How the chemical cocktail inside our homes is poisoning our children

WORKING TOGETHER TO CLEAR THE AIR

Jo Immig

National Toxics Network

Total Environment Centre

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April 2005

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Jo Immig is one of Australia's leading campaigners on toxic chemicals. For over a decade she has campaigned to ban dangerous chemicals from the natural environment, around our homes and in agriculture, promoting safer, cleaner alternatives wherever possible.

Jo is deeply concerned about children's exposure to chemicals and its effects on their health. She has authored many articles and several books including: *Toxic Playground: A guide to reducing the chemical load in schools and childcare centres* and *Safer Solutions: Integrated pest management for schools and childcare centres.*

She is an environmental scientist and represents peak environment groups on government committees on pesticides and genetically engineered food. Jo is a passionate and vocal advocate of organic agriculture and eco-living and hopes that future generations will be able to enjoy good health, clean air and water, healthy food and a diverse natural environment.

National Toxics Network

www.oztoxics.org/ntn

The National Toxics Network (NTN) is a community-based network working for pollution reduction, protection of environmental health and environmental justice for all. NTN was first formed in 1993 and since then has grown as a national network to support community and environmental organisations across Australia, New Zealand and the South Pacific.

NTN is involved in a wide range of national and international campaigns including contaminated sites, toxic waste, and industrial pollution. NTN is vocal advocate of community-right-to-know and the precautionary principle and its application in legislation and policy. NTN is the Australian Focal Point for the International Persistent Organic Pollutants (POPs) Elimination Network and hosts the international working group on community monitoring. NTN represents Australian NGOs at many international forums on toxic chemicals.

NTN is actively involved in the Intergovernmental Forum on Chemical Safety (IFCS) providing an Australian focal point for their INFOCAP information and capacity building program. NTN's capacity building arm, Oztoxics, has completed a number of activities including Body Burden Handbook, the Conventions Handbook and the Tools for Healthy Schools project. Through its focus on community capacity building initiatives, NTN supports communities involved in hazardous waste management and environmental health issues.

NTN committee members are involved in a range of national advisory bodies including the Hazardous Waste Reference Group, the Dioxin Consultative Group, the National Industrial Chemicals Notification Assessment Scheme and Australian Pesticides and Veterinary Medicines Authority committees as well as participating in their related technical advisory panels.

In recognition of the importance of children's environmental health issues, NTN has released a briefing paper *Children's Environmental Health – Intergenerational Equity in Action* as part of its major campaign focus on *Children's Health and Persistent Bio-accumulative Toxins (PBTs)* in 2005.

Total Environment Centre

www.tec.org.au

Total Environment Centre (TEC) is a community-based advocacy organisation dedicated to defending the environment. Since its inception in 1972, TEC has campaigned on a wide range of environment issues and also established Australia's most extensive independent toxic chemical advisory service.

A voluntary board is responsible for its operations and funding is via public donations and project specific grants. A short summary of TEC's major achievements with respect to toxic chemical issues follows:

1979 - TEC launched the **Clean Air for Children Campaign** with inner city groups and medical professionals, aiming to eliminate lead from petrol. New national emission control laws have been adopted nationwide to eliminate lead and reduce other emissions in new cars.

1983 - TEC's Toxic Chemicals Committee organised the first national conference on the **Toxic Chemical Load on the Environment and Human Health**. Conferences on the **Health Impacts of Solvents and Chemicals in Schools** in the 1990s broke new ground.

1986 - TEC published the **A-Z of Chemicals in the Home** in conjunction with the Australian Consumer's Association – now in its fourth edition.

1995 - 1999 - 1995 TEC's 10-year campaign resulted in a ban on **organochlorine pesticides** for termite control in Australia. In 1997 TEC lobbied for tighter controls on aerial application of pesticides in rural NSW to curb spray drift and later produced **Clearing the Air - Pesticide Spray Drift Kit**. TEC's 1999 intensive pesticide campaign saw the overhaul of the **NSW Pesticides Act**.

1998 - TEC launched **Toxic Chemicals in Your Environment (TYCE)** a web-based resource for the community on toxic chemicals. TEC prepared **Indoor Air Quality Guidelines for Sydney Olympic Facilities** for Green Games Watch 2000. The Guidelines were adopted by the CSIRO into a Technical Report.

2000 - TEC released **Toxic Playground: A guide to reducing the chemical load in school and childcare centres**. Written by Jo Immig, the book was the first of its kind in Australia and provides an essential resource for teachers, administrators, maintenance staff, parents, child care workers and children to actively set about reducing the chemical load in schools and childcare centres, as well the home and office.

2002 - TEC released **Safer Solutions: integrated pest management for schools**. Written by Jo Immig, the book provides detailed information on implementing safer options for school pest management in order to eliminate the use of dangerous pesticides.

2005 - In partnership with other NGOs, TEC is the recipient of a substantial grant from the NSW Environmental Trust for collaborative environmental education programs over several years on eco-living. A key element of the program will be education on household chemicals and indoor air pollution.

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SUMMARY

We have reached an impasse as a society in the way we manufacture, regulate and use toxic chemicals. Underlying assumptions made by industry and regulators that we can all be exposed to 'safe levels' of toxic chemicals are failing to protect our children's health and the environment.

Some chemicals have been shown to be dangerous at extremely low levels, which previously was not thought possible. There is evidence that toxic and persistent chemicals are now ubiquitous in the environment and that they also contaminate our bodies. Most alarmingly, common chemical pollutants around the home have been found to contaminate the most precious food - breast milk.

There is widespread recognition that children are at greatest risk from these chemical exposures because they are biologically and developmentally more sensitive to the effects of chemicals.

Chemical pollution is known to contribute to preventable childhood diseases such as asthma, other respiratory and behavioural disorders and is also implicated in increases in childhood cancers and birth defects.

Prevention is better than cure

By addressing chemical pollution indoors, our quality of life can improve without foregoing modern conveniences. The best strategy for dealing with indoor air pollution is to not create it in the first place.

