Pesticide residues in blood samples from Punjab villages

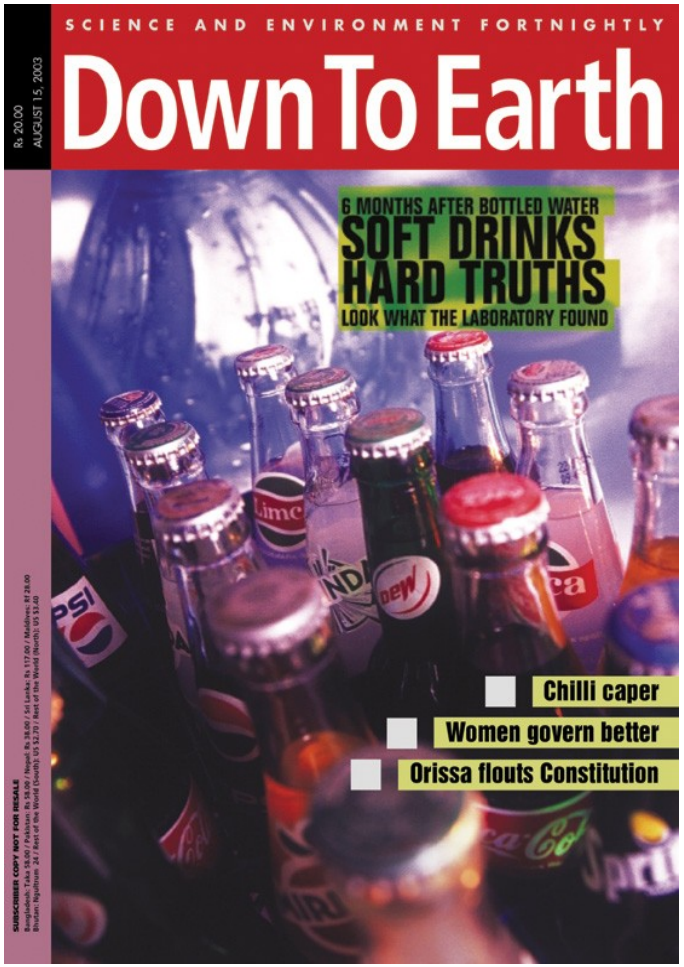
Analysis done by
CSE's Pollution Monitoring Laboratory

Centre for Science and Environment

CSE's Pollution Monitoring Lab

- **Set up in 2000, with state of the art equipment for pesticide residue, heavy metal and air pollution monitoring.**
- **We set it up to:**
  - **to investigate issues of public health concern: drinking water (fluoride), bottled water and soft drinks (pesticides).**
  - **respond to community requests (endosulfan case in Kerala)**
- **Conspiracy of silence in data. Need science for ecological security. Need information publicly.**
- **Concerns our health. Our bodies. Our children.**

Two studies. Too many questions. And some answers too!

