Chemicals Compromising Our Children

neurotoxic briefing

THE SILENT PANDEMIC

In Europe, widespread damage to children's brain function has resulted from exposure to neurotoxic chemicals, including lead, mercury, and PCBs. A more precautionary approach is needed to prevent pregnant women and children from being exposed to further chemicals which impair brain development. Current legislation, including the newly agreed EU Regulation (REACH[1]) is still inadequate, despite the fact that studies show that more effective controls could actually save money and bring many social benefits.

The frightening estimate is that 1 in 6 children in the USA now has a developmental disability, which include learning disabilities, attention deficit disorders, and behavioural problems.[2] The numbers for Europe are likely to be roughly comparable. Interacting genetic, environmental, and social factors are important determinants of childhood brain development and function. However, chemicals in the environment are a preventable cause of deficits in brain function in many children.

PAST REGULATORY FAILURE

Failure to control chemicals has resulted in measurable deficits in IQ and attention disorders in children. Compelling data suggest that in Europe the brain development of thousands of children has been affected by exposure to levels of man-made pollutants, called PCBs.[3,4,5] Similarly, it can be concluded that lead and mercury have affected the brain function of a great many children throughout Europe.[6,7,8] For mercury and PCBs, exposure mainly arises from contamination of the food chain, particularly fish. Lead exposure arises from old paints, water supplies, including lead piping and solder, and historically from leaded petrol.

It is a sad fact that the developmental neurotoxic properties of lead, mercury and PCBs were picked up by epidemiology, after the damage to children had been done. Prior testing of these chemicals was inadequate, and a high level of proof was required and therefore widespread exposure and harm to the population at large was not prevented.[9]

Just recently, some 200 eminent scientists from five continents declared that exposure to common chemicals makes babies more likely to develop an array of health problems later in life, including diabetes, attention deficit disorders, prostate cancer, fertility problems, thyroid disorders and even obesity. When foetuses and newborns are exposed to various toxic substances, growth of critical organs and functions can be skewed. In a process called "fetal programming," the children have become susceptible to diseases later in life, and may in some cases pass on the susceptibility to their offspring.[10]

At present, the main strategies to reduce risks and damage to brain development for present and future generations are strong implementation of the EU Environment and Health Action Plan and the WHO Children's Environment and Health Action Plan. Although the EU recently has brought into force the REACH Regulation for industrial chemicals, it requires a number of improvements and assiduous implementation to properly address developmental neurotoxicants.

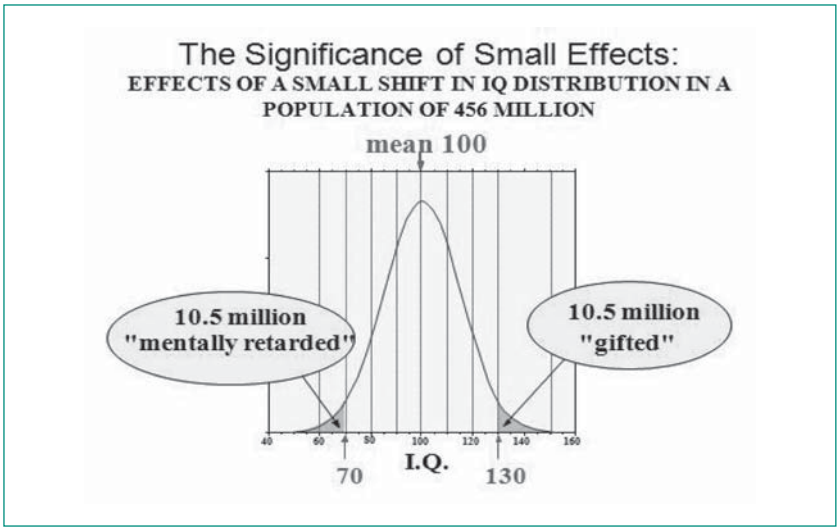
CONSEQUENCES OF INADEQUATE REGULATION

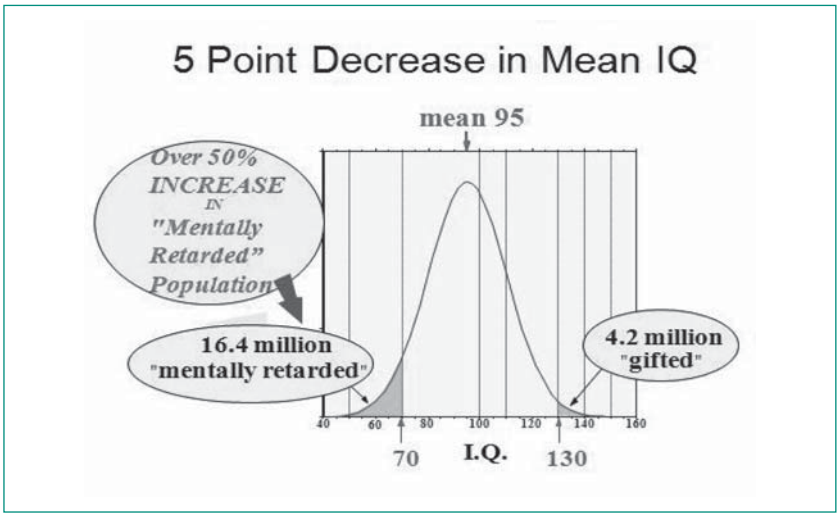
It has been suggested that the wealth of a nation is correlated with developmental health and aggregate intelligence.[11] Unfortunately, chemicals to which there is still some ongoing exposure are known to have caused deficits in IQ and will have resulted in children being thwarted from reaching their full potential.