Preventing children's exposure to toxic chemicals is the most effective way of protecting their health. Children are the most vulnerable and if we protect them we will go a long way towards protecting the rest of the community.

Medical and scientific research indicates that children have specific needs and vulnerabilities in relation to chemical exposure. Regardless of any remaining uncertainties, this must be translated into child-centred environmental health policy and regulation, with a precautionary and prevention-orientated approach.

Safer products must be identifiable in the marketplace

Chemical pollution inside our homes and buildings is known to be far greater than pollution levels outdoors and we are spending more and more time inside these polluted spaces.

To avoid chemical pollution, citizens literally have to be 'chemical sleuths'. Should we have to do this? Is it possible?

Finding reliable and independent information on the safety of products and their emissions is practically impossible in Australia. One of the fundamental problems is the lack of any assessment and labelling scheme to identify safer products in the marketplace. Another problem is the lack of enforceable indoor air quality standards for all buildings.

Several countries including Finland, Denmark, Norway, Germany and the Netherlands have developed useful product assessment and labelling schemes for indoor air emissions.

Incentives for cleaner products

Safe homes, clean air and pure water should be fundamental rights of all citizens. Industry must be given incentives to strive for cleaner and safer products, which should be made available at affordable prices to everybody, not just niche markets.

Governments must effectively regulate existing toxic chemicals and introduce a new regulatory regime that promotes clean, green chemistry and discourages dangerous chemicals.

Education campaigns urgently needed

While the community is aware of well-publicised indoor pollution problems such as tobacco smoke, lead and asbestos, people are not generally aware of other chemical pollution in their homes such as volatile organic compounds.

There are opportunities for extensive community education campaigns, targeted at health professionals and other relevant groups, to raise awareness about indoor chemical pollution and its effects on children's health.

We need to urgently apply ourselves to this task. The beneficiaries will be our children and future generations as well as the environment and other species that also depend on it for their survival.

RECOMMENDATIONS

1 Introduce child-centred environmental health policy and regulation

In Australia, virtually no government policy or regulation focuses specifically on children's environmental health, particularly in relation to indoor air pollution. NTN and TEC join the global call for a new child-centred paradigm for environmental health policy and regulation.

Specific steps:

- Introduce Commonwealth legislation, with State enabling powers, for a *Children's Environmental Health Protection Act* (in the absence of prompt national action, states should act independently);
- Establish a national level specialist office for Children's Environmental Health;
- Establish a Children's Environmental Health Network; and,
- Review the processes for setting environmental and health standards to ensure they fully take into account children's unique vulnerability to chemical hazards.

2 Adopt a new regulatory framework for chemicals in Australia

The current 'permissive' regulatory framework for chemical management is not adequately protecting children's health because it allows purportedly 'safe levels' of known toxic chemicals to be in our air, water and food. There no safe levels of bio-accumulative chemicals.

Draft European legislation is establishing a new framework for chemical regulation, which has been described as one of the most important initiatives of the European Commission to protect future generations from chemical pollution.

The Environment Protection and Heritage Council National Chemicals Taskforce has identified that one of the greatest challenges in relation to chemical regulation is ensuring the various systems are linked by common principles and coordination mechanisms.

Indoor chemical pollution cannot be adequately addressed unless fundamental changes are made to the way chemicals and products are manufactured and regulated in Australia.

Specific steps:

- Harmonise the Australian regulatory framework for chemicals in line with EU direction for safer chemicals;
- Apply the precautionary principle to existing chemicals which constitute a danger to children's health by adopting programs with requirements and deadlines to achieve the elimination of all persistent and bio-accumulative chemicals and chemical products which are recognised as irreversibly dangerous to children's health; and,
- Apply the substitution principle to ensure where safer chemicals are available, toxic ones are no longer permitted.

3 Sponsor and promote prevention-orientated research

There are a few examples of industry-driven initiatives to reduce hazardous chemical components in products. This piecemeal approach however will not go anywhere near solving the problem of indoor chemical pollution.

Control or elimination of pollutant emissions at the source material is considered the best strategy because it prevents pollution from occurring in the first instance. This approach is preferable to relying on ventilation systems and their increased energy requirements.

Labelling schemes allow low emission products to be identified in the marketplace. Without drivers however, it is unlikely this will happen in any systematic way.

Specific steps:

- Establish an assessment and labelling scheme so that low emission products can be easily identified and promoted in the marketplace;
- Adopt a comprehensive set of enforceable indoor air quality goals across all indoor environments for all chemical pollutants; and,
- Undertake collaborative research projects with health professionals to further examine the impact of chemical pollution indoors on children's health.

4 Undertake extensive community education campaigns

Indoor chemical pollution and its effects on children's health is a complex issue which has not fully entered the consciousness of regulators and the broader community. While awareness is growing and the issue is being reported on more frequently, there is still a long way to go.

Specific steps:

- Undertake targeted education campaigns for the public, health professionals, child-care workers and policy-makers around the preventable nature of environmentally-induced diseases in children; and,
- Undertake targeted education campaigns offering practical, effective and affordable solutions to chemical pollution indoors.

COMMUNITY ACTION ON CHEMICAL POLLUTION

A brief history of chemical campaigns

Toxic chemical pollution knows no boundaries and travels the globe in our air, water, soil and food. Communities pay for this pollution with their health and sometimes their lives.

The environment also bears the 'externalised costs' associated with the tens of thousands of synthetic chemicals, which have become increasingly intertwined in our lives since the 1940s. Many of these man-made chemicals now pose serious threats to our health with their ability to persist in the environment and our bodies, causing damage for many generations.

Environment and community organisations have been actively working to end this toxic pollution for decades. Over the years campaigns have focused on curbing air and water pollution and toxic chemical wastes, as well as exposing the health and environmental dangers and the inadequacy of chemical testing and regulation.

