the criteri	a	×
R		for diagnosing ADHD, and in yet other kinds of studie	es,	R
S		called case control studies, two groups of children w	vere	S
		studied. One group had been identified and diagnosed		
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Transcript by DTI Corporation Asia, Limited

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	1	A
В	Commi Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		with ADHD, and the other had not, and then blood samp	les	С
		were collected to see whether or not the group carryi	ng	
D		the diagnosis of ADHD had a significantly higher bloo	d	D
E		lead level than the group that did not.]	E
Е	Q.	In the last paragraph on this page, you talk about		-
F		various studies which show the association between	J	F.
G		childhood lead exposure and propensity for violence a	nd	G
п		aggression. Then you went on to say that in fact thes	se	••
п		studies are difficult to conduct and they are subject	to	H
I		a variety of biases. Why do you say that?]	I
J	A.	Well, in order to try to see if there's an associatio	n	J
		between early childhood lead exposure, which is the		-
K		primary concern, and the propensity to engage in thes	e]	K
L		kinds of behaviours 20 years later, it's very difficu	lt	L
		to identify a situation in which you have those data.		
M		If you do the study by identifying individuals who)	M
Ν		already have committed offences, it's difficult to lo	ok I	N
0		back and get reliable information about their early		0
-		childhood lead exposure. Typically, you don't have		U
Р		access to those data. So one of the biases would be -]	Р
Q		it's called a retrospective bias; whereas people or		0
		parents of individuals who are offenders, as adults m	ау	×
R		have different levels of recall. They may be more]	R
S		likely to say, "Oh, yes, he was lead poisoned as	S	S
Т		a child" and you don't really know whether that's tru	e	Т

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
or not or if they are just looking for an explanation	С
So it's difficult to find exactly the right	D
situation in which you can address this question in	E
a very compelling way. The study that I mentioned where the neuroimaging	F
was conducted, a study in Cincinnatti, has provided the	G
best evidence, in my mind, of this association, because they enrolled these children during pregnancy. As the	Н
children grew older, they collected periodically blood	Ι
lead histories, and then they followed the children	J
	Anex: Realtime English Transcription based on floor / Simultaneous Interpretation Commission of Inquiry into Excess Lead Found in Drinking Water Day 2 or not or if they are just looking for an explanation for their child's behaviour. So it's difficult to find exactly the right situation in which you can address this question in a very compelling way. The study that I mentioned where the neuroimaging was conducted, a study in Cincinnatti, has provided the best evidence, in my mind, of this association, because they enrolled these children during pregnancy. As the children grew older, they collected periodically blood lead histories, and then they followed the children until they reached their 20s, and they went to

administrative county records where these individuals

now resided and obtained information from those

objective records as to the number of times these

participants had been arrested for some offence or

So that study, which is very difficult to carry out over that period of time, is less subject to these biases because the blood lead information was collected prospectively, long before the offending occurred, and so there's no concern about bias there. Also because this study had collected a lot of information about factors that I mentioned earlier that are important to take account of -- family socioeconomic status,

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoDay 27Excess Lead Found in Drinking WaterDay 27	В
G	nutrition, stimulating-ness of the home environment, and	
C	so on the associations that they saw between early	C
D	childhood lead exposure and risk of offending and being	D
Е	arrested later in life I think are much more solid; they	E
	provide a much more compelling base of evidence for	
F	drawing a conclusion that lead is linked to a propensity	F
G	for aggression and violence.	G
	But I would add, again, that participants in the	
н	study had lead exposures that were quite high by	Н
Ι	contemporary standards and many of these children	Ι
J	actually got chelated because of their lead poisoning.	I
-	Q. Then in relation to pregnant women, page 9, in the third	U
K	line you mention that:	K
L	" the lead exposure of a foetus is essentially	L
	the same as that of the pregnant woman."	
Μ	Then in the next paragraph you refer to research on	М
N	the potential effects of lead exposure on the health of	Ν
0	pregnant women, in particular reproductive health, the	0
0	course of pregnancy, the health of the foetus at birth,	0
Р	et cetera. Then you have also referred to the US	Р
Q	Centers for Disease Control, which "issued guidelines	0
	for the identification and management of lead exposure	· ·
R	in pregnant and lactating women. The literature review	R
S	conducted evaluated the evidence regarding the	S
т	associations between lead exposure and a variety of	T
T		Ĩ

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	health endpoints."	С
	Then you go on to discuss various aspects regarding	
D	pregnant women, including fertility, hypertension,	D
Ε	et cetera.	E
	In relation to gestational hypertension, at page 10,	
F	there's just one question I have. Here, you say:	F
G	"Cohort and case-control studies have shown that	G
ц	a greater concentration of lead in maternal blood during	
п	pregnancy or in cord blood is significantly associated	Н
Ι	with pregnancy hypertension and elevated blood pressure	Ι
	during pregnancy or at delivery. Although these	

associations are statistically significant, they are

K very modest in magnitude ..."

L Just one question: would such limited magnitude affect the validity of the findings in those studies? M A. No, it doesn't affect the validity of the findings, because the findings have been reported in multiple studies. So I think that they are real. But the modest magnitude does affect the interpretation of the clinical P significance.

> Again, as I indicate, the correlation, which is a measure of the degree of relatedness of blood pressure to blood lead, is quite small, meaning that most of the variation among pregnant women in their blood pressure or risk of hypertension is not due to lead, it's due to

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		other factors. Again, we know how to prevent lead		C
		exposure and so it's worthwhile to do everything we d	can,	
D		but it won't solve the problem of pregnancy hypertens	sion	D
E		entirely.		E
F	Q.	Then, in relation to spontaneous abortion, you first mention that:		F
G		"Most studies evaluating the risk of spontaneous		G
		abortion in relation to maternal lead exposure have a	not	
Н		identified a significant relationship at blood lead		Н
I		levels below 30 [micrograms per decilitre]."		Ι
T		Then you refer to one high-quality prospective st	udy	Ŧ
J		conducted in Mexico City which actually reported that	t	J
K		"the risk began to increase, and increased consistent	tly	K
L		thereafter, when maternal blood lead level exceeded		L
		5 [micrograms per decilitre]".		
Μ		Are there any special features in this particular		Μ
Ν		study conducted in Mexico City which show this result	t?	N
2	Α.	Well, I say it's high quality because of the care th	at	
0		the investigators took to try to identify potential		0
Р		confounding factors that may also be related to risk	of	Р
0		spontaneous abortion. As I say, this study did sugge	est	0
×.		that the risk of spontaneous abortion begins to rise		Q
R		once maternal blood lead exceeds 5 micrograms per		R
S		decilitre. I have no reason to think that the study	is	S
		wrong, but in this kind of work one never draws a st	rong	
Т				Т
U				U

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		conclusion based on one epidemiological study, becaus	se C
		it's always possible there's something unique about	
D		Mexico City and the women and their practices that ma	D D
E		have contributed to this result. So it's always help	ful E
F		to be able to have evidence that's been collected in	
F.		multiple studies, that all point towards the same	F
G		direction.	G
п		So I think this study is important in telling us	
п		that there may be something, an important signal here	H 2,
I		but until we have additional evidence I would be	I
J		reticent to draw a very strong conclusion.	J
	Q.	Then in relation to foetal growth, that is the next	
K		passage, you have mentioned that the evidence regardi	.ng K
L		the association between lead exposure and foetal grow	vth L
		is perhaps not that consistent.	
Μ	A.	Right.	М
Ν	Q.	Can you explain a bit more on this?	Ν
0	A.	Well, I just mean that some studies find that increas	sed
0		blood lead during pregnancy is associated with a redu	aced
Р		length of gestation. Other studies don't find that.	Р
Q		The same with the other endpoints, the birth weight,	0
		head circumference, birth length. So I find it very	C
R		difficult to know what the truth is. Until we get	R
S		a heavier weight of evidence pointing in one directio	on, S
_		it's difficult to draw a strong conclusion, in my mir	nd.
Т			Т
U			U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	CHAIRMAN: But logically, it should have a greater adverse	С
	effect on the baby's growth, because the baby's brain is	
D	developing at the time?	D
Е	A. I'm sorry?	Ε
Б	CHAIRMAN: Because the baby's brain is developing at the	-
F	time, so logically it should have a greater adverse	F
G	effect on foetal growth?	G
н	A. Yes, you would think so. Interestingly, the evidence	п
n	has not borne that out.	п
Ι	CHAIRMAN: I see.	Ι
J	A. And I don't have an explanation for it. It appears to	Л
	be that the exposure of a postnatal child is a stronger	-
K	predictor of their IQ and educational achievement than	К
L	is their prenatal exposure. It may be that there are	L
	some protective features in the foetal unit that protect	
Μ	them, protect the foetal brain, from the lead.	Μ
Ν	It's an important question, and it is a little	Ν
0	counter-intuitive, but so far the evidence just doesn't	0
0	bear it out.	0
Р	CHAIRMAN: Thank you.	Р
0	MR KHAW: Perhaps there is just one minor typo, in the last	0
×	paragraph on this page:	v
R	"The NTP concluded that the evidence was"	R
S	I think the word "is" is perhaps redundant.	S
	A. Yes. I apologise for that.	
Т		Т
U		U
V	- 29 -	v

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С	Q.	If we turn to the next page, in relation to lactatin	g C
D		women, in the first paragraph, about the sixth line,	you
D		have mentioned:	D
Ε		" the concentration of lead in breastmilk is l	ow, E
Б		comparable to that in the plasma fraction of blood	_
F		(which accounts for only about 1 per cent of the lead	d in F
G		whole blood). Thus, this pathway of exposure likely	G
		contributes relatively little to an infant's lead	
н		exposure."	Н
Ι		Then you went on to say:	I
т		"Water can be a very important pathway of lead	т
9		exposure for infants who consume formula" milk	J
К		powder "made up with water that contains lead.	K
L		Balancing the known benefits of breastfeeding and the	e L
		slight risks of substantial lead exposure from	
Μ		breastfeeding, the US CDC encourages mothers with	Μ
Ν		a blood lead level [not exceeding 40 micrograms per	Ν
0		decilitre] to breastfeed."	
0		So I take it that so long as the blood lead level	of
Р		the mother is not higher than 40 micrograms per	Р
0		decilitre, it is still safe for her to breastfeed.	[s
×		that the case?	Ŷ
R	A.	That's correct.	R
S	Q.	Regarding elderly people, we have the same discussio	n in S
_		relation to legacy lead, the old lead that accumulate	es
Т			Т
U			U
V		- 30 -	V

Transcript by DTI Corporation Asia, Limited

Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B in the body. С С If we turn to page 12, internal page 12, you have D D mentioned one recent development in lead toxicology which is generating considerable interest. That is the Е Е study regarding the association between overexpression F F of genes involved in the production of a protein, which is a constituent of the plaques that are found in the G G brains of patients with Alzheimer's Disease with lead Н Η exposure. Ι Ι Can you explain a bit more on this study, on whether it is applicable to human beings? J J A. Well, the simple answer is we don't know. The studies K K have only been done in rodents and monkeys at this point. This is another case where it's very difficult L L to do this study in humans because the finding in the Μ Μ animals is that it's the exposure to lead in very early life that predicts this late overexpression of these Ν Ν

To do this study in humans, we would have to have a prospective cohort that we had early-life lead exposure measures on, and follow them up to age 60 and Q beyond, and unfortunately that's very difficult to do R and usual people have to take advantage of other data that had been collected, in which this question can be asked. But there are relatively smaller opportunities

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genes involved in neurodegeneration.

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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Day 27

There is one study in humans that I was involved in where, at age 30, we looked to see whether, on children for whom we did have good lead exposure histories, we looked to see whether or not there was a relationship to F the level of expression of genes that are involved in this amyloid protein synthesis pathway.

HNow, what we are really concerned about is whether
or not the genes are being over-expressed in the brain,Ibut we obviously can't do that, so we were limited to
seeing whether they were over-expressed in the blood,
and we did see some suggestive relationships betweenKgene expression of individuals around 30 years of age in
relation to actually their cord blood lead levels.MThat's the only study that we have in humans at the
moment.

So this hypothesis remains highly speculative, but it is of concern because the current elderly population grew up in a time when we were exposed to much more lead than our current cohorts of children, and so we do know that the incidence of Alzheimer's Disease is rapidly increasing as our population ages, so it's reasonably -and it's biologically plausible to think that lead might be involved in this process, but again it's too soon to draw very strong conclusions.

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation Α Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B Q. Thank you. С С Further down this page, at 1h, you talk about D D long-term patients with chronic illnesses. Then you have referred to kidney function, cardiovascular Е Е function and also cognitive function. F F There's just one aspect regarding cognitive function that I would like you to elaborate. That is, in the G G middle of this particular passage regarding cognitive Η Η function, internal page 13, you have mentioned at Ι Ι line 4: "One study of individuals exposed to lead J J occupationally suggested that the inverse associations K K between an index of lifetime lead exposure and scores on neuropsychological tests were greater in individuals who L L had 'low cognitive reserve' operationalised as poorer Μ Μ reading achievement, an outcome that presumably pre-dated the onset of occupational exposure to lead." Ν Ν Can I just ask you to explain a bit about the low 0 0 cognitive reserve point that you have mentioned here? Р A. Yes. That's a concept that pertains to how readily Р an individual can be protected from an adverse effect of Q Q an exposure such as lead. It's thought that if R R an individual who is cognitively functioning at a higher level, as reflected in a higher reading achievement or S S other scholastic achievement, may be less affected by Т Т U U

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Transcript by DTI Corporation Asia, Limited

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		a given exposure, such as lead, and so show fewer		С
D		they are buffered, and it's people whose cognitive	1	D
Ε		performance is more fragile who may suffer a greater		E
F	Q.	impact. Then, regarding the WHO standards that we have talked	d	F
G		about very often at this Inquiry, you first discussed	1	G
Н		the lead content in tap water and then you have gone through the changes in relation to the WHO Guidelines	5.	H
I		May I just first ask you this: can you briefly let us	3	Ι
J		know your personal participation in the formulation of	of	J
K	Α.	the WHO Guidelines over the years? I have not been involved in the guidelines pertaining	g to	K
L		water lead. I currently chair a committee at the WHO		L

L	water lead. I currently chair a committee at the WHO
	that's developing guidelines for the diagnosis and
Μ	treatment and prevention of lead poisoning in children
Ν	and adults. I've been involved in the lead evaluations
0	for the WHO/FAO joint expert committee on food additives
0	and contaminants that has set provisional tolerable
Р	weekly intake for lead, that is the basis for the water
0	lead guidelines. Then I have also been involved in the
	Foodborne Disease Epidemiology Reference Group, which is
R	developing estimates of the global burden of foodborne
S	disease, and I have been involved in the chemical aspect
	of that process and lead is one of the chemicals that we
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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		have developed estimates for.		C
D	Q.	Thank you. We all know that the current reference vare regarding lead in water is 10 micrograms per litre.	lue At	D
E		internal page 14, the first paragraph, perhaps the la	st	Е
F		six or seven lines of this particular paragraph, you have mentioned that:		F
G		" this is designated as 'provisional' on the		G
Н		basis of treatment performance and analytical achievability."		н
I		Then you went on to say:		I
J		"The WHO further stated that, ' lead is	e s	J
K		from plumbing in buildings, and the remedy consists		K
L		principally of removing plumbing and fittings contain	ing	L
М		lead, which requires much time and money. It is		м
141		therefore emphasised that all other practical measure	S	IVI
N		to reduce total exposure to lead, including corrosion		Ν
0		Do you have anything further to add in this respec	st?	0
Р	A.	Not really. Unlike many chemicals which are present	in	Р
Q		the source water, where you can take measures at that		0
-		point in the system, lead is different, in that it is		x
R		introduced into the system at places closer to the po	int	R
S		of consumption. So I think the WHO is recognising th	at	S
Т		to remove plumbing and fittings is costly, and so the	У	Т
U				U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	recommend that as a first preliminary step, to take	С
	measures to reduce corrosivity of the water it, to	
D	reduce leaching of lead, and presumably they would	D
Е	endorse, if that doesn't work, then to take the more	Ε
_	costly step of replacing the fittings.	
F	CHAIRMAN: So does that mean that that was known to the WHO	F
G	back even in 1958, when they first developed the	G
	allowable limit?	
Н	A. I don't know the answer, what they knew back in 1958.	Н
I	Certainly lead in water and the contribution of lead in	Ι
T	plumbing and actually the use of lead to make pipes was	Ţ
J	known back then. But I don't have specific knowledge of	J
К	that.	K
L	CHAIRMAN: But certainly it was known back in 1974, when the	L
-	United States passed this Safe Drinking Water Act	L
Μ	(1974)?	Μ
Ν	A. Again, that was before my time. I don't know what	Ν
	the	
0	CHAIRMAN: Okay. Thank you.	0
Р	MR KHAW: In relation to blood lead content, we know that	Р
0	the current reference values are 5 micrograms per	0
Q	decilitre for children and 10 for adults. You have also	Q
R	mentioned at internal page 15	R
S	CHAIRMAN: Before you move to page 15, I note on page 14 the	S
	United States adopts sort of a higher value,	5
Т		Т
U		U
V	- 36 -	v

Transcript by DTI Corporation Asia, Limited

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	15 micrograms. Is there a rationale behind that?	С
	A. Well, that's not the only respect in which the EPA's	
D	guideline is different than the WHO's, because the EPA	D
Ε	does allow up to 10 per cent of violation, of 15, before	Ε
Б	some action is mandated.	-
r	CHAIRMAN: I see.	F
G	A. They will allow up to 10 per cent to be above	G
ч	CHAIRMAN: So 16.5?	
п	A. Yes. So all of these guidelines really try to balance	Н
Ι	health-based considerations with practicality, and	Ι
J	I think, you know, that's why they are all provisional,	J
	because the health information and the technologies	_
K	improve, and so over time permit the implementation of	K
L	more stringent guidelines. But this is where they are	L
	at the moment for the EPA.	
Μ	CHAIRMAN: I understand the ideal value of course is zero.	Μ
Ν	Does that mean that 16.5 is still acceptable?	Ν
0	A. According to the EPA	0
0	CHAIRMAN: But what about according to you?	0
Р	A. You know, it's hard to take one number out of context.	Р
0	CHAIRMAN: Right.	0
•	A. It would depend upon because, as I've said, lead is	×
R	a multimedia pollutant, so we have to take a look at the	R
S	entire profile of exposure sources the paint, the	S
m	air, the soil, the diet, hobbies, occupations. For some	
Т		Т
U		U

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A	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	people, having a 16.5 might be relatively trivial	С
	because they are not exposed to lead in any other	
D	aspects of their life, but for other people, who have	D
E	a higher baseline exposure, that may be enough to put	E
	them into a range where we need to be concerned.	
F	So I think it really is hard to give one answer.	F
G	CHAIRMAN: I see, that's what you mean. So it's the blood	G
н	lead level that matters, rather than the lead in water?	п
11	A. In my view, that's what we use to make decisions,	п
Ι	management decisions, as to whether or not we need to	Ι
J	help an individual reduce their exposure. It's what's	I
	in their body, that to me is the index of likelihood of	U
K	an adverse effect.	K
L	CHAIRMAN: Thank you.	L
	MR KHAW: In relation to the blood lead level, you have come	
М	to a conclusion at internal page 16 that the reference	М
Ν	values selected by the Hong Kong government for	Ν
0	prioritising individuals for follow-up based on blood	
0	lead level are appropriate and consistent with those	0
Р	identified by the international bodies.	Р
0	A. That's right.	0
x	Q. You can confirm that?	Y
R	A. Yes, I do.	R
S	Q. If we then take a look at the recommendations for	S
	follow-up actions in respect of both children and	
Т		Т
U		U
v	- 38 -	V

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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adults, as suggested by the CDC of the United States, at С С internal page 17. If we talk about children first, the D D first table, we can see in the left-hand column, blood lead concentration less than 5 micrograms per decilitre, Е Е and then we can see that the recommendations for F F follow-up actions are more limited. They consist of lead education, environmental assessment, and then G G follow-up blood lead monitoring. Η Η

In the next column, if we are talking about blood I lead concentration which is in the range of 5 to J 45 micrograms per decilitre, then there have been more recommendations for follow-up actions. For example, we K have things like environmental investigation, lead L hazard reduction, neurodevelopmental monitoring, abdominal X-ray.