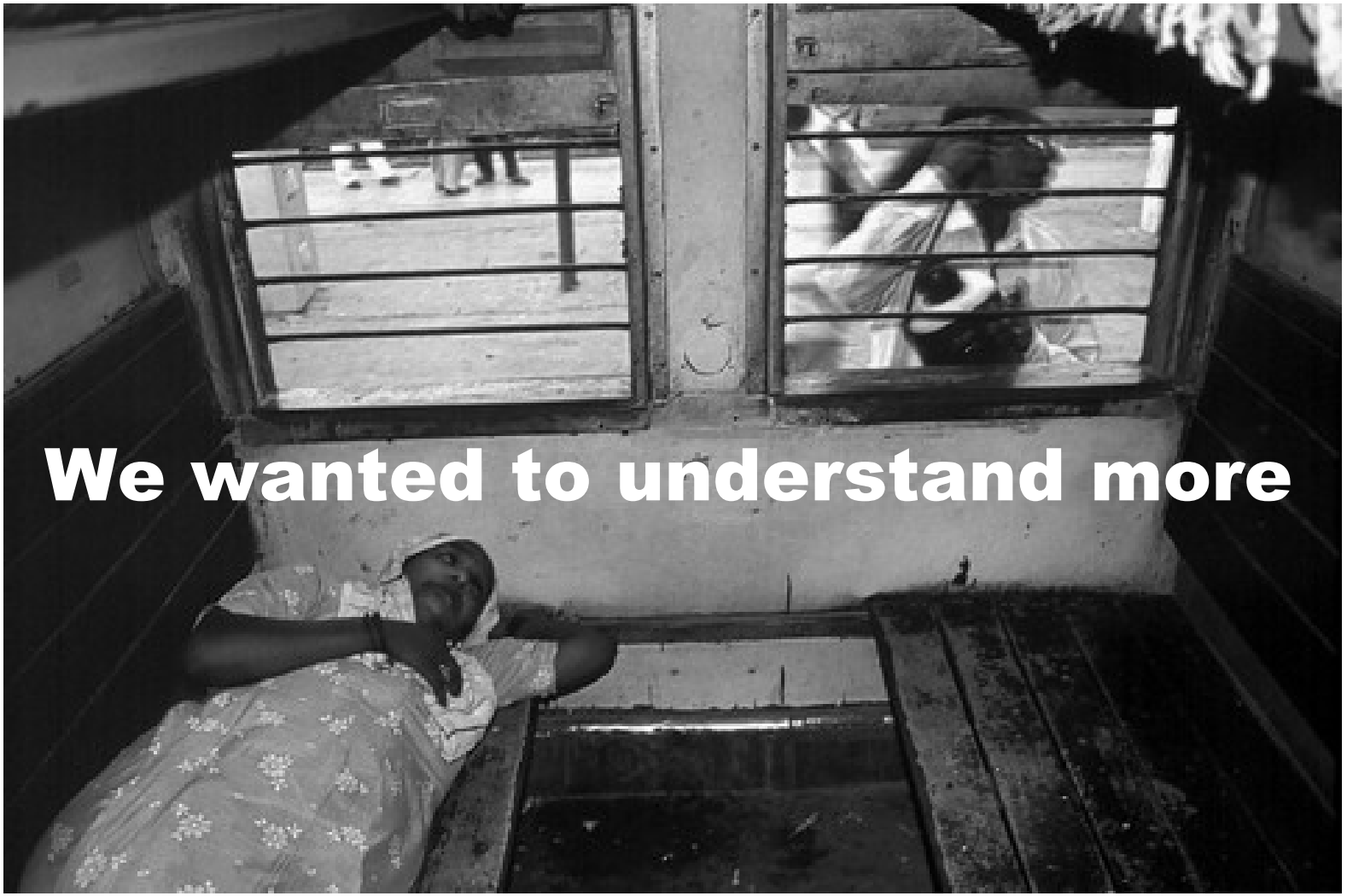


A case: Hardly any answer

Why Punjab…

- Lots of anecdotal reports of high cancer incidence in certain areas of Punjab.
- We sent a colleague to investigate.
- Came back with reports of trains with cancer patients from Punjab going to Rajasthan for treatment.

Why Punjab…



Body's burden

- **Number of studies done in the past to collect data on body's burden of chemicals**
- **ICMR has compiled data from many such studies**
- **Almost all the studies tested for organochlorine chemicals**
- **And all of them have found that we carry these toxins in our blood, fat and milk**

Levels of DDT and HCH content in human blood samples in general population in India

City	Year	Number of samples	Total DDT (ppm)	Total HCH (ppm)
Lucknow	**1980**	**25**	**0.02**	**0.022**
Delhi	**1982**	**340**	**0.71**	**0.49**
Lucknow	**1983**	**48**	**0.028**	**0.075**
Delhi	**1985**	**50**	**0.301**	**–**
Ahmedabad (rural)	**1992**	**31**	**0.048**	**0.148**
Ahmedabad (urban)	**1997**	**14**	**0.032**	**0.039**

Levels of DDT and HCH residues in human milk samples in general population in India

City	Number of samples	Whole milk basis (ppm)	
		Total DDT	Total HCH
Lucknow	**25**	**0.127**	**0.107**
Ludhiana	**75**	**0.51**	**0.195**
Bangalore	**6**	**0.053**	**0.014**
Calcutta	**6**	**0.114**	**0.031**
Bombay	**6**	**0.224**	**0.053**
Delhi	**60**	**0.344**	**–**
Delhi	**60**	**–**	**0.38**
Ahmedabad	**50**	**0.305**	**0.224**