Rachel Carson's pivotal book *Silent Spring* (1962) was a seminal work and alerted the world to the dangers of pesticides and their effects on the natural world, including humans. It inspired many environmentalists and was a call to arms for people to protect the environment from toxic threats.

Another landmark book *Our Stolen Future* (1996) was similarly potent. It warned of the dangers of man-made chemicals and their impacts on fertility, reproduction and intelligence, which have significant implications for future generations.

The hole in the ozone layer showed us how an everyday household product (aerosols with chlorofluorocarbons or CFC propellants) contributed to a planetary wide impact of immense proportions.

Major industrial chemical disasters such as Love Canal[1] and Bhopal[2], serve as stark reminders that it is the entire life cycle of synthetic chemicals that can cause damage to communities and the environment.

Chemical campaigns have focused on banning known toxic chemicals (particularly pesticides like organochlorines such as DDT and dieldrin, and the industrial PCBs), as well as tightening regulatory controls over the manufacture, use and disposal of toxic chemicals. Campaigns have also played a critical role in educating the community about safer alternatives and called for better community engagement processes in the regulation and management of chemicals that impact the quality of our air, water and food.

Animal welfare groups have campaigned on cruelty issues associated with the use of animals in laboratories to test chemicals. They have also raised awareness about the numerous technical and scientific problems associated with animal-based laboratory tests to predict human reactions and environmental consequences.

Often when these cruel animal tests have shown clear evidence of the negative effects of chemicals, the results have been hidden and the chemical industry has continued to grow at an enormous rate.

In the 21st century, global chemical corporations are amongst the most powerful and influential entities in the world.

1 The Love Canal disaster, Niagara Falls USA (1978): Twenty five years after the Hooker Chemical Company stopped using the Love Canal as an industrial dump, it was recognised that 82 different compounds, 11 of them suspected carcinogens, were found to be percolating upward through the soil, their drum containers rotting and leaching their contents into the backyards and basements of 100 homes and a public school built on the banks of the canal. Residents were eventually evacuated, but not before the community suffered considerable health problems including birth defects and cancers. http://www.epa.gov/history/topics/lovecanal/01.htm

2 The Bhopal disaster India (1984): The Union Carbide plant began leaking 27 tons of the deadly gas methyl isocynate used in the manufacture of pesticides, plastics and polyurethane foam. None of the six safety systems designed to contain such a leak were operational, allowing the gas to spread throughout the city of Bhopal. Half a million people were exposed to the gas and 20,000 have died to date as a result of their exposure. www.bhopal.net

International NGOs

For international non-government organisations such as Greenpeace, Friends of the Earth (FOE) and the World Wildlife Fund (WWF), ridding the world of toxic chemicals and promoting green chemistry is part of core campaign work.

WWF's *Detox Campaign* currently includes a focus on household chemicals. FOE-UK is running a *Safer Chemicals* campaign with an emphasis on household reduction of toxic chemicals, especially around children. Greenpeace International's *Toxic Free Future* campaign focuses on toxic trade, hazardous incineration, reducing chemicals around the home, and in *utero* exposure to chemicals.

Australian NGOs

In Australia, the National Toxics Network (NTN) and Total Environment Centre (TEC) have played a key role in toxic chemical campaigns for several decades. Along with other NGOs, successful campaigns in specific areas have helped to achieve a safer environment for children by stopping lead in petrol, banning most organochlorine pesticides, stopping toxic waste incineration, helping to relocate preschools situated on contaminated land and raising awareness about the dangers of unflued gas heating in classrooms.

TEC has specifically contributed to the debate on indoor air pollution with the development of *Indoor Air Quality Guidelines for Sydney Olympic Facilities*, which were subsequently taken up by the CSIRO as a technical document.[3]

TEC gave evidence to the NSW Government's *Inquiry into Sick Building Syndrome*[4] and emphasised the vulnerability of children to indoor air pollution.

TEC was also instrumental in the review of the *NSW Pesticides Act* and will continue to campaign to ensure measures are introduced to protect children from pesticide exposure.

In collaboration with the Australian Consumer's Association, TEC recently published the fourth edition of the widely read *A-Z of Chemicals in the Home*, which lists many sources of chemical pollution in our homes including the dangers they pose to our health and the environment along with suggestions for safer alternatives.[5]

TEC is currently a partner in a collaborative project funded by the NSW Environmental Trust. The broad project aim is to embark on a community education campaign for eco-living including waste and energy reduction as well as hazardous household chemical reduction.

In the late 1990s, NTN participated in the Commonwealth Government's air toxics forums and assisted in the development of the *2001 State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia.*[6]

NTN represented national environment organisations in the consultative forums for the National Environment Protection Measure on Air Toxics. As well, NTN experts joined the National Taskforce on Risk Assessment that developed the assessment procedures for air toxics.

NTN's focus on protecting children's health led to the development of the briefing paper *Children's Environmental Health: Intergenerational Equity in Action* as well as the *Body Burden Handbook* to empower communities to take action to protect children.

3 J. Immig, S. Rish, & S. Brown (1997), *Indoor Air Quality Guidelines for Sydney Olympic Facilities,* CSIRO BCE Technical Report TR 97/3
4 NSW Legislative Assembly Inquiry into Sick Building Syndrome (1991), http://www.parliament.nsw.gov.au/prod/parlment/committee.nsf/4bb1ef733c6a672cca256e420066a938/c73bb66b35386533ca256aa80007541d!OpenDocument
5 *Total Environment Centre, A-Z Chemicals in the Home,* 4th Ed. ISBN: 1 920705 11 2 Choice Books online http://www.choice.com.au/viewProduct.aspx?sku=AZC4
6 *State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia* (2001), Environment Australia ISBN 0642547394

Critique of regulatory framework

The Environment Protection and Heritage Council (EPHC) National Chemicals Taskforce describes the institutional and legislative framework for chemical management in Australia as 'complex'.

The complexity arises from the maze of assessment and registration systems that have developed covering industrial, agricultural and veterinary, therapeutic and food additive chemicals. Australia also has national frameworks for managing chemical risks in transport and workplaces; setting residue standards in food and produce; limiting access to certain poisons; and managing aspects of environmental quality and monitoring.