M First of all, in relation to environmental
N investigation, and neurodevelopmental monitoring, can
you tell us what steps are needed for these follow-up
actions?

- A. Yes. Usually, the environmental investigation would involve querying a parent about possible lead sources in the environment, finding out where a child spends time, in addition to the home. That of course would be age-dependent. Then, depending on the blood lead level, actually going into the home to collect samples of
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Day 27

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Commission of Inquiry into Excess Lead Found in Drinking Water

Day 27

С	different media that the child might come in contact	С
	with, such as collecting air samples or dust samples,	
D	samples of the soil outside the home, the paint, and	D
E	noting whether or not the paint is chipping, and asking	E
	the parent whether or not they have seen the child put	
F	things in their mouth, the child put things in their	F
G	mouth that are not food. In the extreme it's called	G
н	pica; asking about occupations of the parents, whether	Н
11	they might be involved in an occupation that involves	
I	exposure to lead and so may bring lead home on work	I
J	clothes; asking whether the parents engage in hobbies	J
	that might involve the use of lead and so could	-
K	contaminate the home environment; asking about foods	K
L	that the family eats, the medicines they take, whether	L
	they take herbal medicines, which unfortunately have	
Μ	been reported, in some instances, to have fairly high	Μ
Ν	lead content; looking at the materials that the family	N
0	use to prepare food and to serve food sometimes, at	0
0	least in the United States, they are glazed with lead	0
Р	glaze which can leach lead and so get into the food and	Р
0	be consumed looking at the toys the child plays with	0
C C	and the furniture, whether it's painted with potentially	X
R	lead paint.	R
S	Really, it's taking a comprehensive look at the	S
	environment that the child lives in, to identify	
Т		Т

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		potential sources, because it can be very hard to te	11. c
D	Q.	What about neurodevelopmental monitoring?	
D	A.	This could vary in intensity as well, depending upor	D D
Ε		a child's blood lead concentration. It could be as	Ε
F		simple as asking the parent about a child's	
		developmental milestones, when they first sat unaide	d, F
G		when they first took their first step, said their fi	rst G
Н		word, said their first sentence; or it could involve	
		an in-person assessment using a screening tool by	Н
Ι		a medical professional; or, if there are red flags t	hat I
T		are raised by any of these screening methods, actual	
J		administration of more comprehensive neurodevelopmen	J tal
К		assessments for diagnostic purposes.	K
L		So it really is based on the level of lead exposu	ire L
		and a clinical indication.	
Μ	Q.	Thank you.	Μ
Ν		In relation to adults, that is the last table on	the N
0		same page, we can see that for blood lead concentrat	ion
		which is in the range of 10 to 29 micrograms per	0
Р		decilitre, then various follow-up actions are	Р
Q		recommended.	0
		Then we can see things like exposure assessment.	Q
R		I take it that that is similar to the environmental	R
S		investigation that you have just mentioned?	S
	A.	That's correct, yes.	
Т			Т
U			U

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B Q. Thank you. С С Then, talking about the test results that we have D D got here in Hong Kong, the next part of your report actually addresses the adequacy of the care plan as Е Е devised by the Department of Health. Before you talk F F about the adequacy of the care plan, you have provided a summary of the results, and I understand that at the G G fifth line you have mentioned that the results of repeat Η Η blood lead tests are reported for 28 individuals. Ι Ι I understand that at the time when you were compiling the report, the information set out here was J J based on the first list of test results that you K K gathered at the time? A. That's right, the 22 October 2015 line listing. L L Q. Because in fact subsequently there have been two updated Μ Μ lists, one dated 19 November 2015, and also the latest one is as of 3 December 2015. Ν Ν I think now you have had a chance to look at those 0 0 two updated lists, and just for reference sake, the Р second list, as of 19 November this year, can be found Р at E2/770 to 773, and the latest one is at E2/850 to Q Q 853. R R I understand, Professor, that you have had a chance to now look at these updated lists of blood test S S results. Do you have anything to add to your original Т Т U U

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V
Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		summary of the test results?	С
	A.	Well, I didn't have a chance to carry out the same	
D		calculations that I carried out on the 22 October lis	D
Е		I do note that there is one additional follow-up	E
_		test on a pregnant woman.	
F.	Q.	Yes.	F
G	A.	I reported on the four pregnant women, so there are n	.ow G
п		five. I had calculated an average change, a decrease	in
п		blood lead level, over the one month follow-up interv	al,
Ι		of 13.7 per cent for those four women for whom I had	the I
J		data at the time.	т
0		The fifth woman had a decline of 14.3 per cent	U
K		between her initial and follow-up blood test. So her	K
L		data are very consistent with those that I saw for th	e L
		other four.	
Μ		Looking at non-pregnant individuals, I think what	М
Ν		I had seen in the initial group of 24 non-pregnant	Ν
		individuals was a decline between the baseline or fir	st
0		blood test and the follow-up blood test of about	0
Р		30 per cent. Without having carried out the	Р
0		calculations, by just estimation, it looks like the	0
Q		additional data that are now represented in the line	Q
R		listing are quite consistent with that.	R
S		There is one individual that was of some concern t	.o S
		me: a two-year-old female whose first blood test was	5
Т			Т
U			U

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Transcript by DTI Corporation Asia, Limited

V

A	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С		6.48 micrograms per decilitre, and her follow-up thr	ee	С
		months later was 27.32 micrograms per decilitre, and		C
D		then a blood lead conducted one month after that, it	was	D
E		21.37, and three weeks after that it was 15.3.		E
_		So I'm very happy to see that this child was		
F		followed up so assiduously and it's good that her bl	ood	F
G		lead was coming down. It does suggest, however, that	2	G
п		there was something in her environment, certainly no	t	
п		the water because that had been stopped, but she was		н
I		exposed to something between the first and the		Ι
J		follow-up first follow-up blood lead that led	to	J
		quite a spike in her blood lead level.		0
K		But apart from her, everyone else seems to be a n	ice	K
L		decline in their blood lead; as I say, averaging abo	ut	L
		30 per cent.		
M	Q.	Thank you.		Μ
Ν		Just for record purposes, the two-year-old girl t	hat	Ν
0		you have just mentioned, I think the result of her b	lood	0
0		test can be shown at page 851 of E2. I think her res	sult	U
Р		is the one just above the middle of this page. The		Р
0		first follow-up blood test result, it's about 27.32.		0
2		I will now move on to discuss your recommendation	.S	×
R		in relation to the care plan devised by the Departme	nt	R
S		of Health.		S
		I am just wondering if this is an appropriate tim	le	
Т				Т

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	for a break?	С
	CHAIRMAN: Yes. Let's first take a 20-minute coffee break	
D	and then resume later. Thank you.	D
Е	(11.28 am)	E
	(A short adjournment)	
F	(11.49 am)	F
G	MR KHAW: Regarding the care plan which is discussed at	G
н	internal page 19 of your report, you have provided your	н
	opinion that "the general components of the care plan	п
I	proposed for the residents are appropriate, although	Ι
J	some are not described in detail".	Ţ
	Then you go on to say:	U
K	" while the plan to conduct an 'exposure	K
L	assessment' is sound, no information is provided about	L
	what this assessment will include and what methods will	
М	be used. In general, such an assessment involves	Μ
Ν	consideration of lead hazards in an individual's home	Ν
0	environment outside activities [et cetera]"	
0	Then you have also mentioned that:	0
Р	"The care plan also stipulates a 'health evaluation'	Р
0	for individuals with a blood lead level of 5 [to] 44 $$	0
C	and a 'medical assessment' for individuals with	×
R	a blood lead level [exceeding] 44. What will be	R
S	included in these activities, and whether the clinicians	S
m	performing them will be experienced in assessing	
Т		Т
U		U

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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lead-exposed individuals are not described. Whether the 'developmental assessment' will involve use of screening tools, parent questionnaires, or in-person clinical evaluations is not described."

So there you talk about what is actually lacking or what was then lacking in the care plan that you saw at that time.

Now, I understand that the lawyers representing the Department of Health issued a letter to us yesterday, providing more information regarding the care plan. Perhaps we can take a look at such information and then I'll probably ask for your views on whether you find those plans, those existing plans, adequate or not.

If we can first take a look at E2, tab 71, at page 846. Page 846 talks about the updated tables and also the updated blood test results. I think we have just clarified that point earlier.

Then if we can focus on the next page, that is page 847. Again, we have dealt with the issues arising from the first paragraph, regarding the difference between 28 individuals and 29 individuals, because according to the first list there were 28 individuals, as mentioned in your report, and if we look at the updated list, there are actually 29 individuals.

If we can then move on to look at the second

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation Α Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B paragraph, from the second paragraph onwards it says: С С "As for the 'exposure assessment' mentioned in D D page 19 of [your report], a lead exposure assessment ... is conducted by a nurse of the Department of Health ... Е Е for every individual with elevated blood lead level. F F For selected circumstances, [lead exposure assessment] will be supplemented by a home visit. Relevant G G documents including the questionnaire and reference Η Η materials used for conducting lead exposure assessments, Ι protocol and flowchart for home visits of cases with Ι elevated blood lead level are included in the J J above-mentioned updated 'Master List of documents K K published'." If we can now perhaps take a quick look at the issue L L of the home visit, at page 870. In fact, this is Μ Μ a document entitled, "Investigation protocol for

> elevated blood lead level", published by the Department of Health. If we take a look at "Home visit", page 870, paragraph 13, it says:

"Home visit provides a good opportunity for health education to the case and household members. Also, any probable source(s) of lead exposure of the case may be identified through home visit so as to guide risk reduction measures. The visiting team should take photo(s) of any highly suspicious item(s) in the

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	household and discuss with the Government Laboratory for	С
	the standard and the methodology of analysis prior to	
D	collection of any specimen(s).	D
Е	14. Home visit should be conducted under the	Ε
_	following circumstances:	
F	Single venous [blood lead level exceeding or	F
G	equal to 20 micrograms per decilitre]; or	G
п	Any suspicious source(s) of lead exposure is	
п	identified	Н
I	Follow-up BLL(s) is persistently elevated"	Ι
J	So these are the circumstances which call for home	т
0	visits, according to the measures now taken by the	J
K	Department of Health.	K
L	Do you find this suggestion for home visit	L
	sufficient for this specified category of residents?	
Μ	A. I do. I am very impressed, actually. I particularly	Μ
Ν	like the second bullet point, "Any suspicious source(s)	Ν
0	of lead exposure is identified", as cause for a home	
0	visit.	0
Р	Now, I assume it's identified by means of an initial	Р
0	interview and survey of the informant about what	0
×	potential sources in the home might be. The reason	Y
R	I like this very much is because it really focuses on	R
S	prevention. It doesn't require that someone be exposed	S
	before the home visit is done to reduce exposure and it	
Т		Т
U		U
V	- 48 -	v

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry into Excess Lead Found in Drinking Water	Day 27 B
С	holds the potential of actually preventing the expo	sure.
	So I think this is very well thought-out, yes.	
D	Q. If we go back to the letter from the Department of	D
E	Health, page 847, there are a few more suggestions	here. E
_	If we take a look at the third paragraph, starting	from
F	the words:	F
G	"Regarding the 'developmental assessment' mentic	ned G
ц	in page 19 of the expert report, all children with	
п	elevated blood lead level will receive preliminary	н
I	developmental assessment at [Department of Health's] I
J	Child Assessment Centres or Student Health Serv	ice
U	Special Assessment Centres by a developmental	U
K	surveillance team composed of [doctors] and nurses.	The K
L	developmental assessment covers major developmental	L
	areas including gross and fine motor, language and	
Μ	communication, cognition, learning, behaviour and	М
Ν	emotion, self-care, vision and hearing. This is	Ν
0	conducted through history taking (including birth,	0
0	developmental and medical history, daily and school	0
Р	functioning and parents concern on development and	Р
0	behaviour), reviewing school reports and school wor	k, 0
C	physical examination (including soft neurological	×
R	signs), clinical observation and use of questionnai	res R
S	and assessment tools."	S
-	Then finally it says:	
Т		Т
U		U
V	- 49 -	\mathbf{V}

Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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"Children identified with developmental or behavioural problems will have follow-up evaluation at Child Assessment Service according to individual needs. Children with largely normal development would receive continuous monitoring through enhanced developmental surveillance at Maternal and Child Health Centres ... during pre-school years and annual health visits at student health centres during school years. Parents are provided with anticipatory developmental guidance and information on children's development in the form of pamphlets."

If we can then take a look at the table which I think basically describes the details of this particular plan, at page 871, we can see various -- the table under paragraph 17, we can see various care plans devised for different groups of people with different ranges of blood lead results.

Basically, it summarises what has been set out in the letter that we have seen.

Also, I take it that you have had a chance to look at the checklist, at page 873, which contains all the items that need to be examined during the home visit.

Now you have had a chance to see the details of such care plans, are you happy with these suggestions now, or do you have any further comments on the adequacy of the

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Day 27

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoDay 27Excess Lead Found in Drinking WaterDay 27	В
С	care plan?	С
	A. Again, I am very impressed with the level of detail and	
D	the thought that's been invested in the different	D
Е	contingencies.	E
T	What I particularly like about the clinical	
F,	management or developmental assessment plan is that	F
G	children with blood lead levels of 5 to 20 will receive	G
н	a preliminary developmental assessment by the Child	п
п	Assessment Centre or the Maternal and Child Health	п
Ι	Centre or the Student Health Services. I like that	Ι
J	because it actually is more it's providing more	J
	services than the US CDC developmental management	
К	guidelines provide, which suggests that only children	K
L	with levels above 20 be surveilled in this way. But	L
14	I think this is going to provide an opportunity to	
M	identify problems that children may be experiencing that	М
Ν	have nothing to do with lead, but a child would benefit	Ν
0	from receiving some kind of supportive services.	0
0	So I think this is generally even beyond the scope	U
Р	of responding to the water lead issue, this is going to	Р
Q	benefit children and parents.	0
	I also had a chance to look at the lead exposure	C
R	assessment questionnaire that will be administered.	R
S	That's page 877 and beyond. I find that it covers all	S
T	of the topics that I listed in my report that would be	
T		Т
U		U

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Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		important to include in an exposure assessment.	С
		So, again, I am very pleased to see this level of	-
D		detail. I think it's going to serve the purpose for	D
E		which it was designed.	Ε
Б	Q.	Thank you. I think finally, we have come to the last	:
F.		question that you have answered in your report, ie the	ne F
G		efficacy and suitability of the acceptance criteria	Laid G
н		down by the Water Supplies Department for heavy metal	ls,
		and if necessary to make recommendations. That's	п
Ι		internal page 19, paragraph (5). I think here, apart	I
J		from lead, you have also discussed the acceptance	I
		criteria in relation to three other heavy metals, ie	-
K		cadmium, chromium and nickel. I think you have come	to K
L		the conclusion that the acceptance criteria specified	d by L
		the Water Supplies Department are based on sound	
Μ		reasoning. Can I just for the purposes of general	М
Ν		understanding of these heavy metals I am sure that	z N
0		you have a lot of experience in dealing with heavy me	etal
0		poisoning. If we are talking about heavy metals such	ι as
Р		cadmium, chromium and nickel, what are the general ha	arm P
0		that they can do to human beings?	0
C C	A.	Well, it differs from metal to metal. Cadmium is	×
R		primarily a renal toxicant. It damages renal functio	n, R
S		it reduces the ability to kidneys to filter out pois	ons S
		in the body. So it can lead to chronic renal failure	:
Т			Т
U			U
v		- 52 -	V

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		and require transplant, at very high doses, mainly	C
D		occupationalists, people who encounter cadmium working	ng
D		in their jobs.	D
Ε		Chromium is a little more complicated, because th	ere E
		are different forms of chromium. Trivalent chromium	or
F		chromium (III) is actually an essential nutrient, so	we
G		need a little bit of that. Chromium (VI), hexavalent	G
н		chromium, is one of the most toxic chemicals known, a	and
11		it's well known, it's recognised by the International	n
Ι		Agency for Research on Cancer as a human carcinogen.	I
J		Nickel, there's actually not that much evidence	J
		about nickel. Nickel is, like chromium (III),	
K		essential, but too much is thought to be an irritant	. К
L		So that's the reason for establishing exposure limits	³ L
		for nickel.	
M	Q.	In general, how can these heavy metals we're talk	ing
Ν		about cadmium, chromium and nickel how can they	Ν
0		actually enter water?	
0	A.	Sometimes they are just in the groundwater. They are	e
Р		natural constituents of the earth's crust. So,	Р
0		depending upon where an aquifer from which drinking	0
×		water is taken, they may be naturally present, or the	ey 🤇
R		could be present as a contaminant. Cadmium is used	R
S		industrially a lot. Hexavalent chromium is also	s
		an industrial pollutant. And so, depending on the ca	ire
Т			Т
U			U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	taken in its disposal, it could contaminate water	C
D	Q. Thank you very much. That leads us to your conclusion	D
Е	at page 22. If I may just quote what you have said	F
2	here, "Summary of conclusions":	Ľ
F	"Lead serves no biological purpose in the body.	F
G	There is no 'safe' level of lead, as adverse effects in	G
	different organ systems, particularly the central	
п	nervous system, have been observed at blood lead levels	Н
Ι	less than 5 micrograms per decilitre. Therefore, the	Ι
J	ideal blood lead concentration for a human is 0 \dots	J
-	Because of the ubiquity of lead in the contemporary	0
K	environment, this will not be achievable in the near	K
L	term. All lead exposure is preventable, however. The	L
М	goal, therefore, must be to reduce exposure as much as	
IVI	is feasible. The many sources and pathways of lead	M
Ν	exposure complicate the path to achieving this goal.	Ν
0	Removing one pathway/source might produce only a modest	0
-	reduction in blood lead level. That lead is	0
Р	an accumulative toxicant stored in multiple pools in the	Р
Q	body besides blood introduces an additional	Q
	complication. The partial data available demonstrating	
R	an average reduction of approximately 30 per cent in the	R
S	blood lead levels of residents of the affected public	S
т	housing estates following interruption of the water	- TE
1		T
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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

С	pathway suggests to me that lead in the drinking water	С
	was, indeed, contributing to the exposure of the	
D	residents. I would anticipate that, over time, the	D
E	residents' blood lead levels will re-equilibrate and	E
	reach a new steady state that reflects their lead	
F	exposure from other (non-water) sources and their	F
G	endogenous lead sources reflecting past exposures. The	G
	blood lead concentrations achieved will therefore depend	
H	on what other sources/pathways contribute to	Н
I	an individual's lead exposure, as well as the magnitude	Ι

Just as a sort of general comment, now you've had K a chance to look at all the blood test results of the residents involved and the updated test results -- just L as from a broad comparative angle, in view of the other Μ studies and cases that you have seen in other countries, what is your observation about the magnitude of this Ν particular incident, in view of the test results that we 0 have seen?

of the individual's historical lead exposure."

