

Transcription | Dioxin! What citizens, workers and policymakers should know Interview with Dr Linda Birnbaum on April 19, 2004

Ref: LindaBirnbaum-2004

Dioxin! What citizens, workers and policymakers should know.

Interview with Dr Linda Birnbaum on April 19, 2004.

At the time she was Director of the US Environmental Protection Agency's Environment Toxicology Division. In 2010 she became Director of the National Institute of Environmental Health Sciences.

What are Dioxins?

Dioxins are a family of chemicals that have similar structures and similar mechanism of action and similar effects. Dioxins are extremely persistent chemicals and because of their structure they are resistant to both physical and biological degradation. Dioxins get introduced into the environment by a variety of ways either they are directly discharged into the water and then what happens when it gets into water is dioxins are sticky molecules, they don't like water very well they would rather be in fatty tissues or fatty material and they will bind to particles, settle out into the sediment, the sediment actually gets eaten by small critters and they begin to bio-accumulate up the aquatic food chain. If dioxins are emitted from an incineration process, from any kind of a combustion process, into the atmosphere a certain amount of dioxins can actually be in the gas phase but most of them again will be stuck to little dust particles in the air and the same thing will tend to happen as happened in the water. They are bound to the dust particles they will come down with the rain and they will settle down, they will get onto plants and onto crops, animals will eat the plants and crops and then eventually we eat the animals, so we eat the animals on land or we eat the animals from the sea and that's basically the way that dioxins get into people. We do think that at least for the general population over 90% in fact probably over 95% of our exposure is from the foods that we eat primarily foods of animal origin.

How toxic are dioxins?

Dioxin is not your typical toxic chemical which might affect one kind of effect not only cause neurotoxicity or reproductive toxicity or cancer. Dioxins seems to have the ability to interfere with basic processes in our bodies so that in fact dioxin has been shown in our experimental animals studies and now we are seeing more of this in our human studies dioxin has been shown not only to cause cancer but to cause effects on the skin, to cause effects on the gastrointestinal system, to cause effects on the reproductive system, on the immune system, on the cardiovascular system, on the endocrine system, and on the nervous system as well. Much of our concern for dioxin is based upon the fact since it can affect basic biological processes, how cells divide and how they differentiate from one kind of cell on to another kind of cell. We have a great deal of concern about exposure to dioxin during development especially in the womb. And our animal studies have shown that dioxin prenatal exposure to dioxin is associated with the effects on the developing reproductive system, on the developing nervous system, on the developing immune system. Some of the kind of things that we see in children whose mothers were at the high end of the normal population, we see children whose immune system appears to be suppressed so that they are more susceptible to certain kinds of infections, we see children who when they go through puberty, the little boys appear to have, don't develop as well as you would expect them to develop and we see changes in the behaviour of both boys and girls, we see some effects on their learning ability so that we can see that some of these children if you look at the population of children you can see that the distribution of IQs is a little bit lower than we would normally expect from the population. We find effects, persistent effects on these children on their nervous system, on their reproductive system, on their immune system.

Not everything here is signed, sealed and delivered but we do have some studies that suggest there might be an association between dioxin and diabetes, between dioxin and endometriosis and obviously between dioxin and cancer. When we study a chemical that seems to cause one kind of effect in one sex of one species of one class of animals I don't have a lot of confidence that that something that may be applicable to people. But dioxins are chemicals that have been shown to affect every class of vertebrates, fish, amphibians, reptiles, birds, mammals. They have been shown to affect both males and females, they have been shown to affect many, many different kinds of tissues and organs, they have been shown to have

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affects during development, during childhood, during adulthood in our animals it is hard for me to think that people are going to be that different. Now there is one end point that is fairly, is now been shown to be associated with exposure of the men who become fathers and this is based upon studies of poisoning episodes and what we find in those cases was we are finding that there appear to be fewer little boys and more little girls born to men who are highly exposed. Again when they were children or young adults. The data does suggest especially from the studies of the background populations when you look when you look at the children of women who for some reason have higher exposure than the background population, those children, their distribution of IQs, their sensitivity to infections, those responses, or those children are potentially greater risk.

Workers can be exposed in additional ways other than in the food that they eat. They can be exposed to dioxins in the dust or in the air of their workplace, they may inhale some of it, either as a vapour in other words in the gas phase or they may actually inhale it and if it is bound particles what happens is it actually ends up being swallowed. Workers may also have some additional exposure through their mouth if they touch dirty fingers to their mouths. And there is a potential from exposure through their skin. Most of the occupational studies have focussed, they have been mortality studies. They have asked, what have people died from and is there an association there with the exposure to dioxin? We really need to be looking at incident studies as well, for example most cases Type 2 diabetes may not be what is listed as the cause of death and yet may very well be associated with elevated levels of dioxin as an example.

Does Dioxin cause cancer?

We know that dioxin causes cancer in animals. Dioxin has been tested in at least 19 now different animal studies involving rats, mice, hamsters and even fish and been shown to cause tumours in these animals. We now have a number of human studies also studies of populations who have high exposure to dioxin and these studies lead us to conclude that dioxin does have the ability to cause cancer in people. Now if we asked well how much dioxin do you need to cause cancer in people we find that the amount of dioxin needed in the body of people is very similar to the amount of dioxin that was needed in the bodies of our experimental animals. And if we estimate what the risk is from dioxin exposure we base that risk today very much on human data and the human data gives us similar numbers to what we have gotten from our animal studies. The international agency for research on cancer evaluated this question very rigorously in 1997 and the conclusion of those panels, and I was a member of those panels at that time, was that the data, was that dioxin is a known human carcinogen.

Are animal tests relevant to human health?

Animal testing is a standard and an appropriate practise to understand the potential for human health effects. Essentially all drugs and all surgical procedures are developed first in animals before they are applied to humans. It would not be ethical for us to take a chemical for which we have great concerns about the potential for health effects and knowingly expose anybody to this chemical. Nature is inheritably conservative the same processes that happen in rats and mice and monkeys and fish even happen in our bodies as well. Our understanding about the levels in our bodies that might associated with effects is based on large part on our animal studies which have shown that levels in the 10s to 100ppt fat adjusted, we always adjust our dioxin levels to fat, are associated with a number of adverse health effects such effects on the developing reproductive system, immune system, nervous system, also potential for endometriosis, also a number of other effects. Some people may suggest that some effects have a threshold that below which nothing happening. I would argue that in many cases things may be happening below a certain level we just don't have the ability to measure them. And in fact for many effects that are caused by dioxin we can't find a dose below which nothing is happening. When we look at levels in our experimental animals where we have seen effects we see biochemical effects occurring at levels between 1-5ng/kg in otherwise levels that are present in essentially most of our population and we see frankly adverse effects, effects on the developing nervous

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system, reproductive system, immune system at levels from about 20ng/kg up to about 60 or 80ng/kg. Everyone in the population today has these chemicals in their bodies. Talking about a chemical that has effects at very low concentrations in the body.