According to the Taskforce Scoping Paper[7]: *"The challenge is to ensure these systems are linked by common principles and coordination mechanisms that reduce the complexity where possible, avoid duplication of effort, provide mutually reinforcing feedback, and deliver consistent outcomes for human health, the environment and trade".*

The Taskforce also concluded that current management frameworks could be more effectively assessed if there were better feedback loops and understanding of chemical impacts in the Australian environment.

Community experience

The community has first hand experience of the complexities of the chemical regulation system in Australia. NGOs have fielded thousands of public enquiries about chemicals ranging from toxicological issues and emerging new health concerns through to basic matters such as to whom to take their concerns and the lack of process and feedback mechanisms in place to deal with the issues raised.

While some agencies have developed community consultation committees and others have put in place better processes for consultation, there is still an overwhelming sense that community concerns largely fall on deaf ears. It is a fair assessment that a section of the community is utterly frustrated with the apparent lack of response by governments to chemical pollution problems and is fed up with contributing to processes that do not lead to real changes.

While the regulatory regime is frequently reviewed for its 'efficiencies' and 'competitiveness' in terms of industry's needs, it is rarely reviewed for its ability to meet the broader community's needs, adding to the perception of a bias toward industry.

The fact that some regulatory agencies such as the Australian Pesticides and Veterinary Medicines Authority (APVMA) are entirely funded by industry-cost recovery programs, with no core funds provided by government for health and environmental programs, is seen as a major problem by the community in terms of capture and lack of accountability.

Improvements in chemical regulation are often driven by disasters rather than proactive policy and regulatory decisions. Trade concerns appear to outweigh environmental and health concerns. When chemical trespass and pollution occurs, the culprits tend to get off lightly, while the broader community and the environment continue to bear the costs.

The community contributes to achieving better outcomes by joining committees, making submissions and participating in forums, often at their own expense. NGOs have been the driving force behind community chemical education programs and have provided an invaluable service often under hostile circumstances.

While the community is expressing genuine concerns about chemical pollution and calling on governments to act, this is not being reflected in the way that governments are approaching chemical regulation in Australia.

The global nature of some chemical pollution requires a global response, as with CFCs, the trade in toxic waste, or the Stockholm Convention on POPs for instance. NTN has been particularly successful in representing Australia at international meetings to further global approaches to chemical pollution, ensuring the Australian Government fulfils its international obligations.

7 Environmental Protection and Heritage Council (EPHC), National Chemicals Taskforce (2003), *Towards Ecologically Sustainable Management of Chemicals in Australia Scoping Paper,* http://www.ephc.gov.au/ephc/chemicals_mgt.html

Indoor chemical pollution by contrast is a more local problem and the community does have some degree of control over it in their own homes, but often very limited control in public places or workplaces, including schools and child-care centres. The safer services and products currently available are fewer and harder to find and identify, and are often more expensive. Many are still at the niche stage of marketing and are not aimed at the mainstream.

In order to bring the indoor air pollution issue to the mainstream, higher order problems need to be tackled. The risk assessment and risk management paradigm on which the chemical regulatory regime is based, does not provide an effective framework for fast-tracking safer chemicals or for quickly getting rid of toxic chemicals. It is a slow and fragmented system that clearly is not protecting community health or the environment. It permits ongoing exposure to 'low doses' of chemicals because it is based on 'exposure standards', 'tolerance levels' and 'acceptable daily intakes' of toxic chemicals.

European reforms for chemical regulation

Legislation proposed by the European Union (EU) to overhaul chemical regulation provides a new framework to rethink the way chemicals are regulated in Australia.

In 2001, the European Commission adopted a White Paper[8] setting out a strategy for reform of the chemical regulation process in Europe. An objective of the new *Community Policy for Chemicals* is to ensure a high level of protection for human health and the environment. The proposal is to bring in a new system to register and authorise chemicals called **REACH**, which stands for **R**egistration, **E**valuation and **A**uthorisation of **C**hemicals.

Commenting on the announcement of the proposal, Environment Commissioner Margot Wallström said: *"This is one of the most important initiatives the Commission has taken in the context of sustainable development. We have decided on a step-by-step approach to phase out and substitute the most dangerous substances – the ones that cause cancer, accumulate in our bodies and in our environment and affect our ability to reproduce. This decision is crucial for future generations".*

The Stockholm Convention on Persistent Organic Pollutants

The objective of the *Stockholm Convention on Persistent Organic Pollutants 2001* is to protect human health and the environment from persistent organic pollutants or POPs.

POPs include the organochlorine pesticides; DDT, endrin, dieldrin, aldrin, chlordane, toxaphene, heptachlor, mirex, hexachlorobenzene; and the industrial chemicals and by-products; PCBs, dioxins and furans.

These initial twelve chemicals, the 'poisons without passports' were chosen because they have the common hazardous characteristics of toxicity, persistence and bioaccumulation, and are capable of travelling vast distances via water and air.

The Convention aims to eliminate the production, use and emissions of POPs while preventing the introduction of new chemicals with POP-like characteristics and ensuring the environmentally sound destruction of POPs waste stockpiles.

The Convention sets out the actions to be taken by parties to reduce and where feasible, eliminate releases of byproduct POPs chemicals. Technical and financial assistance is offered to developing country parties to help implement the Stockholm Convention.[9]

8 White Paper on the *Strategy for a Future Chemicals Policy,* http://europa.eu.int/comm/environment/chemicals/whitepaper.htm
9 For further information refer to the *Conventions Handbook*, http://www.oztoxics.org/waigani/pops_c4.html

Under REACH chemical producers would be obliged to send a registration dossier containing safety data to a central chemicals agency for all chemicals produced in quantities above one tonne a year. Less information is required the lower the tonnage of chemicals produced, with basic information required on 1-10 tonne chemicals.