A. As I say, certainly the fact that once the residents were not drinking the lead-contaminated water their blood lead levels came down -- they were being exposed, there's no question about that, and as I say, it is prudent to interrupt any pathways of exposure that one feasibly can. I do look at incidents such as this in

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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terms of the context of other scenarios that I have been С С involved in. When I first got involved in lead work, D D this was back in the late 1970s, at that time the mean blood lead level of US pre-school children was Е Е 15 micrograms per decilitre, and 90 per cent, it was F F 88 per cent, of children had a blood lead level above 10 micrograms per decilitre. G G

I was thrilled at that time when my two sons had blood lead levels of 6 micrograms per decilitre. In the context looking back now, even that's too high, but at the time it was pretty good.

Looking at the 3 December line listing, I see there were only two individuals who had a blood lead level above 15. One was a 89-year-old who had a 16.7 -- it perhaps may have been an occupational exposure at some point in the past -- and the other was a 15.8 in a one-year-old.

So from that perspective, these levels don't seem very high. They are certainly higher than we would like to see, and it's good that they are coming down.

Another episode that I was just dealing with at WHO was an episode of lead poisoning in Zamfara, Nigeria, where more than 400 children died from lead poisoning and one child had a blood lead level of 700 micrograms per decilitre.

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Transcript by DTI Corporation Asia, Limited

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

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CSo there are certainly still cases where children
are very, very seriously poisoned, and I don't thinkDthat's the case here. I don't think any children areEgoing to be showing signs or symptoms of lead toxicity.FOn a population basis, I think we can conclude that
there probably will be some shifts, minor shifts, inGmean level of performance, shifts that you would never
probably notice at the level of the individual child.
So my overall position is that this is a very

I unfortunate situation; I don't think the health
J consequences are going to be terribly serious, and
I think that the authorities are taking totally
K appropriate steps to support the affected people and
L taking steps to make sure that exposure from water is
not a major contributor to the overall exposure.

- Q. Thank you. Finally, may I just confirm a few things N with you, just as a matter of formality. May I just ask N you to confirm that all the facts and matters that you O have set out in your report and you have discussed P today, which are within your personal knowledge, are Q A. Yes, I do.
 - Q. You also confirm that the opinions expressed in your report and also expressed today at the hearing are honestly held?
 - Transcript by DTI Corporation Asia, Limited

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Α	Annex	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С	A.	Yes, they are.		С
_	Q.	Can you please also confirm that the contents of you	r	
D		declaration as an expert, as attached to your report,	,	D
Ε		and also your CV attached to your report, are true as	ıd	Е
Б		correct?		_
F	A.	Correct, yes.		F
G	Q.	You are willing to adopt what you have set out in yo	ur	G
н		report and what you have discussed orally at this		тт
11		hearing today as your expert evidence?		н
Ι	A.	Yes.		Ι
J	MR	KHAW: Thank you very much.		J
	CH	AIRMAN: Thank you. Anyone wants to ask any questions	?	
K		Yes, Mr Pennicott.		K
L	MR	PENNICOTT: I think there are others as well, but I a	m	L
		happy to go first if nobody else wants to go first.		
Μ		Cross-examination by MR PENNICOTT		Μ
Ν	Q.	Prof Bellinger, I represent one of the contractors w	ho	N
0		was responsible for building two of the eleven affect	zed	0
0		estates. One of those affected estates is an estate		U
Р		called Kai Ching, and as it happens it is Kai Ching :	Ĺn	Р
Q		respect of which we have most information in relation	1	Q
		to, amongst other things, blood lead levels, and		
R		I expect you have picked that up during the course of	Ē	R
S		your reading of the materials for the purposes of you	ır	S
Т		report.		т
-				I
U				U

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		You will know, if you have read that material, th	at C
		Kai Ching Estate comprises of six separate residentia	al
D		blocks. Is that something you are aware of?	D
E	A.	I wasn't aware of that level of detail.	E
F	Q.	It is six residential blocks. There are 5,204	
F,		individual units within those six blocks, and what	F
G		I want to do, I hope fairly briefly, is ask you some	G
п		questions about the various matters you have been	
п		discussing with Mr Khaw, but specifically in relation	H to
Ι		the Kai Ching Estate, if I may.	I
T		Before I do that, I am going to hand you some	т
0		documents in a moment that are going help me and	J
K		hopefully help you as well.	K
L		Can I ask you this: so far as the blood lead leve	l L
		tests are concerned, have you established how those	
Μ		tests were actually carried out on the individuals w	M M
Ν		went for those tests?	Ν
	A.	Only indirectly. I notice that some of the values as	re
0		reported as less than 3.3 micrograms per decilitre,	0
Р		which leads me to think that a portable LeadCare	Р
0		analyser instrument was used.	
Q	Q.	Right, and do you know how the blood was taken? Have	Q
R		you made an assumption as to whether it was a venous	R
S		approach or just a prick on the end of a thumb or	S
5		a finger?	5
Т			Т
U			U
V		- 59 -	V

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С	A.	You can use either type of sample with the LeadCare	С
		analyser, and I don't know whether venous or capillar	су
D		blood was used. If the sampling protocol is adequate	, D
E		it shouldn't matter very much.	E
_	Q.	That leads me to ask you this: if you are going blood	d
F		lead level tests in a laboratory, is there any margin	
G		for error that you would impose, or are they sort of	G
ц		absolute figures?	
п	Α.	Oh, absolutely, it does the different methods that	H t
Ι		are used do have different levels of precision.	I
I	Q.	Can you explain what level of precision, for example	,
0		there is on a venous approach?	J
K	A.	Well, the precision would be more specific to the	К
L		method, whether it's isotope dilution mass spectromet	ry L
		or atomic absorption spectrometry or anodic stripping	1
Μ		voltammetry. It's not so much whether it's capillary	or N
Ν		venous blood that's collected. The same level of	N
2		precision would apply depending upon which analytical	-
0		method is used, not the sample collection method.	0
Р	Q.	Can you give an approximation as to the margin of er	ror? P
0	Α.	Well, for the ICP-MS method, it can be plus or minus	
Q		only a half of a microgram per decilitre or even	Q
R		a tenth. Yet for the atomic absorption, it may be pl	us R
S		or minus 1 or 2 micrograms per decilitre. Again, it	S
		depends on whose hands are applying the method.	0
Т			Т
U			U
v		- 60 -	v

Α	Annex:	: Realtime English Transcription based on floor / Simultaneous Interpretation	2	A
В	Comm Excess	aission of Inquiry into a Lead Found in Drinking Water	Day 27	В
С	Q.	Right, the skill of the operator?	(С
	Α.	Right. The US CDC was resisting lowering the action		
D		level from 10 to 5 because they were claiming that ma	any	D
Ε		labs didn't have the ability to get closer than seve:	ral	E
F		micrograms per decilitre in their measurement.		
Г	Q.	Prof Bellinger, one point that you discussed briefly	1	ľ
G		with Mr Khaw earlier arises on page 58, internal	(G
u		page 14, of your report. It's the last sentence of t	he	
п		paragraph, headed "USA Environmental Protection Agend	су",	H
Ι		and it's this point about "If more than 10 per cent o	of I	[
J		the tap water samples collected exceed the action lev	vel	I
		of 0.015 [micrograms per litre] (15 [micrograms per		•
K		litre]), a water system is required to take steps suc	ch I	K
L		as corrosion control treatments", and so forth.	J	Ĺ
		If the percentage is less than 10 per cent let	's	
Μ		say, for example, 7.5 per cent, just by way of	Γ	M
Ν		example is there anything to be done in those	I	N
0		circumstances, or does this only kick in when you get	t to	~
0		10 per cent?	,	J
Р	A.	Yes, my understanding is it only kicks in when you g	et I	P
0		to 10 per cent. But there are some I'm no water		0
c		expert, I have to say that right upfront. I believe		×
R		that if a water system is supplying more than some	I	R
S		number of individuals or units, they are required to	S	5
		take appropriate steps to reduce corrosion. And this	3	
Т]	Г
U			ı	U

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v

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		10 per cent applies to I think smaller systems, that	are C
		providing service to a smaller number of units.	
D	Q.	Have you, for the purposes of your report, studied in	ר D
E		any detail the water tests that have been done in	E
Е		relation to the various affected estates?	
r	Α.	No. I have focused on the health side of things.	F
G	Q.	So you haven't looked at them at all, the results, the	ne G
н		test results?	н
	Α.	Not in detail, no.	11
Ι	Q.	Okay. We will come to it a little bit in a moment.	Ι
J		I wonder if I could now hand out some documents th	nat J
-		are going to help me to ask a few questions. I hope	it
K		won't take too long. (Handed).	K
L		If everybody has those, Prof Bellinger, for the	L
		first document, it's titled "Table A". You will reca	11,
Μ		in your discussion with Mr Khaw earlier, you had	Μ
Ν		identified I think 24 results as at 22 October 2015.	Ν
0	Α.	Right.	
0	Q.	Where there were in fact 28 results, you have taken o	off O
Р		four pregnant women and then got an average of	Р
0		30.8 per cent, I think.	0
Q	A.	(Nodded head).	Q
R	Q.	What we see on table A is in fact 25 results, so sim:	ilar R
S		to you, what we have done is we have taken out the fo	our s
		pregnant women but we have added back the one result	
Т			Т
U			U
V		- 62 -	V
	Transc	ript by DTI Corporation Asia, Limited	

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		that you didn't have, so we've now got 25 rather than	¹ C
D		24. As you can see, we have calculated the average a	nd
D		it's changed very marginally to 30.27.	D
E		Can I ask you this first: this table includes two	E
F		women, lactating women. Why do you think you would	F
r		include those rather than exclude them for this purpo	se?
G		You have taken out the pregnant women, I understand,	and G
н		we see the reasons for that, but why do you include	н
		lactating women?	11
Ι	Α.	Well, to be honest, I didn't notice that. It probabl	-y I
J		would have been better to calculate the average chang	le 1
		including and excluding them. Again, because during	-
K		lactation, bone is still being mobilised to provide	K
L		calcium, it does complicate the kinetics a bit.	L
	Q.	I just wonder whether there was a particular reason :	for
Μ		it. I am not pressing you, I just wanted to know	М
Ν		whether there was a particular reason for it.	Ν
0	A.	Which two were lactating?	
0	Q.	If I am using the references on the left-hand column	, ,
Р		about halfway down there's a reference "KC00190"; do	you P
0		see that?	0
x	Α.	Yes.	Q
R	Q.	The 32-year-and-10-month-old lady and the	R
S		cross-reference for anybody who is interested is E1/5	542, S
		where we will pick up that there's a Y in the lactati	.ng
Т			Т
U			U
V	Transc	- 63 - ript by DTI Corporation Asia, Limited	v

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С		column on that page the other one is KC00257,	С
		a little bit further down the page. And similarly, i	_t's
D		the same page where we pick up the reference.	D
Ε		I am not pressing. I just want to know that there	e E
F		was a reason that there is one calculation with and	one
F		calculation without?	F
G	Α.	Yes. I see they both declined about 18 per cent, and	d G
н		I would have predicted that they would decline a lit	tle H
		bit less than non-lactating individuals. So that wou	ıld
Ι		probably boost up the 30 per cent drop a bit.	Ι
J	Q.	It would clearly push it up?	J
	Α.	It would.	
К	Q.	The other thing on this page, table A, Prof Bellinge	r, K
L		that I just want to ask you a couple of questions	L
		about we have highlighted the two extremes in the	
M		right-hand column which I think you draw attention to	o in M
Ν		your report. That is the most dramatic percentage	Ν
0		change is in the fourth reference down, of minus	0
0		55.54 per cent.	0
Р	Α.	Mm-hmm.	Р
Q	Q.	And the smallest change appears to be in the fifth	Q
		reference up, of minus 2.74 per cent.	-
R	Α.	(Nodded head).	R
S	Q.	Presumably you would agree with me, that's a rather	S
T		large range for this type of exercise?	_
1			Т
U			U
v		- 64 -	V
	Transc	cript by DTI Corporation Asia, Limited	

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	B
C	A.	It's hard to say. I mean, it is a large range, but		C
C		whether it's larger than one would see elsewhere,		C
D		I can't say.		D
E	Q.	What I am quite interested in, Prof Bellinger, is rea	ally	Е
_		whether taking an average of all these percentages		
F		actually tells us anything? Is it very meaningful,		F
G		given the wide range that we have here, just to say		G
н		30 per cent?		
н	A.	Well, it is one way of summarising the evidence. As		H
Ι		I mentioned in my report, there is a statistical		I
J		phenomenon known as regression to the mean, which mea	ins	J
		that if you take repeat measurements of some biologic	al	-
K		function, or any function, usually those who are most	-	K
L		extreme on the first test will regress towards the me	an.	L
м		If they are high on the first test, they will be close	er	
M		to the mean on the second test because they will		Μ
Ν		decrease. If they are very low on the first test, on		N
0		the second test they will probably increase towards t	.he	0
0		mean.		U
Р		I did show that the mean the percentage decline	e	Р
0		between the first and the repeat blood test was large	r	0
τ.		among people whose first blood test result was higher	•	Y
R		Now, that does suggest to me that there was some		R
S		regression to the mean going on. But we can't know h	OW	S
		much regression there was unless we also tested peopl	.e	

- Т
- U

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V

Т

U

Commission of Inquiry into Excess Lead Found in Drinking Water	Day 27 B
	• –
whose did repeat testing on people whose first \boldsymbol{C}	blood C
test did not exceed the reference value. That wou	ıld
D give us a sense.	D
E Q. Yes.	Ε
A. But there are biological reasons why we would exp	pect
there to be variability among people in the diffe:	rence
${\ensuremath{G}}$ between their first and second blood test. Their	age G
would be one thing.	ч
Q. Yes.	п
I A. Because the older people would have more lead in	their I
bones.	I
It also depends upon what the other exposure,	lead
K exposure sources are for an individual. An indivi	idual K
L who's exposed to whose exposure is primarily f:	rom L
non-water sources is not going to show much of a	decline
M once the water pathway is eliminated.	М
N So, you know, for all of those reasons, it's	Ν
impossible in my mind to draw any conclusion from	the
• variability in the per cent change, without having	g lots 0
P more information.	Р
Q. Yes. That's a very fair answer. But just to poir	nt out
that to really underline the point that you have	Ve just
R made the two extremes, the 55 per cent and the	R
S 2.74 per cent the first one appears to be a fer	male
child of 10 months old, that's the 55.54 per cent	, and
Τ	Т
U	U
V - 66 -	v

Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

Α

B

C		the other one and I should emphasise, for a reason we	C
C		will come to in a moment, resides in Yuet Ching House	C
D		we will come to the reason or the relevance for that in	D
E		a moment. At the other end of the scale, as it were,	E
_		the 2.74 per cent, is another child, a female of one	
F		year and four months old. So you've got two children of	F
G		not great difference in age showing a huge difference in	G
ч		the readings between the first and second blood test.	т
п		Does that tell you anything?	н
I	A.	It tells me that water lead was probably a much more	Ι
		significant portion of the first child's the ten	

- J month old child's overall lead exposure than it was the K other child, and that's why you would see a larger drop In the blood lead after the water pathway has been remediated.
- Q. Just looking at these percentages and the drops, if you
 N like, in levels, again the passage that Mr Khaw read out
 to you -- I don't want to go back to it again;
 O I certainly don't want to read it out again -- it's in
 P the passage where you refer to the half-life and you had
 lengthy exposure and acute exposure, and you explain
 what the differences are and the implications of that.
 R Can you apply those principles to these results?
 - A. Not really, and for the reasons that I suggested: because the half-life has a very narrow applicability,

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Т

S

Μ

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

А

В	Excess	E Lead Found in Drinking Water	Day 27	В
С		and how it will play out for an individual will depe	nd	С
		upon the other sources of exposure and how much past		
D		exposure an individual has had. The half-life of 30		D
Ε		days was actually identified by studies where adults	had	E
_		radioactively labelled lead injected into their bloo	d.	
F		A known amount was injected and then measurements we	re	F
G		made of the amount of radioactively labelled lead th	at	G
TT		came out in the urine and the faeces, through the bi	le.	
H		That's how it was arrived at, 30 days, and it's tied	to	Н
Ι		the life cycle of the erythrocyte, the red blood cel	1,	Ι
т		to which 95 per cent of the lead is bound.		т
J	Q.	Yes.		J
K	A.	So while that is true, 30 days is the half-life of		K
L		a labelled atom of lead, for the same reason that th	e	L
		study I mentioned in my report about children who ha	d	
Μ		a blood lead between 25 and 29, it took years for th	eir	Μ
Ν		blood lead to fall by half because of these other		Ν
_		toxicokinetic factors that go well beyond the half-l	ife	
0		of lead.		0
Р	Q.	With regard to the 10-month-old child referable to		Р
0		55 per cent reduction in percentage terms so we k	now	0
Q		the child lived for ten months when she had the firs	t	Q
R		blood test, no doubt a few more months older when sh	е	R
S		had the second blood test from your experience, t	hat	S
5		exposure to lead at the levels we have seen, is that		5
Т				Т
U				U