While a few points deficit in IQ may not be particularly noticeable, the decrease will have profound effects on the population as a whole.

Using as an example a hypothetical population of 456 million, which was the approximate population of the 25 EU Member States in 2004, Graph 1 shows this population with an average IQ of 100. In this case there would be approximately 2.3% of the population with an IQ <70, the score used to define mental retardation. This effectively means there would be 10.5 million retarded and about 10.5 million gifted children.

The second graph shows what happens when the average IQ is decreased by 5 points from 100 to 95. Now, 3.6% of the population, or 16.4 million people have an IQ below 70. This represents more than a 50% increase in the numbers of mentally retarded children. The numbers of gifted children, defined as those with IQs greater than 130, have declined by more than 50% from 10.5 million to 4.2 million. Thus, a small shift in average IQ results in greatly increased need for special education and services, as well as diminished intellectual capacity within the population as a whole.[12]





FINANCIAL COSTS

Action to prevent exposure to developmental neurotoxic chemicals will save billions of euros throughout the EU each year. For the individual over an entire lifetime, deficits in IQ are costly. For example, it has been estimated that the loss of a single IQ point is associated with an average overall reduction in lifetime earnings of 2.39%.[13] When aggregated for a large EU population, the losses are substantial. There are also considerable costs to society, including the costs of providing medical and support services to people with impaired brain function caused by chemicals. Such costs have been estimated in the USA,[14] and equate to around 52.6 billion dollars (=39 billion euros per year). This figure includes the losses of earnings attributable to lead exposure and therapy and care for neurobehavioural disorders caused by other chemical exposures. For the EU (25) the number of children born in 2005 was 4.8 million, as compared to around 4 million in the USA. Even if there is greater spending on medical and support services in the USA compared to Europe, it becomes clear that the costs from lead and other neurotoxicant chemicals in the EU is likely to amount to tens of billions of euros each year. Moreover, this estimate ignores the anguish and suffering of the affected children and parents, and the commensurate financial repercussions that these often entail.

The possibility that chemicals might also interfere with the normal ageing process and contribute to memory deficits in old age should also be a concern.[15] With an increasingly aged population this could also have gross financial and societal repercussions.

INADEQUATE TESTING OF CHEMICALS AND OVERESTIMATES OF 'SAFE LEVELS'

Unfortunately, only a very few chemicals have ever been tested for their ability to de-rail brain development.[16] Current test methods are costly and time consuming, and there is a need to develop better methods to identify chemicals with developmental neurotoxicant properties. Much of the testing may not be adequate to predict the human consequences of long term low level exposures. For example, the

neurotoxic effects of prenatal or early-life exposure to lead, polychlorinated biphenyls, and methylmercury in humans occur at intake levels about three orders of magnitude lower than those predicted from rodent data, and indeed there may be no safe levels.[17] This means that current methods of risk assessment, which extrapolates safe levels for humans from tests on rats and mice, may over-estimate safe levels for humans, and therefore leave people unprotected.[18]

IGNORING WARNING SIGNS

Moreover, even when chemicals have been shown to have developmental neurotoxicant properties in animal experiments, regulatory action is not quickly forthcoming. Take the example of deca-BDE (deca brominated diphenyl ether), which is used as a flame retardant. A Swedish study on mice, reported in 2003 that deca-BDE caused effects on brain development.[19] Then in 2006, another study from a laboratory in the USA also showed that deca-BDE may cause effects on brain function in rodents.[20] But four years since concern about developmental neurotoxicity was first raised, the use of this substance in consumer products is still widespread.

CONCLUSIONS

A more precautionary regulation of chemicals with developmental neurotoxic properties is needed. Such regulatory action needs to employ far greater "assessment factors" or so-called "safety factors" than normally applied when extrapolating from information gleaned in rodent studies to calculate safe levels in humans. The need for greater safety factors is underlined by past experience. Moreover, it might better serve public health if exposure to chemicals with developmental neurotoxic properties was eliminated wherever possible, particularly given the emerging indications that there may be no safe levels. Humans may be particularly sensitive because of the complexity of the human brain and because brain development in humans occurs over a long period. In addition, more chemicals should undergo testing for their effects on behaviour and brain function. Considerable effort is needed to develop additional screens and tests to identify chemicals that can de-rail brain development. Finally, early warning signs should trigger some fast-tracked policy responses, such as provisional restrictions pending further research, which would be in line with the precautionary principle.