Experts would evaluate safety data for higher volume chemicals and other chemicals of concern. Chemicals of very high concern would be phased out, and replaced by safer alternatives, unless industry can show 'adequate control' of the risk from their use or that their 'socio-economic' value outweighed the risks.

Under REACH chemicals of 'very high concern' are:

- Carcinogens, mutagens and reproductive toxins;
- Persistent bio-accumulative and toxic;
- Very persistent and very bio-accumulative; and
- Others such as endocrine disrupters

An independent study into the impacts of the new chemicals policy on environment and health[10], found four potential advantages of REACH over the current EU regulatory system:

- By assessing the properties of substances and thereby making information available more quickly, it has the potential to identify a hazard before (substantial) damage occurs, rather than waiting for monitoring (which is slow and under funded) to provide evidence of harm;
- By providing data in a systematic manner, it enables risks to be assessed rigorously, allowing effective risk management measures to be identified;
- The availability of information on risks enables industry (chemicals manufacturers and downstream users) to take voluntary action in response to stakeholder pressure and/or their own policies; and,
- It provides a basis for quicker regulatory action for the most hazardous substances.

Substitution principle

Some NGOs argue that **REACH** might not go far enough to include measures that will move us away from a 'permissive regime'. As it stands the draft legislation continues with 'adequate control' as the regulatory paradigm and continues human exposure to certain 'tolerable levels' of chemicals that may cause cancer, or genetic damage, endocrine disrupting chemicals and substances that build up in our bodies.

What is needed is a regime that substitutes the safest chemical possible and doesn't permit the population to be exposed to any levels of known toxic chemicals.

This proposal is being described as the *substitution principle* and is defined as *"the substitution of hazardous substances by less hazardous substances or preferably non-hazardous substances where such alternatives are available"*[11].

In practice it means that if a product that uses a hazardous chemical can be manufactured using a safer alternative, at a reasonable cost, the hazardous substance will no longer be permitted for that use.

This may just seem like common sense, but currently things do not work that way. Many unnecessary hazardous substances are used, simply because there is no legislative or economic imperative for substitution to take place systematically.

As a basis for protection of human health and the environment from chemicals of concern, the substitution principle has many advantages:

- It provides a stimulus and direction for innovation. Governments need not prescribe particular alternatives, but rather they define criteria to guide the identification of alternatives;
- It implements the *precautionary principle;*
- It avoids the 'paralysis-by-analysis' syndrome with respect to the thousands of chemicals currently on the market which haven't been tested; and,
- Provides stimulus for Clean Production and sustainable product and system design.

10 *The Impact of the New Chemicals Policy on Health and the Environment Final Report*, June 2003 , prepared for the European Commission Environment Directorate-General, RPA and BRE Environment, http://europa.eu.int/comm/environment/chemicals/reach.htm

11 *Safer Chemicals within Reach: Using the Substitution Principle to Drive Green Chemistry*, REACH Report prepared for the Greenpeace Environmental Trust By Clean Production Action, www.greenpeace.org/international_en/ multimedia/download/1/327507/0/Substitution_Report.pdf -

Position on chemical regulation in Australia

Restoring public confidence in chemical regulation in Australia is major challenge for regulators. By and large the community perceives that regulators are here for industry and do not seriously address community and environmental concerns.

Hundreds of new chemical compounds are constantly being formulated and there is a plethora of older ones still around which have not been adequately tested.

NTN and TEC believe there is a significant and urgent problem with the overload of synthetic chemicals in our lives and their impacts on children in particular. The current regulatory regime is not adequate and cannot effectively manage the problem.

The chemical-by-chemical risk-based approach has severe limitations and doesn't address the root causes of why toxic chemicals and products continue to be freely manufactured and used in our society. It is currently impossible for the broader community to make choices to significantly reduce their exposure to indoor air pollution through product choice alone.

The risk philosophy underpinning regulation continues to permit exposure to 'tolerable limits' of dangerous chemicals. This 'disperse and dilute' model completely breaks down in the case of persistent and bio-accumulative chemicals where exposures just get bigger as they build up in our bodies and the environment.

The regulatory regime does not adequately take into account the unique sensitivity of children to chemical exposures and has failed to implement the *precautionary principle and intergenerational equity* as required under Commonwealth policy and legislation. We need a new regime that promotes clean, green chemistry and penalises toxic chemicals.

NTN and TEC advocate that we need to shift from a 'permissive regime' to a 'preventative regime' so that the safest chemicals can be fast tracked and dangerous chemicals quickly removed from the marketplace.

We also need effective community education campaigns and incentives for industry to find safer and cleaner chemicals and processes for the entire community, not just niche markets. Addressing the fragmentation between agencies and making linkages between health monitoring and environmental pollution will also be a challenge.

CHEMICAL POLLUTION INSIDE OUR HOMES

Outside air pollution is a problem most people are familiar with, but the issue of chemical pollution inside has only recently caught people's attention.

Most people naturally feel being indoors provides a safe haven from the outside world; it is a place to shelter and protect our selves from the dangers outside.

Who could ever imagine that the air inside our homes, workplaces, schools and public places is perhaps some of the most polluted air we will ever breathe and that it poses a serious threat to our health, particularly the health of our children and future generations. Inside there are other sources of indoor air pollution including mould and dust mites.

It is now well documented that children are uniquely vulnerable to the effects of chemical pollution and that their exposure to it is partly responsible for increasing rates of chronic childhood diseases such as asthma and allergies, cancers and birth defects.

Many people would be familiar with the health effects of cigarette pollution and regulations put in place to curb it. This issue has contributed enormously to the community's awareness of indoor pollution and our right to breathe clean air. It was not all that long ago that people were exposed to cigarette pollution on public transport, in public buildings and their workplaces. A significant number of people still smoke in their homes and cars while children are present.

The community is also aware of the impacts of lead exposure on children's health. Widely used in petrol, household paints and other products in the past, but now heavily restricted, the legacy of lead contamination and its damage to children's health will unfortunately be around for generations. Asbestos is another widely used material that has turned out to be a killer whose effects will be felt for many years to come.