Transcript by DTI Corporation Asia, Limited

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V

A

Α	Annex	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		likely to have any long-term effect, do you think,	on C
Ð		the child?	
D	Α.	Well, you know, again, it's hard to say without kno	wing D
Е		more information. If this 10-month-old child was nu	irsed E
Б		for eight months and then had two months of exposur	e to
F		formula made up with water that contained lead, the	n F
G		that child probably didn't have much lead in the bo	dy, G
11		and so that's probably that would explain a big	drop
п		two months later, once the water lead was remediate	H.
Ι		So, you know, under that scenario, I wouldn't antic	ipate I
т		very serious impact on the child's life.	т
J	Q.	Again, I make the point, Prof Bellinger, just simpl	У.
К		because it seems to us that this is very much a sor	t of K
L		micro-analysis that one needs to do on a very much	L
		individual-by-individual basis, and therefore takin	a —
Μ		these broad percentages doesn't really assist the	Μ
Ν		analysis a great deal. Do you agree?	Ν
	A.	Well, I agree that things are always complicated.	This
0		is one way of organising the data. Certainly a mean	n can
Р		be misleading. I didn't calculate a median, you kno	P
0		where it's a 50 per cent value. I suspect that it w	vould
Q		not be that much different than 30 per cent.	Q
R		But yes, these are if you are talking about	R
S		individual management of a child, then an average i	s S
_		meaningless.	
Т			Т
U			T

v

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Α	Annex:	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	В
	Q.	Yes.		
C	Α.	But if you are trying to capture an overall impact,		С
D		I think it's reasonable, with appropriate caveats.		D
F	Q.	Okay. Can I then ask you please to go to what I hope	is	Б
L		called table B, the next chart. Whereas the previous		L
F		table just listed out all of those people who had bee	n	F
G		tested and re-tested, what we have done here,		G
		Prof Bellinger, is we have just focused on what I wou	ld	
Н		call abnormal, still abnormal, tests. So you will se	е,	Н
I		in the box on the left-hand side, we have simply agai	n	Ι
т		just replicated the abnormal results first test and		Ŧ
J		those that were still abnormal after the second test,	SO	J
К		you can see what we have done here.		K
L		Just to explain the blank at number 19 on the top		L
		graph and indeed the bottom graph: that's the		
Μ		two-year-old child that you referred to, when you wer	е	Μ
Ν		discussing the matter with Mr Khaw earlier, the one w	ho	N
0		started at 6.83, went up to 21.32 and then dropped ba	ck	0
0		a little bit on the third test, and then we have seen		0
Р		more recently dropped back a little bit further to 15	on	Р
0		the fourth test. We thought it appropriate just to t	ake	0
C .		that particular person, the child, out of the equation	n,	X
R		as it were.		R
S	A.	I agree.		S
_	Q.	You agree?		
Т				Т
U				U

v

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Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С	Α.	Yes.		С
D	Q.	okay. We see, if we're just comparing abnormal to abnormal, as it were, the average we get is just unde	er	D
Е		20 per cent. Do you see that?		Е
	Α.	Yes.		
F	Q.	What we see in the bottom graph is in fact, at items	12	F
G		and 16, some increases in blood lead levels. Had you	l	G
		spotted those?		
н	Α.	Yes.		Н
Ι	Q.	Any comment about those particular ones, the increas	es?	Ι
J	Α.	The only conclusion I would draw was that water was	not	T
0		a particularly important pathway for those individual	ls	J
К		and that there were other sources in the environment		K
L		that would have remained the same after the water		L
		pathway was interrupted. So they continued to be		
Μ		exposed to those sources and had slight increases in		Μ
N		blood lead because of it.		N
0	Q.	Okay. Then if you go to the next table, table C		
0		again, this is just referable to Kai Ching. And what	we	0
Р		now know, leaving aside the results that I think were	2	Р
0		only received, certainly by us, yesterday or the last	-	0
v		couple of days, that on Kai Ching there have been		V
R		59 individuals who have been tested and re-tested. A	and	R
S		what we have done here is, if you look at the box in		S
		yellow on the left-hand side, those above the line,	that	~
Т				Т
U				TI

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v

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V

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		is between references 388 and 324, are the ones we s	aw C
		on the previous table, the normal to abnormal, save	that
D		this time we have included, as it were, the rogue it	em. D
E	A.	321 per cent.	Ε
F	Q.	Yes. Those below the line are, as it were, abnormal	but
F.		now normal. So this depicts the whole range so far a	F
G		Kai Ching is concerned, and we see that the average	is G
н		22 per cent.	н
11		So, again, not miles off the 30 per cent exercise	н Ч
I		that we saw earlier.	Ι
J		But then over the page to a table I hope called I), Ј
		this is exactly the same as the previous table, but	this
K		time we have taken out the two-year-old child that w	e K
L		were discussing earlier.	L
	A.	Yes.	
Μ	Q.	One sees what a dramatic effect that can have on the	Μ
Ν		average percentage.	Ν
0	A.	Yes.	
0	Q.	Lastly, if I could ask you to go to table E. I hope	О you
Р		can read it, because it's a bit small at the top, bu	t P
0		again this is a breakdown of a number of statistics,	0
×		a number of details, that we have in relation to	Q
R		Kai Ching Estate. You see listed across the top the	R
S		names of the six blocks and then some totals at the	far S
		end. Okay?	
Т			Т
U			U
V		- 72 -	v

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С	Α.	(Nodded head).	С
	Q.	So taking the first one as an example, Hong Ching Ho	puse,
D		there were 165 blood lead level tests done, 149 of w	hich D
E		were normal and 16 which were abnormal. Do you see	E
Б		that?	_
F	Α.	Yes.	F
G	Q.	So that's now 9.7 per cent, for what that's worth.	G
н		If we then go down to the next items in the table	;,
		we can see how the normal and the abnormal break dow	n.
Ι		So there were 12 children of the 16 abnormal, 12	were I
J		children under 6, one between 6 and 8, none between	8 J
		and 18, and then three people between 18 and 65. Do	you
K		see that?	K
L	Α.	Yes.	L
	Q.	Can I then just ask you to look at Yuet Ching House,	
Μ		which is the one on the far right-hand side before y	ou M
Ν		get to the "Totals" column, and there, there were 14	7 N
0		sorry, there were 150 total tests; do you see that?	
0	Α.	Yes.	0
Р	Q.	Of which three were abnormal; do you see that?	Р
0	Α.	Yes.	0
C C	Q.	Underneath all the details regarding the blood lead	×
R		level tests, we have put some details of the water	R
S		sample tests. Do you see that?	S
_	Α.	I'm sorry, where are those?	
Т			Т
U			U
V			
v	Transc	- 73 - ript by DTI Corporation Asia, Limited	V

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	aission of Inquiry into a Lead Found in Drinking Water	Day 27	B
С	Q.	Under this first table, there's just a little table	with	C
_		two lines.		
D	Α.	Yes, I'm sorry.		D
Е	Q.	It says on the left-hand side, "Water samples taken'	'; do	E
F		you see that?		-
r	Α.	Yes.		F
G	Q.	We can see on the far right-hand side of that little	5	G
н		table that there were 93 water samples taken from th	е	TT
11		5,204 units that exist on Kai Ching, of which seven		н
Ι		showed excessive lead in water, out of 93.		I
J		However, if you look at Yuet Ching House, there w	vere	т
Ū		no samples that exceeded the criteria, the 10 microg	rams	J
K		per litre criteria that was being used. Do you see		K
L		that?		L
	A.	Yes.		
М	Q.	So, on one view, Yuet Ching, so far as water samples	was	Μ
Ν		concerned, was clear, or in the clear, and that was	the	N
0		same for another block, Yan Ching House as well?		
0	A.	Yes.		0
Р	Q.	Can I ask you this, Prof Bellinger, by way of		Р
0		introduction: if one assumes, for the sake of argume	nt,	0
Y		that the level or the degree of testing that was don	e on	Q
R		Yuet Ching House was valid and reliable, doesn't tha	t	R
S		raise a serious question as to whether or not any hi	gh	S
		lead levels in blood from the tests is related to th	е	~
Т				Т
U				U
V		- 74 -		v
		/ 1		-

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		water?		С
	A.	No.		U
D	Q.	Why do you say that?		D
Е	A.	Because there's nothing magic about 10 micrograms pe	r	E
_		litre, except that it's a standard. If it were 9 or	8	
F		or 7 or 6, there's still lead in the water and it st	ill	F
G		could be getting into people and be responsible for	some	G
u		fraction of the lead that's measured in the blood.	Just	
п		because the water lead level doesn't exceed 10 doesn	't	н
Ι		mean that the water lead isn't contributing at all t	0	Ι
J		an individual's exposure. It just means it doesn't		J
-		exceed the regulatory standard.		0
К	Q.	But the problem one issue about that, and this is	\$	K
L		a point that you fairly mention in your conclusion,	is	L
		that it's a contributing factor or may be a contribu	ting	
Μ		factor, but you simply can't apportion the contribut	ion,	Μ
Ν		can you?		N
0	A.	Well, you could if you actually did the study where	you	0
0		went in and measured all of the other potential		0
Р		contributing factors; it would be possible to come u	р	Р
0		with a per cent of exposure that you attribute to wa	ter.	0
C C		That's been done in many, many studies. That wasn't		¥
R		done in this case.		R
S		But the fact that we see the declines in blood le	ad	S
_		following the interruption of the water pathway, wha	t	
Т				Т
U				U
V		- 75 -		v

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	В
С		other explanation is there, other than that water was	s no	C
C		longer contributing to blood lead and the blood lead	is	C
D		coming down? Unless you assume that because of the		D
E		publicity, people were going out and learning about a	11	E
		the pathways of exposure to lead and taking steps to		
F		reduce their overall exposure.		F
G	Q.	Understood.		G
н		Just finally then, can I ask this. I know, and yo	ou	TT
11		have already said once, you are not a water expert, y	you	п
I		are a medical expert, and of course I accept that.		Ι
J		Would you expect there to be a correlation, however,		J
		between the water sampling on the one hand and the bl	ood	
K		lead levels on the other?		K
L	Α.	In general, yes, other things being equal. But if		L
		everybody had the same non-water contributions to the	eir	
M		blood lead, but water lead concentration varied among	1	М
Ν		people, yes, you would expect a very high correlation	1	N
0		and water lead would explain all of the variability i	n	0
		people's blood lead.		U
Р		But of course all other things are not equal, and	SO	Р
Q		water will contribute different percentages across		Q
		individuals of their total exposure to lead, which is	3	
R		why I would expect to see variability in the per cent		R
S		decline once water lead is eliminated.		S
т	MR	PENNICOTT: All right. Thank you very much, Professor	•	т
1				I
U				U

- v
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V

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	CHAIRMAN: Mr McCoy?	С
	Cross-examination by DR McCOY	-
D	DR McCOY: Prof Bellinger, is this your first trip to	D
Ε	Hong Kong?	E
Б	A. No. I am fortunate enough to be able to come once	_
r	a year, to help with grant reviews.	F
G	Q. Have you been here previously on formal scientific	G
н	reasons?	н
	A. The once-a-year trip is to review grant proposals	11
Ι	submitted by Hong Kong investigators for funding.	Ι
J	Q. In biology?	J
	A. Biology and medicine, yes.	
К	Q. I noticed in your report that you refer that there are,	K
L	as far back as April 2012, some 28,900 peer review	L
м	publications in relation to excessive lead.	м
141	A. That's right.	M
Ν	Q. It's obviously gone up since then, and not just because	Ν
0	of this incident. But what proportion of those	0
	publications do you think pertain to Hong Kong?	0
Р	A. Probably very few.	Р
Q	Q. Have you ever used Google Scholar?	Q
D	A. Yes.	
ĸ	Q. If you put in "lead" and "Hong Kong", can you estimate	R
S	how many articles might come up, academic scientific	S
Т	papers written about lead poisoning in Hong Kong?	т
-		1
U		U
V	- 77 -	V

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С	Α.	I could hazard a guess but it's just a guess.	С
	Q.	If I tell you that there have actually been publishe	d
D		theses in Hong Kong written on lead poisoning, that	D
E		would not surprise you?	Ε
F	Α.	No.	F
F	Q.	I am going to ask you in due course to have a look a	t
G		one of those published theses, and it examines the ma	any G
н		causes and effects of lead poisoning in Hong Kong.	ч
		In fact, I could ask even now that it be put up o	n
I		the screen, with permission. It's G3, item 88.	I
J		This is a thesis in the faculty of science at	I
-		Hong Kong University. It's slightly dated it's Ap	oril
K		1987, and I noted that it doesn't actually refer to a	any K
L		of your works, but other Hong Kong publications which	n L
		I will take you to do and it's written in the	
Μ		department of chemistry at Hong Kong University.	Μ
Ν		You can see the abstract. On (i) if you roll	Ν
0		over one or two pages, please, past the	
0		acknowledgments keep going, please.	0
Р	Α.	Yes.	Р
0	Q.	The next one. Exactly.	0
×		The abstract, of course, is the summary of the	Q.
R		academic conclusions. I won't read them all out, but	R
S		the author shows that lead is detrimental, especially	y to s
		children, and he identifies some reasons why that is	
Τ			Т
U			U
v		- 78 -	V

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Commis Excess I	ssion of Inquiry into Lead Found in Drinking Water	Day 27	В
С		particularly so, not different from what you have sai	ld	С
D		to the Commission of Inquiry.		D
D		He points out that petroleum so this was 1987		D
Е		gasoline perhaps in your language, was a major		E
F		contributor, and also that there was lead in consumer	2	F
ſ		products available in Hong Kong.		F.
G		Consumer products include, plainly, food and item	S	G
п		like paint, for example.		
п	Α.	(Nodded head).		Н
Ι	Q.	The methodology of the thesis was to actually examine	e	Ι
Ţ		the lead content inside 6,065 Hong Kong schoolchildre	en.	
J		You will see that in the second paragraph, commencing	3,	J
К		"In this survey, the massive screening programmes	. "	K
L		It was a study of, as I said, of over 6,000 child	ren	L
		in Hong Kong, aged from 6 to 17.		
Μ		If we come down, please, to the next paragraph:		Μ
Ν		"In the scheme III screening, 700 primary		Ν
		schoolchildren aged from 6 to 16 years old were studi	ied.	
0		The mean blood lead level of them was found to be	e 14	0
Р		[plus or minus 5.1 micrograms]. The spread of [blood	l	Р
0		lead level] was from 3.7 to 45 [micrograms]. The blo	od	0
Q		lead levels of Hong Kong children are similar to or		Q
R		lower than those in large cities. They [are] found t	.0	R
S		conform to the EEC guidelines on the criteria of undu	ıe	S
		lead absorption."		
Т				Т
U				U

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		Now, the EEC guidelines that the author is referr	al C
D		to, are you able to comment as to whether that	D
		conclusion is sound; that, for example, levels like	2
E	7	45 micrograms conform to the EEC guidelines in 1987?	Ε
F	Α.	Well, I'm not sure actually what the author means by	F
		saying they conform, whether that is intended to mean	n
G		that all levels were below whatever criteria the EEC	was G
Н		using at that time. I personally don't recall what t	the H
Ŧ		EEC guidelines were in 1987.	
1	Q.	Sorry, I wasn't trying to make it a test of absolute	I
J		memory. But we will read on and perhaps it will beco	ome J
V		clear.	•
ĸ		The conclusions are:	K
L		"[There is an] association of some personal, fami	ly, L
м		behavioural and environmental factors with blood lead	d M
IVI		levels of children [when] analysed. It was found that	it M
Ν		sex, mouthing habit, parents' occupation, floor level	l of N
0		residence as well as the time spent on street(s) do l	nave
0		positive association with [lead] levels in children.	
Р		Would you agree with that as a generality,	Р
Q		Prof Bellinger?	0
-	Α.	Certainly there are studies that indicate that all o	f
R		those, under certain circumstances, can contribute to	R R
S		children's lead exposure, yes.	S
	Q.	Yes. Then we read on:	
Т			Т
U			U

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B "With the use of controlled Pearson Correlation С С Analysis, it was discovered that the more direct D D personal factors, namely the occupation of parents and mouthing habits, are more important than the Е Е environmental factors such as floor level of residence F F and the time spent on the street." Then there was a special reference in the thesis to G G the risk of fishermen's children, a study at Aberdeen, Н Η one of the ports on Hong Kong Island, where the children Ι were often literally handling lead weights and there was Ι an ingestion through the body. J J Would that surprise you that that generated K K an obvious risk of potential excess lead? A. No. That's been reported numerous times. L L Q. I am obviously not going to go through all of this Μ Μ thesis, but there are some matters that I would like to raise with you for your comment which may be of Ν Ν assistance to the Commission of Inquiry. 0 0 If we come firstly to page 105, please. This is Р really near the end of the thesis. You find Р a conclusion -- it's chapter 4, page 105 -- about Q Q 30 per cent of the way down the page, you see the words, R R "Australia et cetera", full stop. Then this: "Also the increase in use of copper pipings in S S domestic water supply system should be carefully Т Т