CSE study in Punjab

- **Selected two districts – Bhatinda and Ropar – based on high pesticide use and media reports on cancer patients.**
- **A team of scientists from the PML visited four villages - Mahi Nangal, Jajjal and Balloh in Bhatinda and Dher in the district of Ropar - in Punjab between October 4-7, 2004.**
- **Collected 20 blood samples from randomly selected people**
- **Exposure was apparent. Pesticides were all around.**

CSE study in Punjab

- Blood sample tested by using state-of-the-art Gas Chromatograph (GC).
- Test methods based on widely- recognised US Environmental Protection Agency methodology
- Blood samples tested for 14 Organochlorine (OCs) and 14 Organophosphorous (OPs) pesticides.

Results…… shocking

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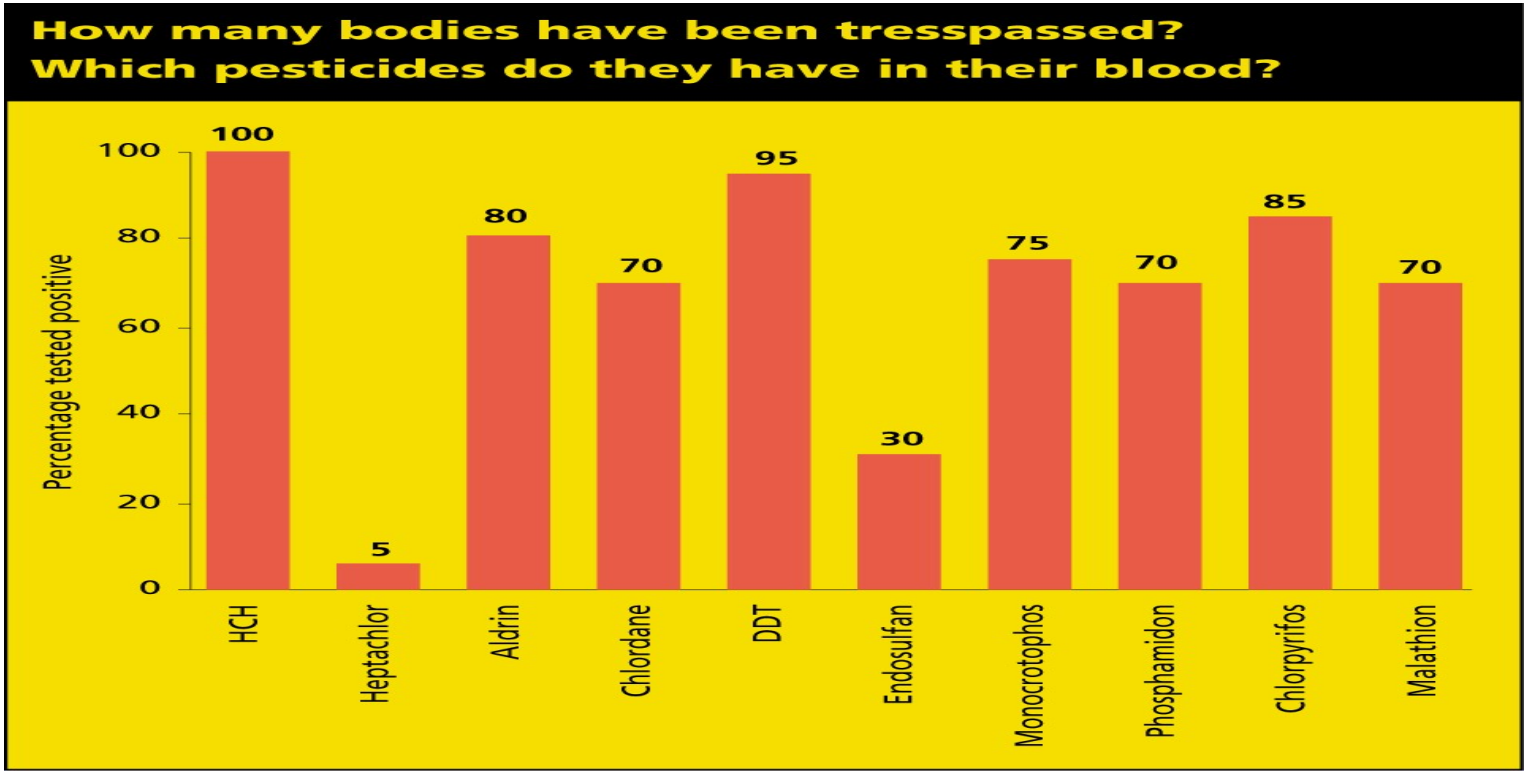
- We found 15 different kinds of pesticides in the 20 blood samples we tested.
- Each blood sample contained a cocktail of 6-13 different pesticides