One group of chemicals identified as Persistent Organic Pollutants (POPs) because of their ability to accumulate in the environment and our bodies and cause harm are subject to a global convention to phase out their manufacture and use *(see The Stockholm Convention on Persistent Organic Pollutants, page 12).*

Another group are termed persistent bio-accumulative toxins (PBTs) and include the recently emerged priority environmental pollutants, perfluoroalkyl sulfonamides (PFASs). A pilot survey of PFASs in Canadian homes sponsored in part by the Canadian health authority showed that PFASs, which are extensively used in household products such as surface treatments for fabric, upholstery, carpet, paper and leather, were found in indoor environments in concentrations up to 100 times greater than outdoor levels.[12]

Time and again there are examples of chemicals once proclaimed 'safe', which have turned out to cause serious health effects and damage to the environment. A body of evidence continues to grow which strongly implicates exposure to the 'chemical cocktail' inside our homes and workplaces, in the food we eat, and in the natural environment, with profound effects on our health, especially our children.

What other toxic time bombs are polluting our indoor air and making children sick?

What action is needed to address this emerging public health catastrophe?

12 Shoeib, M et al., *A Survey of Perfluoroalkyl sulfonamides in indoor and outdoor air using passive air samplers,* Organohalogen Compounds, Vol 66 (2004).

How dangerous chemicals got inside our homes and our bodies

Before the mid 20th century, exposure to toxic chemicals and pollutants was gross and visible. Modern exposure by contrast is insidious and invisible. There are now tens of thousands of synthetic chemicals in our homes and natural environment, largely introduced by industry since the 1940s.

Between 1930 and 2000 global production of man-made chemicals increased from 1 million to 400 million tonnes each year.[13] This is a staggering increase in the volume and types of chemicals for our bodies and the environment to detoxify over such a short period of time.

It is estimated that less than half of all industrial chemicals in common use have ever undergone basic testing for their health and environmental effects. Yet, we are all exposed to these untested chemicals as residues in our food, water and air in an uncontrolled 'experiment' on our health.

Government authorities and industry are often quick to reassure the community that chemicals are rigorously assessed and residues kept at 'safe' levels that pose no threats. Unfortunately, the chemical assessment methods themselves, and their underlying assumptions, are proving incapable of protecting children's health. Worse still, it appears some chemical companies have been withholding information about the dangers their chemicals pose to our health and the environment.

Endocrine disrupters a significant threat

Independent scientists have discovered that some chemicals are in fact highly toxic at extremely low levels, which previously was not thought possible.

Phthalates, a family of chemicals found in commonly-used plastics such as polyvinyl chloride (PVC) that are used to make plastic flexible, have been found to damage the endocrine (hormonal) system of animals at extremely low levels. There is justifiable concern that these chemicals, and many other suspected chemicals, could be significantly impacting on fertility and may also be promoting the development of cancers and other developmental diseases.

In a cautious global assessment of the science on endocrine disruption, the World Health Organisation and the US National Institute of Environmental Health Sciences conclude that the breadth of evidence from laboratory, wildlife and human studies justifies concerns about the possible human health impacts of endocrine disrupting chemicals.[14]

Such a profound and pervasive threat to our children's future requires decisive action by government, industry and the community to halt any further damage. In short, it requires a fundamental change in the way we regulate and manufacture chemicals and the way we live our lives in the 21st century.

Is it 'safe' because it is sold in the supermarket?

Anyone who has spent time answering public inquiries about chemicals would be familiar with the misconception that products on supermarket shelves are 'safe'. People genuinely believe that governments would not allow the community to be exposed to dangerous chemicals, let alone permit toxic products to be sold in shops and supermarkets.

You do not have to look far to find examples of dangerous chemicals we get exposed to everyday. Tobacco smoke, a significant indoor air pollutant, causes cancer and harms babies and foetuses, but cigarettes are still legally sold, albeit with warnings, and people are still allowed to smoke unrestricted around children in their cars and homes.

Formaldehyde, a suspected carcinogen and sensitiser, is widely used in composite wood products such as particleboard, plywood, and fiberboard, glues and adhesives, permanent press fabrics, paper product coatings, and certain insulation materials. It off-gases for many months and is a major contributor to indoor air pollution. It is especially dangerous because people generally can't detect it via smell.

13 Toxic Chemicals a Threat to Wildlife and Humans, WWF http://www.panda.org/campaign/detox/the_problem/
14 Our Stolen Future http://www.ourstolenfuture.org/Consensus/2002-04niehswho.htm

Benzene, an aromatic compound formed during oil refining, is recognised as a class one cancer-causing chemical by the International Agency for Research on Cancer[15]. It is linked with leukaemia in children and we get exposed to it every time we put petrol in the car, breath exhaust fumes and drive in traffic. It is highly unlikely petrol will be banned in the near future, although in some countries measures have been taken to reduce exposure to it such as hoods on petrol pumps or stricter requirements for emissions from cars.

Many common household products such as rubber glue, hairspray, paint thinners, felt-tip pens, household cleaners and correction fluids can contain volatile chemicals that may be toxic during normal use and pose risks for children and the unborn.

Some household products are also intentionally abused, often by young people, by inhaling or 'huffing' them to get high. Inhalant abuse is a significant health risk for children, and has been fatal on many occasions. Inhalant abuse by teenagers is particularly concerning because of the ready access to a host of dangerous everyday products from supermarkets and hardware stores. Chronic inhalant abuse can cause brain damage, hearing loss, bone marrow damage, liver and kidney damage and sudden death.[16]

"Where chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately".

– UK Royal Commission on Environmental Pollution, 2003[17]

Chemicals contaminate breast milk

Perhaps the most disturbing evidence that synthetic chemicals are severely impacting the health of future generations is their confirmed presence in the most precious and vital of all foods – breast milk.