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V

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U

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		monitored because the leaching of lead from the sold	lers	С
D		has been reported to be the source of undue lead absorption."		D
F		That's a well documented empirical fact; I assume	e	Б
Ľ		you would agree with that?		E
F	Α.	Yes, if the pipes have been connected by solder that	2	F
G		contains lead.		G
	Q.	Yes, exactly.		
н		The author in particular identifies a large numbe	er	Н
I		of environmental factors that can contribute to lead	l .	Ι
т		Now, in America, what is the current greatest		Ŧ
J		contributor of lead in the environment?		J
К	A.	It's the lead in dust, house dust.		K
L	Q.	The lead in house dust?		L
	A.	That's usually the strongest predictor of a child's		
Μ		blood lead level.		Μ
Ν	Q.	And it seems naive but how does the house dust get t	20	N
0		contain lead?		0
0	A.	Well, in numerous ways, and that's why it's		0
Р		a significant predictor. It could be lead-based pai	nt	Р
0		that is chipping and crumbling into fine particles t	hat	0
τ.		contribute to the dust. It could be people tracking	in	Y
R		soil from outside that may contain lead, because of		R
S		atmospheric deposition or the deterioration of exter	ior	S
_		lead-based paint that gets into the soil. It could	be	
Т				Т
U				U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	lead blowing in through the windows; back in the days	С
	when lead was added to gasoline, that was a major, major	
D	problem. It also could be in the air because of the	D
E	child's house being proximate to a point source such as	Е
Б	an industry that uses lead. It could be because people	
F	are carrying out activities in the home that involve	F,
G	lead, and little particles get into the dust.	G
н	So it integrates lead from many different sources,	п
	and we think that's why it's usually the best predictor.	11
I	DR McCOY: Yes.	Ι
J	Is that a convenient time?	J
	CHAIRMAN: Let's take the lunch break first. We will resume	
K	at 2.30. Thank you.	K
L	(1.00 pm)	L
	(The luncheon adjournment)	
Μ	(2.35 pm)	М
Ν	CHAIRMAN: Yes, Mr McCoy.	Ν
0	DR McCOY: Good afternoon, Prof Bellinger.	0
U	A. Good afternoon.	0
Р	Q. Just before we broke, I had asked you to confirm what is	Р
0	the number one source in America of lead in the	0
	environment, in the free environment, and you indicated	×
R	that it was basically household dust, or dust?	R
S	A. Correct.	S
	Q. That is simply a product of other processes, as opposed	
Т		Т
U		U
V	- 83 -	V

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С		to it being naturally occurring, I assume?		С
	A.	Yes. It's not a source in itself. It's a pathway.		
D	Q.	That's right.		D
Е		I see from your very lengthy bibliography that yo	u	E
Б		have written widely, and you have studied, for example	le,	_
r		the problem of excess lead with children in India		F
G	A.	Yes.		G
Н	Q.	Bangladesh, Mexico, Palestine, to name just a few	of	Н
I		Have you ever yourself studied the incidence of		I
		excessive lead in any part of Asia?		
J	Α.	Well, Bangladesh and India.		J
K	Q.	They may be for FIFA.		K
L	Α.	What?		L
_	Q.	They may be in terms of football classification, but	say	L
Μ		east of India, have you ever studied any of those As	ian	Μ
Ν		regions, including Hong Kong, China, Japan, Malaysia	?	Ν
0	A.	No, I haven't.		
0	Q.	You haven't? The reason I ask that question is whet	her	0
Р		there are any well-understood regional differences		Р
0		throughout the world in terms of ordinary background		0
C C		lead standards in daily life.		×
R	A.	By "lead standards" do you mean regulatory exposure		R
S		standards?		S
_	Q.	Yes, first of all regulatory, and then second, as		
Т				Т
U				U
v	Transc	- 84 - cript by DTI Corporation Asia, Limited		V

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α	١
В	Comm Excess	aission of Inquiry into a Lead Found in Drinking Water	Day 27 E	3
С		a matter of fact, the incidence of lead.	(2
	A.	Well, I'm not familiar with the lead standards used	in	_
D		each country. I know many do refer to the WHO standa	.rd D)
E		of 5.	F	£
F		In terms of background incidence of lead exposure	,	_
F		yes, there are very large differences, mostly between	۲ ۲	7
G		developed and developing countries. The WHO, in	C	ŗ
н		an analysis they published in 2003, estimated that al	oout	I
		10 per cent of the world's children have a blood lead	1	1
Ι		level greater than 20 micrograms per decilitre, and	Ι	
J		99 per cent of them reside in developing countries.	So J	ſ
		the success we have seen in reducing population lead		
К		exposures in developed countries over the last 30 years	irs K	ζ
L		have not seen the same benefit in developing countrie	es. I	
		So they do have more continue to have more of		_
M		a problem with lead.	Ν	Л
Ν	Q.	Lead does not degrade as such, being an element,	N	V
0		does it?		`
0	A.	That's correct.	· · · · ·	,
Р	Q.	And you can't transmute it into anything else, unles	s P)
Q		you believe in alchemy, I suppose?	()
	A.	That's correct.		-
R	Q.	So once the lead has entered the total environment,	it R	ł
S		remains, unless dispersed by air or water?	S	5
T	A.	That's correct.	_	-
1			1	Ľ
U			τ	J
v		85	Ţ	V
	Transc	cript by DTI Corporation Asia, Limited	·	

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	A	4
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	B
С	Q.	So it would be important in understanding the backgro	ound (С
		levels of lead, in any urban environment, to understa	and	
D		the history of that land before its current usage?	I	D
Ε	Α.	That can be important, yes.	I	E
_	Q.	You see, I will show you in due course that there are	Э	
F		well-documented peer-reviewed academic studies in	I	F
G		Hong Kong that because certain parts of Hong Kong had	1 (G
		been heavily industrialised in the past, the lead		
п		effectively has sunk into the land and remains. Does	ł	H
I		that seem a logical proposition, if the assumption is	3 I	[
т		correct about the prior industrialisation?	1	т
J	Α.	Yes. There have been similar studies in Massachusett	J.S,	I
К		where I live, actually, where people have looked at	I	K
L		historical land use and identified higher blood lead	I	L
		levels among children living in regions which former	-У	
Μ		had industries that used lead.	Γ	M
Ν		So, yes, that's a well-described phenomenon.	ſ	N
0	Q.	So if you are living in an area that has previously b	oeen	•
0		relatively heavily industrialised, is there a likelih	nood	J
Р		that the dust in that area will be significantly high	ier I	P
0		in lead content than otherwise?		0
×	Α.	I would say I would presume yes. It would remain	to	ł
R		be confirmed, but it's a very reasonable hypothesis.	It I	R
S		would add to the background risk and perhaps raise th	ıe	5
		background blood lead level against which other source	ces	
Т]	Г
U			τ	U
V		- 86 -	•	V

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	В
С		would add.		С
	Q.	And the human ingests lead by, what, touch, inhalat	ion,	
D		consumption; every method possible?		D
E	Α.	Except for skin absorption, yes. Inorganic lead is	not	E
		absorbed on the skin. But ingestion and inhalation	are	
F		the main routes of exposure.		F
G	Q.	Can I ask you to come now to page 1 of the thesis the	nat	G
н		I have partly shown you this morning. Page 1. I see	2	н
n		you have a hard copy now.		п
Ι		75 per cent of the way down the page, it says:		Ι
J		"There are many routes by which lead can enter th	ne	J
		air, water and soil as a result of the wide use of l	ead	_
K		and its compounds."		K
L		I won't read all of this out, but in particular t	the	L
		combustion of coal is identified as a source of lead	l	
Μ		entering the environment.		Μ
Ν		Are you familiar with that as a contributing fact	tor	Ν
0		to environmental lead?		0
U	Α.	No, actually. That's a new one. Mercury I know is		0
Р		a problem with coal combustion, but it's new to me t	hat	Р
0		lead may also be released.		0
c .	Q.	Again if we can just move down to the last two lines	s on	x
R		that page:		R
S		"The lead level in the food chain (plant, fish,		S
		vegetable, poultry et cetera) is also increased by		
Т				Т
U				U
v		- 87 -		V

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С		several orders of magnitude."		С
D		"The daily intake of lead of the average person	in	D
Е		[the United Kingdom]" and (2) is the scientific		Е
		reference for it "and USA (3)" ditto "is		
F		estimated to be 18 [micrograms per day and 175		F
G		micrograms per day] respectively."		G
		Are you familiar with those figures?		
Н	A.	Yes. These are quite old numbers, and the estimates	s for	Н
Ι		today are much, much less, in the order of 20 or		I
J		25 micrograms per day, because of all the reductions	; in	J
		the last 20 to 30 years and dispersion of lead into	the	
K		environment.		K
L	Q.	Then if you come down, please, on page 4 to the fir	st	L
		full paragraph, and the last two sentences:		
NI		"Lead has a very slow turnover rate in the body.		М
Ν		What dictates that turnover rate?		N
0	A.	Well, I assume that means the excretion of lead from	m the	0
0		body. I had earlier talked about the different pool	s in	U
Р		the body in which lead resides. Each pool has		Р
0		a different turnover rate, so you can't assign one		0
C C		single number. So lead that's in the type of bone		¥
R		that's hard and compact, like the tibia, has a half-	-life	R
S		of maybe decades, three decades, whereas the lead in	1	S
Т		soft, spongy bone, the trabecular bone that is in		
I				Т
U				U

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Α	Annex	Realtime English Transcription based on floor / Simultaneous Interpretation	1	A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		contact with circulation has a half-life of years to)	С
		a decade, and in soft tissues will be somewhat less,	and	
D		as I mentioned, in blood it's 30 days.	1	D
E		Certainly in bone there's a very slow turnover ra	ate.]	E
		It's not so slow in the blood.		
F.	Q.	Halfway down that page, there's a historical referen	nce	F
G		to lead poisoning from Roman times. It's probably	(G
и		plumbum, being the chemical name for lead, and plumb	ber	
п		going together.	1	H
Ι	Α.	Exactly.	1	I
J	Q.	Plumbers carry lead.		J
	Α.	Right.		
K	Q.	If you turn the page, please, to page 6, you see the	e I	K
L		first reported environmental exposure from lead was	in J	L
		Queensland in Australia in 1892. That was paint.		
Μ		Then an issue the chairman raised with you this	I	M
Ν		morning, the issue about young children. The author	I	N
0		here states:		0
0		"Young children are widely held to be more		U
Р		susceptible to lead poisoning in the environment that	in J	Р
Q		adults for the following reasons.	(0
		1. Young children have a higher metabolic rate t	chan	-
R		adults, so that their intake of food and drink, and]	R
S		hence lead, is greater relative to their body weight	<u>;</u>	S
T.		than that of an adult."		
Т			r	Г
U			I	U

v

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Α	Annex:	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С	_	Do you agree with that?		С
D	A. Q.	Yes. "2. Young children may absorb and retain more lead	from	D
E		the gut than adults."		E
_	Α.	Yes.		
F	Q.	Thank you.		F
G		"3. Young children may have a greater biological	ly	G
ч		active lead burden than adults."		TT
п		Do you agree with that?		н
Ι	Α.	I am not exactly sure what the author means. If he		Ι
J		means that a greater or a lesser fraction of lead is	in	J
-		the bone in children than in adults, so it's more		U
K		available to interact with cellular targets, then ye	s,	K
L		I would say I agree with that interpretation of the		L
		phrase.		
Μ	Q.	"4. The opportunity for oral intake of significant		Μ
Ν		amounts of lead from non-food sources is higher in y	oung	Ν
0		children than in adults due to mouthing habits."		~
0		I think that's pica, the obscure word P-I-C-A, th	le	0
Р		non-nutritive intake by children, eating things that		Р
0		they shouldn't be eating.		0
τ.	Α.	Right, although even children in whom the behaviour	is	Y
R		not as extreme to warrant the application of the ter	m	R
S		pica still typically, developing children explore		S
		their environment with their hands and their mouth,		
Т				Т
U				U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation			A
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		so		С
	Q.	And the fifth one:		
D		"Deficiencies in nutritional status may also be o	f	D
Ε		greater consequence in the enhancement of absorption	of	E
		lead in young children."		
F		Do you agree with that?		F
G	Α.	Yes. Children are more likely than adults to be		G
н		deficient in iron and calcium, and those promote		п
п		absorption of lead in the gut.		п
Ι	Q.	So the conclusion is children are more susceptible t	0	Ι
J		lead poisoning. But can I now ask you: are they more	ž	J
		likely, because of the nature and size of their bone:	s,	U
K		to excrete or eliminate that ingested lead than		K
L		a comparator adult?		L
	A.	I am not familiar with evidence that that's the case	,	
Μ		that the excretion rate is not different from adults		Μ
Ν	Q.	There's no difference at all?		N
0	A.	Not that I am aware of.		0
0	Q.	Then perhaps if I could ask you to come across to		0
Р		page 8, and I am certainly not going to go through a	11	Р
0		of this, but there are just a few highlights. If you	1	0
τ.		come to page 8, please, 10 per cent down the page:		Y
R		"However the public awareness of this problem"		R
S		that's the problem of excessive lead "has increase	ed	S
		since early 1980s."		
Т				Т
U				U
V		- 91 -		v

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		And several factors are set out. I won't read al	l c
		those factors out, but we have at number 4 a referen	ce
D		to the Hong Kong Consumer Council, a prestigious bod	у D
Ε		that by its very name looks after consumer interests	· E
F		It was reported by the Hong Kong Consumer Council th	at
r		the lead in petroleum in 1980 was at 0.84 grams per	r
G		litre, six times more than in the United States. Th	is G
н		was staged down to 0.15 grams in January 1987.	н
		Now, the lead from the petroleum, it enters the	п
Ι		environment. It stays, I think we agree, unless it	is I
Л		literally blown away out of Hong Kong.	Т
	A.	Correct.	9
K	Q.	So, in a small, dense, compact society like Hong Kor	ng, K
L		when lead in petroleum was available, the probabilit	y is L
		it remains adjacent to where the vehicle burnt the l	ead,
Μ		the petrol?	Μ
Ν	A.	Yes, it is emitted in the area proximal to the roadv	ays. N
-		So the farther you go from the roadway, the	
0		concentration of lead declines.	0
Р	Q.	If you come over to page 10, please, at number 8:	Р
0		"High level of lead at kerbside soil was reported	l
Q		Mean concentration of lead was 2,974 [plus or minus]	Q 408
R		[micrograms] and the range was from 271 to 19,073	R
S		[micrograms]."	S
		Extreme readings.	5
Т			Т
U			U
V		- 92 -	V

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	В
С	Α.	It's quite high.		C
	Q.	Then at 9:		
D		"Approximately 7.5 per cent of 1,135 adult blood		D
Е		lead levels were found to exceed generally accepted		Е
		reference value of 35 [micrograms] in a survey carri	ed	
F		out in Hong Kong."		F
G		And the reference is to 60 in the bibliography.		G
п		"The findings suggested that the group studied di	d	
п		not conform to the EEC guidelines."		Н
Ι		Now, with the revised limits, they would be well		Ι
т		over, would they not?		т
U	Α.	Correct.		J
К	Q.	Then 10 and I would like you just to go to page 1	.13	K
L		briefly. At item 61, because D Barltrop and I Thorn	ton	L
		in Hong Kong in 1982 wrote a book, "Lead Pollution i	n	
Μ		Hong Kong Report to the Special Committee on Air		Μ
Ν		Pollution", so that's the source material that the		Ν
0		author is referring to.		
0		If you come back then to page 10, at paragraph or	2	0
Р		item 10:		Р
0		"A report on 'Lead pollution in Hong Kong' prepar	red	0
Q		by two experts from UK was published. It stated that	t	Q
R		a comprehensive evaluation of lead in the environmen	t	R
S		and its impact on the population were required."		S
		Was there comparable efforts, say, in the		~
Т				Т
U				U
V		- 93 -		v

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	B
С		United States at that time?		С
	Α.	Comparable efforts to?		
D	Q.	To publish a comprehensive evaluation of lead in the		D
E		environment.		E
Б	Α.	Yes.		
F	Q.	And in the United Kingdom?		F
G	Α.	I am not as familiar with		G
н	Q.	Have you seen what these two experts in 1982 recomme	nded	н
		to the government should happen? Have you seen the		
Ι		outcome?		Ι
J	Α.	No, I haven't.		J
	Q.	Nor have I.		
K		Now, this thesis involves, as I said, the screeni	ng	K
L		of over 6,000 Hong Kong children. If you turn over,	at	L
м		page 12 I won't spend time on this for the		м
IVI		non-chemists but at page 12 you find the interfere	ence	M
Ν		with the biosynthesis of the haem, the haemoglobin, a	and	N
0		that's set out in diagrammatic form.		0
		The author, at page 11, 80 per cent down, is		Ŭ
Р		identifying zinc protoporphyrin. You would be famili	ar	Р
Q		with that as a metabolite.		Q
_	Α.	It's not really a metabolite but I am familiar with	it.	
R	Q.	So the author of this thesis, he examined ZPP, as I	will	R
S		more conveniently call it. You see the chemistry at	13.	S
т		We can go past that.		лг.
1				1
U				U
V		_ 94 _		v
	Transc	ript by DTI Corporation Asia, Limited		•

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	R
-				D
С		Then at page 16 you see what was achieved. He wen	t	С
D		to government or subsidised Hong Kong schools. The		Л
D		children were all of Chinese race and aged from 6 to	17,	D
Е		and the distribution of schools covered the three maj	or	E
Г		areas of Hong Kong: the Island, which we are now on;		Б
Г		Kowloon Peninsula; and New Territories together with	the	ľ
G		Outlying Islands. Are you generally familiar with the	e	G
u		geography?		
п	A.	Generally, yes.		н
I	Q.	We can avoid now much of this, but we come to page 20).	Ι
т		The blood sample from each of these children was take	n	т
J		from the finger, from a capillary. Now, this morning	,	J
K		Mr Pennicott, senior counsel, did ask you a question		K
L		directed at whether there was a margin of error betwe	en	L
		capillary blood and venous blood for the purposes of		
Μ		determination of excessive lead, and you, would I be		Μ
N		right, were hesitant in accepting that there was		N
_		a difference, or is that unfair?		
0	A.	No, no. There should not be a difference if adequate		0
Р		cleaning protocol is done. The problem with capillar	У	Р
0		samples is that there's sometimes lead dust on the		0
Q		finger, and when you lance and get a drop of blood, i	t	Q
R		takes up some of that lead on the finger, if you have	n't	R
S		cleaned it properly, and so it can give you a false h	igh	S
		reading.		
Т				Т
U				U

V

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Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		But if you follow accepted practices for the	C
		cleaning of the finger before you stick, the capilla	ry
D		blood lead level should be very close to the venous	D
E		blood lead level.	E
_	Q.	If I suggest to you that a recent peer-reviewed stud	У
F		actually shows that even with proper cleaning, there	is F
G		a 10 per cent false positive risk with capillary tak	ing G
н		of blood for the testing of lead, would that surprise	e
п		you?	n
I	Α.	Well, what exactly is is it 10 per cent	Ι
J	Q.	I can produce the paper.	I
	Α.	Is it a 10 per cent difference in the blood lead lev	rel
K		or a 10 per cent difference in	K
L	Q.	In false positives.	L
	Α.	That doesn't mean anything to me.	
Μ	Q.	All right.	М
Ν	Α.	I would have to see the paper.	Ν
0	Q.	I am happy to do that and I will do it soon.	0
U	Α.	But I have seen other papers where the difference	0
Р		between the venous and the capillary levels were example.	ctly P
Q		the same. So I don't know how this study would diffe	er O
		from those.	×
R	Q.	Now, could we then please move way through much of t	his R
S		and come to page 54. The author notes, 30 per cent of	lown S
-		the page, that ZPP, the metabolite, as I'm calling i	t,
Т			Т
U			U
V		- 96 -	v