SPECIFIC RECOMMENDATIONS FOR ACTIONS TO REDUCE AND ULTIMATELY ELIMINATE EXPOSURE TO DEVELOPMENTAL NEUROTOXINS

The EU and the National Governments across Europe should:

- Swiftly formulate and ensure the broadest possible dissemination of public advice for how vulnerable groups can limit their exposure to the chemicals with known and suspected developmental neurotoxic properties;
- Ensure, through the implementation of REACH and its legislative reviews, the strongest possible protection of public health and the environment, particularly including a focus on developmental neurotoxicity;
- Promote sound chemicals management and control, both internationally at SAICM,[21] and bilaterally through development and trade policy with countries outside the EU;
- To protect children against deficits in brain function, initiate and apply in all chemicals legislation and policy fora greater precaution by anticipating that thresholds for effects from developmental neurotoxicants may be non-existent in humans. At a minimum, there is a need for larger safety factors than currently employed when dealing with animal studies;
- Dedicate sufficient financial and other resources to swiftly develop better screens and test methods to identify chemicals with developmental neuro-toxicant properties;
- Prioritise research projects to protect vulnerable groups such as babies, children and pregnant women, particularly taking into account 'low dose' chemical exposure, the timing and duration of exposures, exposures from multiple sources (e.g. food, air, water) and the combined effects of multiple chemicals (i.e. the cocktail-effect);
- Ensure projects monitoring contaminants in humans, linked with ongoing research to evaluate critical developmental milestones in these monitored children (and also in later-life), are sufficient to pick up effects on brain development in the population.

The World Health Organisation (WHO) should:

- Support, collaborate with, and coordinate the mechanisms and activities among research organizations and their supporting agencies to bring the best scientific evidence into international and national chemical management;
- Disseminate research outcomes related to chemicals and their impacts on human health;
- Raise awareness among vulnerable groups like children, pregnant women and women of childbearing age about the chemicals with developmental neurotoxic properties and their health impacts.

Health professionals can:

- Contribute to the strong REACH implementation at the national level by providing comments, expertise and advice on chemicals and health issues to policy makers, environmental groups working in the field, and the public;
- Identify, and promote the scientific and clinical research which contributes to the identification of the chemicals with developmental neurotoxic properties.

1 REACH is the Regulation concerning the Registration, Evaluation, Authorisation and restriction of CHemicals http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1907:EN:NOT
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12 Schettler et al. (2000). In Harm's Way. Greater Boston Physicians for Social Responsibility adapted from Weiss B (1997). Endocrine disruptors and sexually dimorphic behaviours; a question of heads and tails. Neurotox. 18:581-586.
13 Salkever DS (1995). Environ Res.70(1):1-6.
14 Landrigan PJ, Schechter CB, Lipton JM, Fahs MC, Schwartz J (2002). Environmental pollutants and disease in American children: estimates of morbidity, mortality, and costs for lead poisoning, asthma, cancer, and developmental disabilities. Environ Health Perspect.110(7):721-728. The National Academy of Sciences in the USA estimated the fraction of neuro-behavioural disorders that may be attributed to environmental factors. They considered that 3% were caused directly by toxic environmental exposures, and another 25% caused by interactions between genetic susceptibility and environmental factors, defined very broadly. In the USA, a group of scientists then estimated that within this total 28% caused wholly or partly by environmental factors, some 10% are at least partly caused by *toxic exposures*, not including alcohol or tobacco or drugs of abuse. Looking at mental retardation (excluding the effects of lead), cerebral palsy and autism they came up with a cost figure of some 9.2 billion dollars per year for that proportion caused by toxic chemicals of human origin in environmental media. The estimate includes doctors visits, prescription drugs, hospitalisation, assistive devices, therapy and rehabilitation, long term care, home and car modifications, special education services, home care, productivity losses due to morbidity. For lead, Landrigan and co-workers estimated the cost in the USA at 43.4 billion dollars per year for 5 year olds through their life mostly due to loss of earnings.
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Prepared by:

Gwynne Lyons, CHEM Trust
PO Box 56842, London N21 1YH, United Kingdom
E-mail: gwynne.lyons@chemtrust.org.uk
Website: http://www.chemtrust.org.uk/

Lisette van Vliet, Health and Environment Alliance
28 Boulevard Charlemagne, 1000 Brussels, Belgium
E-mail: info@env-health.org
Website: www.env-health.org

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Chemicals Health Monitor *aims to improve public health by ensuring that key scientific evidence on the links between chemicals and ill-health are translated into policy as quickly as possible. The strategy involves fostering dialogue, sharing perspectives and greater collaboration between policy makers and governments on the one hand and scientific researchers, medical and health professionals, patient groups, environmental organizations and the public on the other. We work to highlight the compelling scientific basis for added controls over certain chemicals; and encourage EU policies that are precautionary and participatory, especially with regard to the implementation of REACH, and the substitution of hazardous chemicals. The project was launched by the Health and Environment Alliance (http://www.env-health.org/) in collaboration with other partner organisations across Europe in March 2007. http://www.chemicalshealthmonitor.org*

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