Because of the way some chemicals bind to fatty tissues, measurable concentrations can build up and eventually work their way into breast milk when the body calls on fat supplies during lactation. This is something our grandmothers never had to face and there is no doubt that children today carry a far greater chemical load than any previous generation, partly as a result of ingesting chemicals via breast milk. Despite this potential contamination, it is important to acknowledge that breast-feeding is still far better for the baby's long-term health than formulas.

Not all pollutants bio-accumulate, but some groups of chemicals do such as the persistent organic pollutants (POPs). They can persist for years in the environment and in the human body. Scientists have found that levels of brominated flame retardants in breast milk have increased markedly over the last quarter of a century, while levels of banned chemicals such as DDT and other organochlorine pesticides have reduced *(see Toxic fire retardants discovered in dust taken from computers in offices and schools, page 19)*. The important point here is that banning dangerous and persistent chemicals does work and has measurable benefits.

Another example is the European restriction of polybrominated diphenyl ethers (PBDEs) and the subsequent reduced concentrations of PBDEs in breast milk compared with levels in Australia. On a worldwide basis, the levels of PBDE compounds detected in breast milk in Australia are higher than those levels observed in Europe and Japan but lower than those observed in North America and Canada.[18]

Organic solvents, which are ubiquitous in many indoor environments, have also been detected in human breast milk. Solvents are readily found in paints, varnishes, thinners, dry-cleaning fluids, glues, and degreasers used around the home. Benzene, chloroform, methylene chloride, styrene, perchloroethylene, toluene, trichloroethylene, 1,1,1- trichloroethane and xylene have all been found to contaminate breast milk.[19]

15 International Agency for Research on Cancer http://www-cie.iarc.fr/htdocs/monographs/suppl7/benzene.html
16 *Household Inhalants Pose Danger,* David Van Horn, http://www.healthatoz.com/healthatoz/Atoz/dc/caz/suba/tnsa/alert05122001.jsp
17 UK Royal Commission on Environmental Pollution (2003), *Chemicals in Products: Safeguarding the Environment and Human Health*, http://www.rcep.org.uk/chreport.htm
18 *Organochlorine Pesticides (OCPs) and Polybrominated Diphenyl Ethers (PBDEs) in the Australian Population: Levels in Human Milk*, Environment Protection and Heritage Council of Australia and New Zealand, January 2005 ISBN 0 642 32384 4
19 Natural Resources Defence Council, *Healthy Milk Healthy Baby* http://www.nrdc.org/breastmilk/default.asp

A breakdown product of the widely used antibacterial chemical triclosan, found in toothpastes, deodorants, soaps, clothing and plastic kitchenware has also been found in human breast milk.[20]

There are no 'safe' levels for chemicals that find their way into breast milk and are in turn passed on to the next generation. Contamination of breast milk is a significant indicator that something is seriously wrong with the way chemicals are manufactured and regulated.

Chemicals contaminate our blood

The world's first comprehensive survey on the concentrations of a range of everyday chemicals in blood samples was recently undertaken by WWF-UK in collaboration with the Cooperative Bank. Blood was tested from 47 volunteers from 17 European countries, comprising 39 Members of the European Parliament (MEPs), 4 Observers from Accession Countries,1 former MEP and 3 WWF staff members.

The blood samples were analysed for 101 predominantly persistent, bio-accumulative and toxic man-made chemicals, including: 12 organochlorine pesticides (including DDT and lindane); 45 poly chlorinated biphenyls (PCBs); 21 polybrominated diphenyl ether (PBDE) flame retardants (including those found in the commercially traded penta-, octa- and deca-BDE-flame retardant formulations); 2 other brominated flame retardants, hexabromocyclododecane (HBCD), Tetrabromobisphenol A (TBBP-A); 8 phthalates; and, 13 perfluorinated chemicals.

Whilst many of these chemicals have been banned, many others are of ongoing concern because they are still found in everyday products.

Every volunteer tested was contaminated by a cocktail of hazardous chemicals from each of the five chemical groups tested. Thirteen chemicals were found in every single person tested (for that chemical).

The chemical found in the highest concentration and the highest median concentration in whole blood was the phthalate DEHP (Di Ethyl Hexyl Phthalate). DEHP is an endocrine disrupter and has been identified as a reproductive toxicant.

The chemical found in the highest concentration in blood serum was the deca-BDE – a brominated flame retardant, whilst that found with the highest median concentration was p,p' - DDE (a DDT metabolite).[21]

Plasticisers found in indoor air

"Di Ethyl Hexyl Phthalate (DEHP) is a plasticiser found in plastic products such as wall coverings, tablecloths, floor tiles, furniture upholstery, shower curtains, garden hoses, swimming pool liners, rainwear, baby pants, dolls, some toys, shoes, automobile upholstery and tops, packaging film and sheets, sheathing for wire and cable, medical tubing, and blood storage bags.

DEHP can be released in small amounts to indoor air. Food can also contain DEHP and it is likely that DEHP is transferred by skin contact with plastic clothing or other articles that contain it. Children are further exposed to DEHP by sucking on or skin contact with plastic toys and pacifiers that contain DEHP." [22]

20 ENDS report 349, Feb 2004s, pp13-14 Balmer, M et al., 2004, Env. Sci. & Tech, Vol 38, pp390-395.
21 *Chemical Check Up: An analysis of chemicals in the blood of Members of the European Parliament*, WWF-UK DetoX Campaign and The Cooperative Bank 2004, www.panda.org/downloads/europe/checkupmain.pdf
22 Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Di(2-ethylhexyl)phthalate,* (DEHP) http://www.atsdr.cdc.gov/toxprofiles/tp9.html

Toxic fire retardants discovered in dust taken from computers in offices and schools

"In the first nationwide tests [in the USA] for brominated flame retardants in dust swiped from computers, the Computer Take-Back Campaign (CTBC) and Clean Production Action (CPA) found these neuro-toxic chemicals on every computer sampled.