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation		
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		"is firmly bound with haem and persists there for the	e C
		life span of the red blood cell (about 120 days)."	
D		You agree with that?	D
E	Α.	Yes.	E
-	Q.	So that's relevant to a 30-day cycle in your 25 per	cent
F		equation, the cycle of re-testing the blood every	F
G		30 days?	G
н	A.	Yes.	
п	Q.	If we come much further across towards the end ju	H st
Ι		give me a moment, please the author of this thesis	5 I
Л		concluded that there is a statistical correlation	I
-		between the lead levels in children and the occupation	on
K		of their parents. Is that something you have seen in	K
L		any other study?	L
	Α.	Yes. It's quite well described that parents involved	d in
Μ		occupations involving lead can bring it home and thos	se M
Ν		children will have higher blood lead levels than	Ν
0		children of parents who don't work with lead.	
0	Q.	May I ask you to please leave that document, and I w	ould
Р		like to look at a study that refers to one of your ov	vn P
0		works, with appropriate approval, I should add.	0
×.		Could you come please to item G3/90, please. That	t's
R		right, "Home sweet home? A case study of household d	lust R
S		contamination in Hong Kong", from the University of	S
		Cincinnatti and the Chinese University of Hong Kong :	in
Т			Т
U			U
V		- 97 -	V

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	March 2000.	С
	If we just look at the abstract:	
D	"It is well recognised that many heavy metals have	D
Е	chronic effects particularly to young children"	Ε
Б	I will leave words out in the interests of time.	
ſ	" house dust This research aims at	F
G	quantifying the concentrations of heavy metals within	G
н	the home environment in Hong Kong and their	п
п	relationships with environmental factors. The results	п
Ι	of this study seem to suggest that traffic and the age	Ι
J	of the building and neighbourhood are more important	I
	factors than the types of industry and socioeconomic	U
К	status in affecting household dust contamination. The	K
L	metal burdens in Kwun Tong"	L
	Now, that's a particular district in Kowloon.	
Μ	" an old area with heavy traffic, are	Μ
Ν	significantly higher than other districts."	Ν
0	If we just move past that and come to a second	
0	document, and this is the next one, G3/92, called, "The	0
Р	study of metal contamination in urban soils of	Р
0	Hong Kong". This is written between Imperial College	0
×	London, the Department of Civil and Structural	Q
R	Engineering at Hong Kong Polytechnic University, and the	R
S	Department of Land Surveying and Geo-informatics at the	S
	Hong Kong Polytechnic University, in September 2003.	~
Т		Т
U		U

V

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A	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	If we again look at the abstract, it refers to the	С
	highly urbanised Kowloon area:	
D	"A significant spatial relationship was found for	D
Е	[nickel, copper, lead and zinc] in the soils using	Ε
	a GIS-based analysis, suggesting that these metal	
F	contaminants in the soils of Kowloon had common	F
G	sources. Several hot-spot areas of metal contamination	G
п	were identified from the composite metal geochemical	
11	map, mainly in the old industrial and residential	H
I	areas The [lead] isotope composition of the	Ι
J	contaminated soils showed clear anthropogenic origins."	т
0	I will try to deconstruct some of that with you very	J
K	briefly, and I won't spend long on this, I promise you.	К
L	If you come to the second page of this article, at	L
	page 114, five or six lines down first of all, you	
М	can see your own name there, Prof Bellinger, and	Μ
Ν	immediately after that:	Ν
0	"The heavy metal concentrations of soils have been	
0	widely studied in Hong Kong"	0
Р	And here a list of Hong Kong academics, from 1978,	Р
0	1982, 1987, 1996, 1997 and 2001, who have all studied	0
×.	them.	Y
R	According to a survey conducted in 1981 by Lau and	R
S	Wong \ldots in which the heavy metals in soils of different	S
	sectors (recreational, commercial, industrial and minor	
Т		Τ
U		U

V

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Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B agricultural) were studied, the highest [cadmium] С С concentration in Hong Kong was found in a recreational D D area (Chung Pui), where 54 [micrograms per kilo of cadmium] was found in roadside soils. The highest Е Е copper concentration ... was found in an industrial area F F (Aberdeen). The highest [lead] and [zinc] concentrations in Hong Kong ... were found in G G an agricultural area (Man Uk Pin)." Η Η That's up near the border, Sha Tau Kok area, for Ι Ι those more familiar. Then please coming over to the conclusion, you'll J J see at page 116 the results and discussion, and at K K page 116, the right-hand column, about three lines down into the last paragraph: L L "It has been shown that the concentration of [lead] Μ Μ in Hong Kong is related to Hong Kong's high traffic volumes ... Although [lead] has been banned in petrol Ν Ν for a number of years, the concentration of [lead] in 0 0 urban soils still reflects the significant degree of Р historical [lead] contamination nation and the long Р half-life of [lead] in soils." Q Q That would be consistent with your own experience? R R Α. Yes. Q. If we turn over, at 119, the left column, halfway down: S S "Several hot-spots [of very high levels] are Т Т U U

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V

Α Annex: Realtime English Transcription based on floor / Simultaneous Interpretation А Commission of Inquiry into Excess Lead Found in Drinking Water Day 27 B B identified from the composite geochemical map, С С including" -- and these will make more sense to others D D in the room like than yourself -- "Lai Keng, Cheung Sha Wan, Shek Kip Mei, Kowloon City, Е Е Ngau Chi Wan, To Kwa Wan, Ho Man Tin. These are mainly F F old industrial and residential areas in Kowloon. Therefore, the history of an urban site can contribute G G to heavy metals in soils." Η Η Page 119, in the right-hand column, it is pointed Ι out that "soils in the hot-spot areas were generally Ι about 2.5 times more contaminated than the rest of the J J urban area". There's even a reference to the fact that K K "the hot-spot areas were generally found at the northeast or east side of a major road", because of the L L diffusion of pollutants by the prevailing wind in Μ Μ Hong Kong, which is from the southwest. One last point. At page 120, the left column, five Ν Ν lines from the bottom: 0 0 "3.3.3. The effects of buildings and landscapes on Р heavy metal dispersion. Р ... It has been shown that high-rise buildings can Q Q obstruct air movements, and prevent the particulates in R R air from dissipating." Have you seen this conclusion reached before, S S Prof Bellinger? Т Т U U V V

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water Day	r 27 B
С	Α.	No, I haven't.	С
	Q.	That's a study by Taiwanese academics, under their own	C C
D		regime.	D
Е		If we turn over, the effect of it is that the shape,	Ε
_		height, density and configuration of buildings disallows	
F		the lead particulates to ever leave the area where they	F
G		originally had been, so they simply stay and remain.	G
п		Does that appear at first blush to be a logical	
11		conclusion? In a sense, they are trapped where they got	н
Ι		to?	Ι
J	A.	Oh, it does yes. If something prevents the	I
-		particulates from becoming airborne and carried by the	Ŭ
K		prevailing winds, then it's likely to continue to reside	K
L		in the soils.	L
	Q.	So if we have a combination of what had been in the past	2
Μ		a heavily or medium heavy industrialised areas, and they	, M
Ν		have now been built upon in a dense way, high buildings,	Ν
0		the logical inference is that what was originally in the	
0		soil and has now become dust will therefore remain in	0
Р		that area; it can't escape?	Р
0	A.	That's correct.	0
τ.	Q.	There's more I won't go through them all, but there	×
R		are more to the effect other studies. In fact, there	R
S		are a large number of Hong Kong studies on these issues.	S
		Now, Prof Bellinger, perhaps I could bring these	
Т			Т
U			U
V		- 102 -	V

	-
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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into Is Lead Found in Drinking Water	Day 27 B
С		points, as it were, to a head. At page 49 of your	С
D		expert report, the bottom right-hand corner of page	ō, D
D		also marked with a large 49. The first full paragrap	ph: D
E		"Lead is often characterised as a 'multimedia'	Ε
F		pollutant because of the diverse ways in which human	F
-		exposure can occur. The major classes of	r
G		sources/pathways of exposure to inorganic lead (the	form G
н		of lead in solder) include food, air, soil, paint, an	nd H
		water, although exposure can also occur as a result of	of
Ι		many other activities"	Ι
J		And you make a reference to herbal medicine; here	, J
		of course, it would be Chinese medicine.	
K		Now, lead in food, and I see you have studied, fo	r K
L		example, the effect of lead in turmeric, I think was	it L
		in Bangladesh or India. It's a root vegetable. Do r	oot
Μ		vegetables take in the lead?	М
Ν	A.	To a certain extent, yes, and leafy greens will	Ν
0		accumulate lead that's in the air or in soil and the	a 🔒
0		becomes entrained as air as soil is worked. Then als	30
Р		in the past there have been some lead-based pesticide	es P
0		used in agriculture lead arsenic, a great combina	cion 0
-		of lead and arsenic.	×
R		Then lead is also introduced along the way as foo	d R
S		is processed and packaged. Lead-soldered cans used t	:o s
T		be a big problem.	
Т			Т
U			U

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v

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation	Α	
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B	;
С		So it's possible at a number of points in the	С	•
		production system for lead to get into food.		
D	Q.	What about seafood?	D)
E	A.	To my knowledge, lead was not a major problem in	E	2
_		seafood, although I can imagine, if there are local		
F		hot-spots near discharge points from industry, seafor	od, F	1
G		especially shell fish, that are feeding in that area	on G	Ţ
ц		the bottom where lead may settle into the sediments,		T
п		that may be a problem locally. I am not familiar wit	.h	I
Ι		it being a problem globally.	Ι	
J	Q.	Now, the next one you have is air. Hong Kong is	т	
0		positioned adjacent or part of the Pearl River Delta	т Т	
K		which is on any view reasonably heavily industrialise	ed. K	Σ.
L		What is the effect of air pollution coming from those	e L	_
		sources? It transports lead or it may do so?		
Μ	A.	Well, it depends on what those transports burn, if t	hey N	1
Ν		are still using leaded petrol, which I don't think the	ney N	1
0		are. Then, if lead is used in any of the industrial		_
0		processes that go on in those locales, and it's not	0)
Р		within my area of expertise, I don't know I don't	Р	,
0		know if there have been recent measurements of air-le	ead	•
¥.		concentrations in Hong Kong.	Q	!
R	Q.	So you've identified for the Commission there are	R	1
S		a number of sources of lead which can have contribute	ed S	
		to the aggregate total of lead inside an individual's	5	
Т			Т	'
U			U	J
V		- 104 -	v	7

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		body?	С
	A.	That's correct.	
D	Q.	And on the face of it, the lead in any solder that h	as D
Е		been used is a potential source of some of that lead?	e E
	A.	Presumably, yes.	
F	Q.	The outcomes that Mr Pennicott showed you this morni	ng F
G		and the variations and the differences, is that like	-У G
		to be attributable to any particular factor in any	
Н		particular individual? Is there any predetermined	Н
Ι		allocation that you can say is due to lead solder?	I
т	A.	No. I presume you are referring to the per cent dec	ine
J		in blood lead observed?	J
K	Q.	Yes.	K
L	A.	As I said, every individual differs in terms of what	L
		they are exposed to from all these different potentia	al
Μ		sources, in terms of how frequently they come in cont	act M
Ν		with it, what foods they eat, whether they play outs	de N
		in contaminated soil. So my first hypothesis would b	e
0		that it's the mix of the contributions of these	0
Р		different pathways and sources differs from one	Р
0		individual to the next, and as a result of that you	
Q		would expect to see some variation among individuals	Q
R		the per cent decline when one of these pathways,	R
S		specifically water, is interrupted and no longer	8
		contributing.	5
Т			Т
U			U

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v

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	A	ł
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B	3
C	Q.	Yes, because even the difference in an individual's o	liet (7)
D		could well be material?	-	•
D	Α.	Absolutely.	I)
Ε	Q.	I indicated I would show you the materials relating	20 F	£
Б		the protocol for taking of blood. Could I have this	-	
Г		given to you, please. (Handed). This is a document	ľ	!
G		called "Pediatric lead toxicity work-up", and it is	C	J
н		published on 6 September 2015.	T	т
		I also have, incidentally, a document from the	Г	1
Ι		Oregon Department of Human Services, the Oregon Lead	I	
J		Poisoning Prevention Program, which I would like you	to J	l
		look at, but please look at the first document.		
K		One can see, under the cross-heading "Whole blood	ŀ	ζ
L		<pre>lead level":</pre>	I	
		"Whole blood lead level is the criterion		
Μ		standard for confirming the diagnosis of lead poisoni	.ng.	Л
Ν		For convenience, a finger-stick capillary lead level	has N	N
0		been used for screening. Properly collected capillar	У	•
0		samples have a 10 per cent false-positive rate. Once	(J
Р		an elevated lead level is detected, a venous lead lev	rel P)
0		is assessed for confirmation."	(h
×	Α.	Yes, that's absolutely right. In fact last week, at	the	ł
R		meeting of the guideline work group, producing	F	R
S		guidelines for the diagnosis and treatment of lead	S	3
т		poisoning in Geneva, this is an important part of our	_	
1			1	Ľ
U			τ	J

v

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С		document, that capillary samples are fine for screen	ing C
D		but you don't make treatment decisions based on them	;
D		you get a confirmatory venous blood lead level. But	D
E		that's when you are contemplating clinical managemen	t. E
F	Q.	Do you know, for the Hong Kong results, whether they	7
F		were obtained by capillary or venous method?	F
G	Α.	I don't know, no.	G
	Q.	So it is important because if it was capillary, but	had
H		not been audited by a venous test, then there is	Н
I		significant intrinsic doubt as to the reliability of	the I
Ŧ		original capillary reading?	
J	Α.	But the pattern of findings over time, in the	L
K		individuals that were identified as having a result	K
L		above the reference level, are so coherent in terms	of L
		the distribution of declines, I think that's very, v	ery
Μ		unlikely, that there was contamination of the origin	al M
Ν		blood lead levels.	Ν
0		Usually, when there's a contamination from	
0		a capillary sample, the value is greatly elevated,	0
Р		because a microgram of lead is microscopic, and much	Р
0		more than that is on the finger from contamination.	so,
Q		when that gets in the blood, you are going to see	Q
R		a blood lead level that is much higher than 6 or 7.	R
S	Q.	Can I ask you a likely different matter for a moment	
		Do you agree that lead absorption in children is	-
Т			Т
U			U

V

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		increased when there is insufficient calcium in the		С
		child's diet?		-
D	Α.	There are epidemiological studies showing that child:	ren	D
Ε		whose diets are insufficient in calcium do have highe	er	Е
T		blood lead levels, and it's based on the underlying		_
F		biology. The inference is that the absorption of lea	d	F
G		is higher in those children. I don't know of any		G
н		experimental evidence to back that up, but it makes		п
		sense in terms of the known biology.		п
I	Q.	If I can just ask you the same question but changing	the	I
J		variable. Instead of an insufficiency of calcium, if		J
		there was an insufficiency of iron in the diet, is the	at	
K		also likely to lead to increased lead absorption in		K
L		children?		L
	Α.	Yes.		
IVI	Q.	Why is that?		M
Ν	Α.	Well, lead and iron also look very similar to the	Y	N
0		look similar to one another chemically, just as lead		Λ
Ū		looks similar to calcium, so they compete for binding	ſ	U
Р		sites in the gut. So if iron is not present, then le	ad	Р
Q		will preferentially be attached to those binding site	es	Q
		and be absorbed into the gut and then into the blood.		-
R	DR	McCOY: I have no further questions. Thank you, sir.		R
S		Thank you, Prof Bellinger.	:	S
т	CHZ	AIRMAN: Anybody else? Mr Ho.		T
1				Г
U				U

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v

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		Cross-examination by MR HO		С
	MR	HO: I just have one or two very minor questions.		
D		Prof Bellinger, I am representing the Housing		D
Ε		Authority. I have just got one or two minor question	ns	Е
F		for you.		F
Г		When you were answering my learned friend Mr McCo	oy's	F
G		question, he showed you a paper which I think was in	L	G
н		1987, and there were some figures about food intake,	and	н
		you said those are outdated because now, normally, t	he	11
Ι		intake of lead from food is much lower. Do you reme	mber	Ι
J		that?		J
	A.	Yes. Was that I thought that was total lead inta	.ke,	
К		not intake just from food.		K
L	Q.	Right.		L
24		May I just ask you to look at a background paper	to	
M		the WHO Guidelines for Drinking-water, which is a pa	per	Μ
Ν		that's been referred to in this Inquiry, and that is	at	N
0		A1. Page 403 is the cover page. Perhaps you can have	ле	0
0		a look at that first.		U
Р		You see the title. This is a background document	•	Р
Q		If you look at the next page, you will see the date	of	0
-		this paper is 2011; do you see that?		·
R	A.	Yes.		R
S	Q.	Are you familiar with this paper?		S
_	A.	Yes.		
Т				Т
U				U
v		- 109 -		v

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С	Q.	You are?		С
_	Α.	Yes.		
D	Q.	Did you have a hand in the preparation of this paper	?	D
Ε	A.	No. I had a hand in the process that this was based]	E
F		on		Г
1	Q.	I see. Thank you very much.	,	Г
G	Α.	And the JECFA re-evaluation of lead earlier in 2011.		G
ч	Q.	If I may ask you to go to page 2, which is at page 4	10,	
п		please.		п
I		Paragraph 2 of course you see, I believe, thes	e I	I
J		are the sort of pathways that you identified and		J
		explained to us earlier: air; 2.2 is water; 2.3, we	see	
K		food; 2.4, which is over the page, we see "Other rou	tes	K
L		of exposure", and that refers to household dust as be	eing	L
		one of the significant sources.		
Μ		If I may ask you to come back to food, at 2.3. A	t	M
Ν		the bottom of that page, do you see it gives example:	s of j	N
0		the daily dietary lead intake from various countries,	,	~
0		for example, like Sweden, and over the page, do you	see	U
Р		66 micrograms for Finland; 23 micrograms for the USA	;	Р
Q		and further down the page we see a figure for England	d;	0
-		we also see Canada, which is 53.8 micrograms per day	;	x
R		Belgium, 90 micrograms per day; Sweden has a lower]	R
S		figure, 24; Mexico has, amongst these countries, the	ł	S
T		highest, 177. Do you see that?		
Т			,	Т