And we found it in very high amount

Results…… shocking



How much of which pesticides in blood?

	Organochlorine pesticides						Organophosphorous pesticides				Total pesticides
	HCH	Heptachlor	Aldrin	Chlordane	DDT	Endosulfan	Monocrotophos	Phosphamidon	Chlorpyrifos	Malathion	
Average pesticides in Punjab blood samples (mg/l)	0.057	0.0006	0.0062	0.009	0.065	0.0046	0.095	0.037	0.066	0.030	0.370

Results…… shocking

- **But… How High?**

- Levels of certain organochlorine pesticides (OCs) were found to be 15-605 times higher than those found in the blood samples of the US population as tested by the US Centre for Disease Control and Prevention (CDC)

Organochlorines in blood

Horrific

Pesticide residues we found in Punjab are much higher than in the US

	β-HCH	Lindane	Heptachlor	DDE	DDT
Punjab blood samples					
Percentage of sample with pesticides (%)	35	100	5	95	50
Mean concentration of pesticide (ng/g of lipids)	1,254	4537	110	8,996	1,990
Pesticides found in blood by CDC study on US population					
Percentage of sample with pesticides (%)	62	1.7	27	99	26
Mean concentration of pesticide (ng/g of lipids)	9.68	<7.5	<7.5	260	<10.6
Number of times the Punjab samples exceed the pesticides concentration when compared to US samples	129	605	15	35	188

Note: Organochlorine pesticides are lipophilic and concentrate in the body's lipid stores including the lipid in the blood serum. For comparison, levels for these compounds are expressed as per gram of total lipid in the blood serum.

That is not all

- **We also found residues of the newer, and so-called "non-persistent" pesticides – Organophosphates**

- **This is one of the first studies to investigate the presence of Organophosphates in human blood in the country.**

Understanding pesticides

- Organochlorines are older generation pesticides.
  [DDT, BHC, Aldrin]
- Persistent, harmful
  Found everywhere
  [Mother's milk, blood, tissues, food…]
- Regulation started around 70s
  Some were later banned

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NEXT GEN…

Understanding pesticides

- Industry introduces Organophosphorous, ‘gen-next’ pesticides [Monocrotophos, Chlorpyrifos, Malathion]

- Supposedly ‘Safer’ as they are non-persistent

Understanding pesticides

- **But, far more toxic than Organochlorines**

- Monocrotophos, one of the highest used pesticide in the country, has **8 times higher** short-term toxicity than DDT.
- Chloropyrifos, used widely has **46 times higher** long-term toxicity than HCH

- **[Toxicity ignored as believed to be non-persistent!]**

But…

- **We found a supposedly low persistent Organophosphate, monocrotophos in 75% of the blood samples from Punjab**
- **We also found chlorpyrifos, widely used Organophosphate in 85% of samples**
- **70% of the samples also contained two more Organophosphates: phosphamidon and malathion**

Organophosphates

- **Organophosphates constituted more than 60% of the total pesticide residues in the blood samples from Punjab**

- **This finding is disturbing because……**
- **Organophosphates are now getting added in body to the earlier contamination of Organochlorines**
- **Organophosphates have far higher toxicity that the older Organochlorines**

Organophosphates

- **What does it mean in terms of health effect on humans?**

- **Do we know what these pesticides are doing to the people of Punjab?**
- **Do we know if the rates of cancer are higher in Punjab because of these toxins?**