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U

V

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U

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27	В
С	A.	Yes.		С
	Q.	So there is a great variety of the daily dietary int	.ake	
D		of lead between the countries?		D
Ε	A.	Right. One caution I would interject here is that i	t is	E
-		important to look at the dates that these figures we	re	
F		taken from, because, looking very quickly at the		F
G		references, I see that the Finnish number comes from		G
ц		a 1980 study, the USA from 1982 to 1984, and Sweden	from	
Π		1985. So these are quite outdated numbers.		н
Ι	Q.	Right.		Ι
J	A.	They are much lower now.		т
U	Q.	Right. But even amongst what we call the developed		J
K		countries, for example some of the European countrie	S	K
L		and even Canada, the daily intake from diet could be		L
		much higher than what you said, 20 to 25?		
Μ	A.	They could be. You do have to be careful about diet	ary	Μ
Ν		estimates, because it depends a lot about how you su	rvey	Ν
0		the diet.		_
0	Q.	Certainly.		0
Р	A.	There's a lot of variability of individuals within t	he	Р
0		same country and what their diet is. So you just have	Je	0
Q		to be careful to not put too much stock in any singl	e	Q
R		number unless you know exactly how the data were		R
S	Q.	Exactly. So there can be different variants which m	ay	S
		contribute to a higher figure or a lower figure, eve	n	5
Т				Т
U				U
V		111		V
		- 111 -		•

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α	ł
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B	;
С		amongst developed countries on the one side and	С	•
		developing countries on the other side?		
D	A.	It's very hard to be certain here.	D)
E	Q.	You can't just generalise, as it were?	E	
	Α.	You can, but at your own peril.		
F	Q.	All right. Interestingly, the last sentence of that	F	
G		paragraph talks about even you get lead from drinking	J G	ſ
п		wine.		T
п		I know quite a lot of my colleagues here drink wi	ne,	l
Ι		so do be careful.	I	
J		Moving down the page to 2.5, you see there is	I	
		a sentence that starts:	-	
K		"More than 80 per cent of the daily intake of lea	d K	Ĺ
L		is derived from the ingestion of food, dirt and dust.	." L	4
		From water, that is a relatively small proportion	of	
Μ		total intake. That's still true, isn't it?	Ν	1
Ν	A.	I think on average that's a fair statement, but it w	ill N	I
0		vary from setting to setting.		
0	Q.	In fact, the same point is made, if we go to the end	of	,
Р		this document at page 423. The last paragraph on tha	t P	,
0		page, if we start with the second sentence of the las	st)
C		paragraph:	×	-
R		"Nevertheless, because lead exposure arises from	R	1
S		a range of sources, of which water is frequently a mag	inor S	
_		one, as it is extremely difficult to achieve		
Т			Т	1
U			U	J

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		a concentration lower than 10"	C
		Again, I believe that's in fact a sentence that i	S
D		lifted and becomes part of your report, so that must	be D
Е		correct?	E
Б	A.	Yes, as far as I know.	_
F.	Q.	Thank you very much.	F
G		I see that apart from what is stated here air,	G
п		water, food, household dust, and so on in your ow	n
11		report at page 63 of the bundle, you also identify	Н
I		children's toys as a potential source of lead intake	. І
J	A.	(Nodded head).	т
U	Q.	Is that, in your experience, a general problem with	lead
K		in children's toys?	K
L	A.	In the US, it is a problem with toys imported from	L
		certain areas. Mainland China is one of the areas of	Ê
Μ		great concern.	М
Ν	Q.	Sorry to say.	Ν
0	A.	Sorry to say, yes.	
0	Q.	Yes, in mainland China there is a danger or a risk,	at
Р		least, of producing toys that may contain lead conte	nt. P
0	A.	Yes, but it's true for toys imported from other area	is as
Y		well. The surveillance is not really what we would I	Q like
R		to see, and if a child is mouthing a toy that's pain	ted R
S		with lead-based paint, that can lead to very high	S
		exposures.	
Т			Т
U			U
V		- 113 -	v

BCommission of Inquiry into Excess Lead Found in Drinking WaterDay 27	В
C Q. Of course let's put your report into perspective. You	С
D various groups of people, but of course, in any	D
${f E}$ individual case, if we want to see the effect of lead on	E
a particular individual, we have to do a lot more study,	
F examination and so on in order to find out the cause; is	F
G that correct?	G
A. What do you mean by particular effects on an individual?	
A Q. For example, if we isolate one particular person in	Н
${f I}$ question, then what you are doing in your report	Ι
wouldn't give the answer?	т
A. What I said in my report applies to groups of	J
K individuals, and the associations that have been	K
L observed are population statistics.	L
Q. Yes.	
${f M}$ A. It can be difficult to identify effects in any	Μ
${f N}$ individual child. All we can say is that, on average,	Ν
children with higher blood lead levels or adults with	
O higher blood lead levels have this health adversity.	0
P Q. Yes. Thank you. This is a sort of statistical general	Р
observation?	0
A. Right. We can't say with certainty. We might be able	Q
${\bf R}$ to say more likely than not a child's problems are due	R
s to lead.	S
Q. Thank you. But in order to find out as referring to	2
Τ	Т
U	U

v

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| Α | Annex: Realtime English Transcription based on floor / Simultaneous Interpretation | Α |
|----|--|---|
| В | Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27 | В |
| С | a particular individual, we have to study a lot more, we | С |
| | have to have a lot more information about his | |
| D | background, his living environment and so on? | D |
| E | A. I see what you mean. Yes, in order to identify the | Е |
| _ | potential contributors to blood lead level. | |
| F | MR HO: Yes. Thank you, Professor. | F |
| G | Cross-examination by MS WONG | G |
| ц | MS WONG: Prof Bellinger, if I may ask a few questions. | п |
| 11 | This morning, Mr Chairman has raised the issue of | Н |
| Ι | the rationale as to why the US was adopting a higher | Ι |
| J | value of 15 micrograms. I wonder if I may assist by | т |
| Ū | producing or showing you a document. (Handed). | 9 |
| K | Prof Bellinger, I think this is a meeting note dated | K |
| L | 11 January 2006, by National Drinking Water Advisory | L |
| | Committee. | |
| Μ | Is it correct that this is a federal advisory | Μ |
| Ν | committee that supports the EPA in implementing its | Ν |
| 0 | duties and responsibilities? | |
| 0 | A. That's my understanding, yes. | 0 |
| Р | Q. We can look at page 2. We see from that table, there | Р |
| 0 | are three different contaminants commonly found in | 0 |
| Y | drinking water; correct? | Q |
| R | A. Yes. | R |
| S | Q. They include the distribution before water enters the | S |
| | distribution system; the second one is at the end of the | |
| Т | | Т |
| U | | U |
| v | - 115 - | v |

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water I	Day 27	В
С		filtration process, before distribution system; and		С
		lastly, at the consumer's tap.		
D		I can see there are three different regulatory		D
Е		approaches; correct? Different EPA regulatory		Е
Б		standards, in that table.		_
r	A.	Three approaches, one for each of the contaminants?		Ł
G	Q.	Yes, for each contaminant.		G
н		Can you explain why we have three different		п
11		standards for the three different sources?		п
Ι	A.	A different standard for arsenic and cryptosporidium a	and	Ι
J		lead?		J
	Q.	Yes.		Ū
K	Α.	Because there's a conclusion that we need to worry abo	out	K
L		different levels of contamination for each of the thre	e,	L
		that they can't all be the same the same standard		
Μ		would not be appropriate for all three. They need to		Μ
Ν		have their specific standard, based on the hazard		Ν
0		identification process and the whole risk assessment		0
0		that underlies the setting of standards.		0
Р	Q.	And the purpose is of course to eliminate the lead in		Р
0		each of these possible sources, so that you could		0
C		achieve the so-called lead offset zero in drinking		×
R		water?		R
S	A.	Well, I think the EPA says that it's not really feasik	ole	S
_		to achieve a level of zero.		
Т				Т
U				U
V		- 116 -		v

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С	Q.	Yes.	C
	A.	So they set a standard that they hope will be protec	tive
D		of the most vulnerable subgroup of the population.	D
E	Q.	Yes, and if we turn to page 3, which appears to expl	ain E
-		why this 15 micrograms was arrived at if we look a	at
F,		paragraph 2, it states:	F
G		"To establish the action level, EPA reviewed	G
н		information from representative water systems, effica	асу
п		of different treatment technologies, and	н
I		cost-effectiveness of these technologies."	I
J		And it referred to footnote 1, which states:	Т
-		"EPA gathered data from 39 medium-sized water	Ū.
K		systems. Approximately 96 per cent of these systems	K
L		were able to keep in the 90th percentile in the range	e of L
		10-20 [micrograms per litre]. Thus, EPA concluded th	at
Μ		15 [micrograms per litre] represented the feasible le	evel M
Ν		for public water systems."	Ν
0		It appears why they have chosen this particular	
0		figure. Do you accept that, Professor?	0
Р	Α.	Yes, it's not strictly health-based but it takes int	• P
0		account the feasibility as well. It's a risk managem	lent
×.		standard, not necessarily a health-based standard.	Q
R	Q.	Yes. Thank you. It refers to an action level. This	is R
S		my last question. So is it correct that this action	S
		level is simply a screening tool for determining when	cher
Т			Т
U			U
V		- 117 -	V

Α	Annex	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		certain treatment technique actions are required?		С
	A.	That's my understanding, yes.		
D	Q.	Thank you.		D
Е	MS	WONG: Thank you, Professor.		E
		Cross-examination by MR LEE		
F	MR	LEE: Yes, Professor. You have said that a child gets	5	F
G		one chance to develop his brain, something like that		G
ч		If he misses that chance, presumably, when the child		т
п		grows older, his IQ level would not compare as well a	as	н
I		his peers; is that right?		I
J	A.	Could you say the last part, may not compare?		J
	Q.	May not compare as well as his peers.		
K	A.	Not as well as it would have been had the child not	been	K
L		exposed to lead. It may still be higher than his pee	ers.	L
	Q.	But he has one chance to develop the brain, and if h	e	
Μ		misses that chance, can he ever catch up?		Μ
Ν	A.	Unfortunately, with brain development, it may not be		N
0		possible to catch up. As I mentioned, a variety of		0
0		processes need to happen at the right time, and putt:	ing	0
Р		cells in the right place, and if that chance is lost		Р
0		then there may be permanent effects that cannot be		0
C C		overcome. The effects may be reduced if the child ha	is	×
R		certain advantages after that point, but the brain		R
S		cannot go back and rewire itself.		S
-	Q.	But if the lead content, say from whatever source, g	ets	
Т				Т
U				IJ

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Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	В
С		into the blood, then presumably it could reach the brain?		C
D	A.	Unfortunately, yes. There is as adults, we have		D
Е		a nice system called the blood-brain barrier that has	5	Е
		very tight junctions between the endothelial cells ar	ıd	-
F		it limits the size of molecules that can pass into the	le	F
G		brain.		G
TT		In children, those adjunctions are not so tight,		
н		they are kind of leaky, for the first couple of years	· •	H
Ι		So things like lead can get into the brain more easil	-У	I
J		in a young child than in an adult. That's why the		J
-		central nervous system is more vulnerable in a child		U
K		than the peripheral nervous system in an adult.		K
L	Q.	When the lead gets into the brain, does it settle the	ere?	L
	A.	Yes. Unfortunately, it has an easier time getting ir	1	
Μ		than getting out.		Μ
Ν	Q.	Ah. So what effect would it be on that child?		N
0	A.	Well, it depends on the dose, how much lead. What we	2	0
0		now think is that there are certain areas of the brai	n	U
Р		that are more vulnerable to the effects of lead than		Р
Q		other areas. One of the primary areas is the frontal		Q
		lobe, the prefrontal cortex, which is where what are		-
R		called executive functions tend to lie, and those are	2	R
S		things like the ability to do long-term planning and		S
т		organisation, to develop strategies and to adapt the		T
1				T
U				U

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V

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Annex: Realtime English Transcription based on floor / Simultaneous Interpretation

Commission of Inquiry into Excess Lead Found in Drinking Water

Α

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С

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strategies in the face of new information, the ability to delay gratification. This is why we think that children with too much lead are more prone to ADHD and behavioural problems, because executive functions are the major underlying deficit of children with ADHD.

We also know that lead is particularly dangerous to a small area of the brain called the hippocampus which is where learning and memory take place, a process called long-term potentiation, which is dependent upon the glutamate system of the brain, which is a neurotransmitter, and lead interferes with the function of that.

So this is a child who may have trouble keeping up in school, may get into behavioural difficulties, and those I think also underlie the propensity I mentioned to aggression and getting into trouble and violence, because they can't delay gratification, don't have as much success in school and so drop out and start making poor choices because of executive function problems.

So I think these issues compound as a child get older and play out in ways that are very disadvantageous.

- Q. So once the lead gets into the brain, and supposing the cause of the lead in the brain is actually from lead in the water -- let's assume that -- will the child improve
- Т
- U

V

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Α

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С

D

Е

F

G

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Day 27

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27 B
С		after he moves away from that source?	C
	A.	Well, it's always good if exposure is reduced. So i	f
D		the child is no longer taking in lead from that sour	ce, D
Е		that's certainly of benefit.	E
_		In the literature on lead, you do see that the ea	rly
F		deficits associated with childhood exposure are	F
G		permanent. Personally, I don't believe that. I thin	k G
		it's too pessimistic. I think there are studies t	che
н		prospective studies that have followed children do s	how
I		that the deficits persist, but usually children rema	in I
J		in the same environment, and so they are continually	J
		exposed.	
К		My feeling, and there is actually some animal	K
L		evidence to support this, is if you raise an animal	in L
		an enriched environment, which for a rat means a big	ger
Μ		cage, a cage that includes toys to jump around on an	d M
Ν		other rats to interact with, that actually can preve	nt N
0		some lead-associated cognitive problems.	0
Ū	Q.	Provided there is no lead in the toys?	0
Р	A.	No lead in the toys, correct. But we don't know	we P
Q		don't have good studies to indicate whether that's t	rue Q
		for children, and I believe that it probably is, but	we
R		just haven't done those studies.	R
S	Q.	But would you agree with me that once lead gets into	the ${f s}$
Т		brain, it might or it might not be permanent? Would	you T
U			U

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A

B

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Commission of Inquiry into Excess Lead Found in Drinking Water A

B

Day 27

C	_		С
D	Α.	It might not. There are animal studies that show	п
D		that that have sacrificed the animals and measured	D
Ε		the actual concentration of lead in different areas of	E
Г		the brain, and those studies have shown that if you	Б
г		put if you expose an animal, their blood lead goes	ľ
G		up, eventually their brain lead goes up. You take the	G
н		animal out of that, you stop the exposure, their blood	п
		lead comes down, but for the foreseeable future the	п
Ι		brain lead remains elevated. But the animals have been	Ι
J		sacrificed. If they let the animals live forever,	J
		perhaps brain lead would come down, but so far, it	Ū
K		doesn't look like that.	K
L	Q.	Let me come back to lead in the brain of a child. Can	L
		you get rid of the lead once it gets into the brain?	
Μ	A.	As far as we know, the chelating drugs that are used	Μ
Ν		when a blood lead level in a child gets above 45	N
0		primarily takes the lead out of the blood and to	
0		a lesser extent some of the soft tissues. But the brain	0
Р		doesn't seem to be one of those soft tissues, and	Р
0		I think it's because the chelating agent is too large	0
Q		a molecule and even it can't cross the blood-brain	Q
R		barrier. So the answer is, as far as we know, no.	R
S	Q.	So the chelation treatment, is it an intrusive form of	ç
5		treatment?	3
Т			Т
U			T
-			U

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С	Α.	Certainly it has to be considered		С
D	Q. A.	How would it affect the child, say? Well, there are different options among chelation.		D
E		Until about a decade and a half ago, the chelation		E
-		required hospitalisation and giving the child very		
F,		painful intramuscular injections or IV injections of		F
G		chelating agents.		G
н	Q.	How frequent would the injections with?		
п	Α.	Well, for the most common course of chelation, it's		н
Ι		a 19-day course of treatment, and then you stop and 2	et	I
J		the re-equilibration process that I talked about go o	on.	J
		Usually what happens is the child's blood lead drops		
K		precipitously when you start chelation, but then a we	eek	K
L		or so after you compete it, it comes back up because	of	L
		the re-equilibration, and so it's necessary to give		
Μ		another course of chelation.		Μ
Ν	Q.	So how many courses of 19 days each?		N
0	Α.	As many as needed. In the Zamfara episode, where		0
0		children had blood lead levels of several hundred		0
Р		I talked to the paediatrician who did the chelation a	and	Р
Q		one child required 68 courses of chelation, and the		0
		blood lead still was elevated.		C
R		There are now oral chelators, dimercaptosuccinic		R
S		acid, that can be given on an out-patient basis, which	ch	S
т		is much less intrusive and more acceptable to parents	3	m
1				T.
U				U

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Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		and children.		С
_	Q.	Is it also more effective?		
D	Α.	It is not effective in reducing the cognitive defici	ts.	D
E		It does reduce the blood lead and the soft tissue lea	ad,	Е
		but there was a randomised trial where children of b	Lood	
F.		lead levels of 20 to 44 were randomised to receive		F
G		chelation with oral succimer or placebo, no treatment	-1	G
н		and the children were followed up after treatment was	5	п
п		completed and there was absolutely no difference in t	che	п
Ι		cognitive outcomes of the children.		Ι
J		So waiting for the child to become poisoned, it's		J
		too late, apparently, to prevent the adverse effects	of	Ū
K		lead on the brain.		K
L	Q.	Professor, you mentioned chelation. Are there other		L
		methods of treatment?		
Μ	A.	That's the first choice. But as I say, chelation is		Μ
Ν		only indicated when a child's blood lead is above 45.		N
0	Q.	That's very high.		0
0	Α.	Yes. For blood lead levels 44 and below, the		0
Р		interventions are the environmental investigation, to)	Р
0		identify an ongoing source, the nutritional counsell	lng,	0
τ.		to make sure that the diet is adequate. But		Y
R		unfortunately there's really not much else to offer.		R
S		The chelation is counter-productive in a child with		S
		a blood lead below 44 because it chelates not only le	ead	
Т				Т
U				U

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v

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water Day	27 B
С		but chemicals that look like lead, and the calcium and	С
		the zinc that we talked about earlier, and there is some	
D		renal toxicity. So it's not performed below 45.	D
Е	Q.	I move on to another topic. You have been asked many	E
		questions by other counsel about other sources of lead	
F		getting into the body, apart from lead in the water;	F
G		soil, air, dust and all this. Let me pose a number of	G
		questions to you.	
н		I will use two examples, scenario A and scenario B.	Н
I		Before I go to those examples, is there any relationship	Ι
т		between the level of lead in water and the level of lead	т
J		in the blood?	J
K	Α.	Yes.	K
L	Q.	Scenario A: if the lead content in water is low, like	L
		2 micrograms per litre, but the lead content in the	
Μ		blood is relatively high, say 20 micrograms per	Μ
Ν		decilitre, would you say in this example that the excess	Ν
		of lead in the water is an important contributing factor	
0		to the rather high presence of lead in the blood?	0
Р	A.	I would say it's unlikely. It's more likely that	Р
0		there's some other source that's of primary importance	0
×		for that one child.	Q
R		When I said there is a relationship between water	R
S		lead and blood lead, that again is looking at a large	S
		population, where those sorts of unusual circumstances	
Т			Т
U			U
V		- 125 -	V

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Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		would even out.	C
	Q.	So I come to scenario B. Now, this time there's als	0
D		high lead content in the water, say 50 micrograms pe	r D
E		litre in the water, and on the blood side it's also	E
_		high, say also 50 micrograms per decilitre. In	
F		scenario B, would you say the lead content, high lead	d F
G		content in the water, is an important contributing	G
т		factor to the lead in the blood?	
п	Α.	Probably, but again I would want to know what the ot	H her
I		potential sources are, and I would want to know if t	ne I
т		child was actually drinking the water.	т
9	Q.	Of course, or the baby drinking milk powder where le	aded
K		water was used.	K
L	Α.	Yes.	L
	Q.	But of course I forgot to mention that if you assume	the
Μ		other factors were equal in scenario A and scenario	в М
Ν		do you follow me?	Ν
0	Α.	(Nodded head).	
0	Q.	Otherwise, if the other factors are totally differen	0 t,
Р		then you cannot make a comparison. So you have to ma	ake P
0		a comparison on the basis that the other factors wer	e
Q		equal in scenario A and scenario B?	Q
R	Α.	I agree.	R
S	Q.	So, if that is the case, then if the presence of lea	d in S
		the water is high and the presence of lead in the bl	bod
Т			Т
U			U
V		- 126 -	v

Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	aission of Inquiry into s Lead Found in Drinking Water	Day 27	В
С		is also high, then you would say the water is		С
D		an important contributory factor?		_
D	A.	More likely than not, and you might want to interrup	t	D
E		the water pathway to see what happens to the blood le	ead	Е
Б		and see if it drops.		-
F	Q.	Yes. Thank you.		F
G		Now, you have in your report made some importance	on	G
н		the age of a child: 0 to 1 and then 1 to 6, and then	1 6	п
		to 18. I think this is more or less what you are		п
Ι		directed to do by the Commission.		Ι
J	A.	Yes.		J
-	Q.	But six years is a rational age; is that right?		0
K	A.	A threshold?		K
L	Q.	The threshold of six.		L
	Α.	What do you mean by "threshold"?		
Μ	Q.	Because I see in your own report, at page 7, interna	1	Μ
Ν		pagination, that is page 51, the first complete		N
0		paragraph:		~
0		"A series of neuroimaging studies of young adults		0
Р		(mean age 20 years) in whom detailed histories of lea	ad	Р
0		exposure prior to the age of 6 years were available		0
C C		provides evidence that early-life exposure produces		Y
R		persistent changes in brain structure and function."		R
S		There, you use six years; is that right?		S
	Α.	Well, in this study, they measured blood lead quarte	rly	
Т				Т
U				U

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v

 \mathbf{V}

Α	Annex:	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		in these children for the first few years of life, ar	nd C
		then up to six years of age, but levels beyond that v	vere
D		not available until they became adults.	D
Ε	Q.	I see. So you say this: if you call that a threshold	lat E
Б		all of six years, it's really optional? You could pu	t
F		it up to eight years or seven years?	F
G	Α.	I was just describing the data that were presented is	n G
н		this paper. They didn't have blood leads at eight.	
п	Q.	But the Commission then designated six years as the	н
Ι		threshold?	Ι
J	A.	Yes, and I think that's because, for instance, the	I
-		US CDC says that children up to six are the most	Ŭ
K		vulnerable group. There is no bright line.	K
L	Q.	But there is logic in it?	L
	A.	There's what?	
Μ	Q.	There's logic in six years, is there; you agree?	М
Ν	A.	Well, I agree that the risk is greater among young	Ν
0		children, but I don't think there's a bright line. F	or
0		pragmatic reasons, we have to choose a cut-off, and s	Jix 0
Р		is the one that people generally use. But, you know,	Р
0		lead isn't good for anybody.	0
C	Q.	And it should be zero?	×
R	Α.	That would be great. I would love to see that.	R
S	Q.	Yes.	S
_		Now, looking at your report, at page 17, the	
Т			Т
U			U
V		100	۲7
Ŧ	Transc	ript by DTI Corporation Asia, Limited	v

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С		internal pagination it's the care plan, is that	C
C		right, that has been used in the US?	C
D	Α.	Correct.	D
Е	Q.	For children, what is the age of those children? What	at E
		is the threshold there?	
F	Α.	This is children under six.	F
G	Q.	Also six?	G
п	A.	Yes.	
п	Q.	Very well. You see on the left-hand side, it's "Bloc	H od
I		lead concentration [less than 5 micrograms per	I
J		decilitre]". Then you have a number of things: lead	т
-		education, dietary and environmental, and then	
К		environmental assessment for pre-1978 housing.	К
L		That's old housing; right?	L
	A.	Yes. That's when leaded paint for interior use was	
Μ		banned in the United States. So it's a useful screen	ing
Ν		criterion.	Ν
0	Q.	Then follow-up blood lead monitoring. If you look at	
0		that and compare it to Hong Kong it's bundle E2,	0
Р		page 871. I think you just got these documents	Р
Q		yesterday or today. It should be there.	0
-		We can see the chart. The first one, 1, then it's	5
R		less than 5 micrograms per decilitre; "Reassurance ar	nd R
S		no further follow-up".	S
_		So, in other words, as far as the Hong Kong	
Т			Т
U			U
V			• 7
•	Transc	- 129 - ript by DTI Corporation Asia, Limited	v

Α	Annex:	: Realtime English Transcription based on floor / Simultaneous Interpretation	1	A
В	Comm Excess	ission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		government is concerned, when the lead content in the	<u>)</u>	С
		blood is less than 5 micrograms, then they don't do		
D		anything about the child, it would appear? Do you	Ι	D
E		understand that?]	E
F	Α.	Yes.		
F	Q.	But in the United States, there were these four thind	gs	F
G		that I have mentioned to you three things; right?	(G
н	Α.	I'm sorry, could you repeat that?	1	п
	Q.	I referred to your own chart just now. So, even less	3	Π
Ι		than 5 micrograms, there are three things done in the	5 I	[
J		United States?		T
	Α.	Well, I think I actually made an error here, because	if	-
K		you look down the table, for the schedule for follow-	-up I	K
L		testing, the first	J	L
	Q.	Your table or the Hong Kong government's table? You	say	
Μ		there's a mistake. Mistake in	Ν	М
Ν	Α.	In my table.	ľ	N
0	Q.	Okay.		•
0	Α.	Yes. There isn't a schedule for following up a blood	1	U
Р		lead level of a child whose concentration is less that	in I	Р
0		5 micrograms per decilitre. You can see it's only wh	.en	0
×		it's between 5 and 10, the recommendation is to have	· · · · · · · · · · · · · · · · · · ·	Q
R		a follow-up between two and four months after the	J	R
S		initial value, and then, if the blood lead is declini	ing,	5
		only after six to nine months.		
Т]	Г
U			τ	U
V		- 130 -	۲	V

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С		So, in the United States, there is not any univer	sal C
		screening of children for blood lead. There's target	ced
D		screening if the child has some risk factors, if some	eone D
E		suspects that they may be exposed to too much lead.	Е
		In my own State, there is mandated screening to	
F		age 4, but then thereafter only if there are	F
G		circumstances that make the paediatrician suspicious	. G
п	Q.	When there are certain symptoms; is that right?	
п	Α.	Well, not symptoms of lead toxicity, but if the chil	H d
I		has risk factors, so that if the child is living in	Ι
T		a pre-1978 home, or if a sibling has been lead poiso	ned,
0		or if it's known the parent is occupationally expose	d to
K		lead; factors such as those.	К
L	Q.	Now, the Hong Kong government set the threshold at e	ight L
		years old instead of six.	
Μ	A.	Six? That's prudent. It's conservative.	Μ
Ν	Q.	That's more prudent, because instead of six it's now	N
2		eight?	
0	A.	Right.	0
Р	Q.	But these are only children in the affected public	Р
0		estate, as far as the Hong Kong government is concer	ned,
Q		right, not generally?	Q
R	A.	That's right. Actually, they include children under	12, R
S		so that's even more prudent.	S
	Q.	But the trouble is, if a child lives in a certain pu	blic
Т			Т
U			U
V		- 131 -	v

Α	Annex.	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
B	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27 B
С		housing estate which is affected by lead in the wate	r, C
		and he has been living there for a number of years,	out
D		there was no discovery of excess of lead in water ye	t, D
Ε		and then he moves out, and then say he becomes nine	or E
F		ten years of age, then he goes above the threshold o	f
Г		eight years, and so he will miss out from the	F
G		government's plan. Do you follow me? Because the	G
и		government only looks at children under eight years	old.
п	Α.	I don't know that that's the case.	н
I	Q.	But if that is the case, what do you think about it?	I
J	Α.	Well, they are doing screening of all individuals wh	0 I
		live in the estates.	U
K	Q.	You understand that the Hong Kong government does	K
L		screening for all children in these estates which ar	e L
		affected? Is that your understanding?	
Μ	Α.	That was my understanding, yes. And I would hope th	at N
Ν		there is a system in place to continue tracking thes	e N
0		individuals over time. So, in the scenario you	
0		mentioned of a child moving out of the estates, if t	hat
Р		child still has an elevated blood lead, no matter wh	ere P
0		that child is, they should be in the case management	0
×		system until the blood lead falls below the reference	e
R		value.	R
S	Q.	But the problem is, if a child is already nine or te	n S
		when the whole of Hong Kong knew about this excess o	£
Т			Т
U			U

U

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	nission of Inquiry into s Lead Found in Drinking Water	Day 27	B
С		lead in water, then he is already too old for the		С
		threshold of eight.		
D	A.	Well, looking at the line listing that I have been		D
Ε		provided, there are individuals above the age of eight	lt	Е
F		who are being followed and, if they have a blood lead	Ł	-
г		level above the reference, they are being re-tested.		F.
G		So your scenario doesn't accord with my		G
и		understanding of the data that I have been given.		
п	Q.	Perhaps I should show you a document which we got fr	om	н
Ι		the internet, a government document. It is from the		I
J		Centre for Health Protection, and the title is "Incid	dent	т
U		of lead in drinking water". (Handed).		J
К		These are what's called the frequently asked		K
L		questions, and then the government providing the		L
		answers. The question is, "When can we arrange for		
Μ		a blood test?"		Μ
Ν		"For residents of the affected public estates who		N
0		are children under eight years old, pregnant women a	nd	0
0		lactating women, they can make arrangements for blood	ł	0
Р		testing via the hotline The hotline will operate		Р
0		[between certain hours]. It will be diverted to the		0
×		Government hotline after operating hours."		Q
R		So it only caters to children under eight years o	ld	R
S		and pregnant or lactating women. So if the children	are	S
T.		over eight years old, then they have to consult their	c	
T				Т
U				U

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Α	Annex	: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Comm Excess	ission of Inquiry into a Lead Found in Drinking Water	Day 27 B
С		own laboratory or whatever.	С
		That is why, if a child had lived in one of these	:
D		estates affected by excess lead in the water but the	n D
Ε		moved out, and is now nine or ten, then there's no s	uch E
F		facility provided to this child.	
г	A.	I see what you are saying, yes. It appears so.	F,
G	Q.	Is that satisfactory?	G
н	A.	Well, in the ideal world, no. This document does sa	у,
		in this particular situation, we need to channel lim	n ited
Ι		resources to children under eight, pregnant women an	d I
J		lactating women. If I were forced to make a choice	т
Ū		about which groups to focus on, I would make the sam	e
K		choice.	К
L		But I agree, in an ideal world, the coverage woul	.d L
		include other subgroups as well.	
Μ	Q.	But would you not mention somewhere, maybe in a foot	note M
Ν		or whatever, that if the children have been living i	n N
0		these estates for a number of years but now they are	
0		over the age of eight, then also ring the hotline or	at
Р		least get their parents to ring the hotline?	Р
0	A.	That's a very point.	0
C C	Q.	Thank you. Now, if the government sets the threshol	d at
R		eight years, which you say is prudent, more prudent	than R
S		six, but they should treat it as a reference point o	nly, S
		or should they treat it as at a reference level or	
Т			Т
U			U
V		- 134 -	V

Α	Annex.	Realtime English Transcription based on floor / Simultaneous Interpretation		A
В	Comm Excess	ission of Inquiry into Lead Found in Drinking Water	Day 27	B
С		an action level? Do you see the difference between		С
		reference level and action level?		
D	Α.	I don't. In the care plan, they do recommend or man	late	D
E		certain follow-up activities, if a child's level exce	eeds	E
Б		the reference value. So it looks to me as if action	and	_
F		reference levels are being interpreted as one and the	5	F
G		same.		G
н	Q.	Now, I want you to look at the letter from the		н
		government which you have been looking at. This is		11
Ι		page 846 of E2. You have been looking at this letter		Ι
J		already, right, earlier?		J
	Α.	Yes.		
K	Q.	You are familiar with this letter.		K
L		Go to the next page, towards the bottom of the pa	ge,	L
м		847. The last paragraph says:		
M		"Children identified with developmental or		M
Ν		behavioural problems"		N
0		Perhaps I should go sorry, I want to read the		0
		paragraph above that, beginning with "Regarding":		U
Р		"Regarding the 'developmental assessment' mention	ed	Р
Q		in page 19 of the expert report"		Q
_		That is your report; right?		
R	Α.	Yes.		R
S	Q.	" all children with elevated blood lead level wil	1	S
т		receive preliminary developmental assessment at DH's		т
1				1
U				U
V	Transc	- 135 - ript by DTI Corporation Asia, Limited		V

Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	А
В	Commission of Inquiry intoExcess Lead Found in Drinking WaterDay 27	В
С	Child Assessment Centres" that's Department of	C
D	Health "(for pre-school children below 6 years) or	_
D	Student Health Service Special Assessment Centres (for	D
Ε	schoolchildren 6 to 12 years) by a developmental	Ε
F	surveillance team composed of paediatricians and nurses."	F
G	Then it talks about what the development assessment	G
	covers. Then the last paragraph:	
Η	"Children identified with developmental or	Н
I	behavioural problems will have follow-up evaluation at	I
J	Child Assessment Service according to individual needs."	Л
-	So once a child is identified to have these	U
K	problems, developmental or behavioural, then there will	K
L	be follow-up. Then:	L
	"Children with largely normal development would	
M	receive continuous monitoring through enhanced	Μ
Ν	developmental surveillance at Maternal and Child Health	Ν
0	Centres during pre-school years and annual health	0
Ū	visits at Student Health Centres during school years."	Ū
Р	So two types, those who are identified with	Р
0	behavioural or developmental problems, there will be	0
C C	follow-up; those with largely normal development would	×
R	still have enhanced developmental surveillance. Then:	R
S	"Parents are provided with anticipatory	S
-	developmental guidance and information on children's	
Т		Т
U		U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry into Excess Lead Found in Drinking Water	Day 27 B
С	development in the form of pamphlets. These pamphlet	ts C
D	are available online at [so and so]. Due to the larg	ge D
_	volume of these documents, hard copies will be provi	ded P
Ε	upon [the Commission of Inquiry's] request."	Ε
F	Do you see that? Have you actually gone online t	○ F
	take a look at these pamphlets?	
G	A. No, I didn't.	G
н	MR LEE: Can I have some indulgence? I want to discuss	with H
т	my junior, because it does say if you want hard copi	es,
1	it's only upon your request. We couldn't get a copy	1
J	ourselves.	J
к	CHAIRMAN: Do you want a copy?	K
	MR LEE: Yes.	K
L	CHAIRMAN: Have you ever seen this document first?	L
Μ	MR LEE: Online, yes. Because to us, they are totally	М
	unimportant. Nothing to do with this case.	
Ν	CHAIRMAN: So you want a copy?	Ν
0	MR LEE: I want to show you and the members	0
D	CHAIRMAN: Why don't you show me online first?	
P	MR LEE: Okay, online. Can we do it here? I don't know	Р
Q	whether we can do it now, because we do not have	Q
R	CHAIRMAN: Let me make this suggestion, since now it's	D
A	almost 4.15. Why don't you or your junior go back to	
S	your chambers and look at the relevant paragraphs an	d S
Т	identify the relevant paragraphs, and then I don't t	hink T
		_
U		U

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Α	Annex: Realtime English Transcription based on floor / Simultaneous Interpretation	Α
В	Commission of Inquiry into Excess Lead Found in Drinking Water	Day 27 B
С	you really need to print an entire copy of these	С
	documents. So print the relevant paragraphs or pages	5,
D	or indicate to us which particular paragraph or page	S D
Ε	that you want, then we can print it ourselves.	Ε
F	MR LEE: My junior read them. Perhaps I can consult wit	h
r	her.	F
G	CHAIRMAN: Yes. Or you can tell me now, actually.	G
н	MR LEE: It may be possible for us not to go into these	н
	pamphlets, but I would like to discuss with the team	in
Ι	the meantime.	I
J	CHAIRMAN: All right. So if	J
	MR LEE: I won't be long, but I would like to have some	time
K	to make sure I won't be long.	К
L	CHAIRMAN: I will give you the evening to prepare your c	ase. L
	So if you think a particular paragraph or pages are	
Μ	relevant to our hearing, then inform my secretaries	and M
Ν	the other legal teams.	Ν
0	MR LEE: Yes, we will do that.	0
U	CHAIRMAN: So that's it for the day, Prof Bellinger.	0
Р	I would be grateful if you could come back at 10 o'c	lock P
Q	tomorrow morning.	0
	WITNESS: Certainly.	
R	CHAIRMAN: Thank you.	R
S	(4.15 pm)	S
_	(The hearing adjourned until 10.00 am the following da	.у)
Т		Т
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