- **No, we don't……**

Organophosphates

- **But what we do know is that the levels of these pesticides we found in blood exceeds what is scientifically considered the "acceptable exposure limits" for humans**

Much more than acceptable

- **Take for example monocrotophos**
- **The short-term exposure limit for the humans set by WHO/FAO for this pesticide is 0.002 mg/kg body weight/day.**
- **An adult weighing 60 kg therefore cannot be safely exposed to more than 0.12 mg/day of monocrotophos**
- **Now, we found the average levels of monocrotophos in Punjab blood samples as 0.095 mg/l.**
- **Considering that average adult has about 5 litres blood, the total amount of monocrotophos in blood alone was 0.475 mg.**
- **This is four times higher than the short-term exposure limit for the whole body.**

Much more than acceptable

- **It was not only for monocrotophos….**
- **The level of chlorpyrifos found in the blood samples alone was more than 3 times the short-term exposure limit**
- **But what if the people we tested were repeatedly exposed to these pesticides (chronic exposure) instead of being exposed for only short-time.**
- **In such a scenario, the results are even more shocking**
- **The average amount of monocrotophos in just the blood of the population we tested was 158 times higher than the long-term exposure limit**

Health implications?

- **We cannot say for certain.**
- **The effects of specific chemicals can vary among individuals.**
- **The science of pesticide in body and its linkage with human health is still developing.**
- **Moreover, we don't carry only one pesticide in our bodies. We carry a cocktail.**

- **And, virtually nothing is known about the combined health impacts of dozens of these chemicals in the body at the same time.**

What are the health implications?

- **What we do know is that toxicological tests (tests on animals) starkly show the clear linkage between pesticides and a range of health problems:**
  from developmental disorders to fertility problems,
  from neurological disorders like Parkinson's disease to cancer.

Organophosphates

- **Studies done on animals also show that even a single, low-level exposure to certain organophosphates, during early brain development, can cause permanent changes in brain chemistry.**

Short term exposure – Newer toxins

- **Chlorpyrifos reduces synthesis of DNA in the developing brain, leading to less brain cells.**
- **If these findings are extrapolated to humans, early childhood exposure to chlorpyrifos may lead to lasting effects on learning, attention, and behaviour.**
- **A 2003 study in New York, found chlorpyrifos and its toxic metabolite chlorphyrifos oxon crossing the placenta barrier.**
  Even unborn babies are unsafe if their mothers are exposed to low levels of these chemicals

No connection. No liability.

- **But we cannot say this for the people of Punjab.**
- **Because death certificates never cite pesticide exposure as a cause of death.**

- **No truth. No connection. No liability.**

What do we do then?

- Slowly, world is moving beyond finding linkages between pesticides and disease they cause. It is no more important.
- It is understood that these toxins will have implications, even if we cannot prove it by scientific means.
- What is more important is to know how much and how many of these chemicals are trespassing human bodies.
- The bottom line is simple: No chemicals can be allowed to trespass our bodies.

Way ahead:Regulate these toxins

- **The UK's Royal Commission on Environmental Pollution in 2003 stated "w*here chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately*"**
- **Many researchers, scientists and NGOs now believe that body burden studies may hold the key to a full-proof system of regulating the use of pesticide and other chemicals**
- **It is no more about testing pesticides in food and then regulating pesticide use.**
- **It is now about testing pesticides in human bodies and then regulating and controlling their use.**

India: Poor regulations

- **Our government has no specific programme for bio-monitoring.**
- **Lack of data. Lack of regulations. Result. Contamination of not just our food and water but our bodies.**
- **Severe implication for future generations**
- **Government must become serious about regulating these toxins**

Monitoring and regulation

- **We must have chemical Trespass law - a law to prevent trespassing of human bodies by chemicals and to hold manufacturers accountable.**
- **We must have a system in place for regular monitoring of pesticides in human bodies for the whole country.**
- **The data generated from these studies must be used for regulating pesticides**
- **Phase out chemicals that are found in large number of people or in higher quantities**
- **This is the only way we can stop poisoning of people.**