The highest levels found were a form of polybrominated diphenyl ethers (PBDEs) called deca-BDE, one of the most widely used fire retardant chemicals in the electronics industry. These results indicate that there is exposure to certain brominated flame retardants and that computers are likely to be a significant source of deca-BDE exposure in the dust of homes, offices, schools, and businesses. There is evidence that these chemicals could be hazardous to human health. All exposures, no matter how small, are of concern because deca-BDE is a bio-accumulative substance. This means that multiple exposures to low levels of deca-BDE add up over time and build up in the body. There is no safe dose associated with these chemicals.

Computer manufacturers can prevent unnecessary risks by using safer alternatives that meet stringent fire standards and are less harmful to human health and the environment.

Of grave concern is the research showing that women in North America have the highest levels globally of these chemicals in their breast milk and evidence continues to mount about their effect on the neurological and endocrine systems. These levels are doubling every two to five years in the North American population.

About 40% of PBDEs are used in the outer casings of computers, printers and televisions and by far the largest volume PBDE mixture used as a flame retardant has been deca-BDE. Two of the three forms of PBDEs - penta-and octa-BDE - will be taken off the market by the end of 2004, but deca-BDE and other brominated flame retardants will continue to be used in the United States, unless action is taken by state and federal governments." [23]

23 Extract from the Executive Summary, *Brominated Flame Retardants in Dust on Computers: The Case for Safer Chemicals and Better Computer Design,* Alexandra McPherson, Beverley Thorpe and Ann Blake, Computer Take-Back Campaign (CTBC) and Clean Production Action (CPA), June 2004. http://www.cleanproduction.org/AAbase/default.htm

INTERNATIONAL RECOGNITION OF CHILDREN'S VULNERABILITY TO CHEMICAL POLLUTION

A number of international agencies have recently highlighted the significance of environmental pollution and its impact on children's health.

The Third (1999) and Fourth (2004) Ministerial Conferences by World Health Organisation (WHO) Member States on Environment and Health[24] recognised children's unique vulnerability to chemicals and the need for exposure prevention to protect children from environmental threats to their health. The Fourth conference concluded that indoor air pollution[25], lead and unsafe drinking water are some of the major threats to children's health.[26]

The Children's Health and Environment program of the WHO states: *"Increasing hazards where children live are raising concern about the effects of the deterioration of the environment on their health. Children have a special vulnerability to environmental pollution, and their specific exposure patterns make them subject to higher exposures."*[27]

The Fourth Session of the Intergovernmental Forum on Chemical Safety in 2003 focused on "Protecting Children from Harmful Chemical Exposures, Chemical Safety and Children's Health". The Forum reported that children are more sensitive to chemical exposures and that household chemicals play a role in the development of environmentally related diseases in children.[28]

Comparative risk studies performed by the US Environment Protection Agency and its Science Advisory Board have consistently ranked indoor air pollution among the top five environmental risks to public health.[29]

Why children are uniquely sensitive to chemical exposures

It has been assumed in toxicology that children are 'little adults' in terms of their response to chemical exposures. The rationale is that their reactions to chemical exposures will be the same as adults but will occur at lower doses. 'Safety margins' are sometimes factored into assessments to compensate for the difference, but this is inconsistent from country to country.

Chlorpyrifos still used in Australian homes despite US ban

"In 2000, the US EPA moved to ban the domestic use of chlorpyrifos, a common pesticide used for termite treatment in homes, hospitals and preschools. Certain agricultural applications on foods that are heavily consumed by children were also restricted.

These regulatory actions were the result of the US EPA taking a precautionary approach after its re-evaluation of the chemical's potential risk to children, despite the United States not officially adopting the precautionary principle as a general basis for risk regulation.

In Australia, notwithstanding its own inclusion of the precautionary principle in policy and legislation, regulatory authorities did not follow the US example because Australia's risk assessment was not required to build in the same extra ten-fold safety/uncertainty factor to protect children."[30]

24 WHO Ministerial Conferences on Environment and Health http://www.euro.who.int/eprise/main/WHO/progs/bud/Home
25 The IAP threats to children in developing countries differ from those in industrialised countries.
26 *Burden of disease attributable to selected environmental factors and injuries among Europe's children and adolescents* by Francesca Valent, d'Anna Little, Giorgio Tamburini, Fabio Barbone, WHO Regional Office for Europe ISBN 92 4 159190 0 World Health Organisation 2004
27 The WHO Children's Health and Environment program http://www.euro.who.int/eprise/main/WHO/progs/che/Home
28 Fourth Session of the Intergovernmental Forum on Chemical Safety, Bangkok 2003 http://www.epha.org/a/871
29 United States Environment Protection Agency http://www.epa.gov/iaq/pubs/targetng.html
30 *The Precautionary Principle Gets Real,* National Toxics Network, http://www.oztoxics.org/ntn/indexfront.html

It is understood in scientific and medical circles that children have a special vulnerability to hazardous chemicals. Protecting their health should become the foundation of chemical regulation and assessment programs, in order to achieve the best protection of public health. By protecting children's health first, it is likely that the health of the rest of the community will also be protected.[30]

The United Nations and the World Health Organisation recognise that children's biology, physiology and behaviour make them uniquely vulnerable to the effects of chemical exposure. The following is a summary of some of the reasons why children are more sensitive to chemical exposure.[31]

Greater chemical load

- The body burden of chemicals of today's children is the greatest it has ever been in history. It is estimated that every child carries the burden of 300 or more chemicals that could not have been present in their grandparents.
- Many chemicals accumulate in our bodies and the environment without enzymes to break down these novel molecular structures. These accumulated chemicals build up in the body with increasing age.
- Some bio-accumulative chemicals such as dioxins and polychlorinated biphenyls (PCBs) are passed to the next generation across the placenta and in breast milk.
- Children have a whole lifetime of exposures ahead of them so there is a longer period of time to develop chronic diseases that take decades to appear as a result of environmental chemical exposures.

Embryo and foetus

- Embryos are at greater risk of mutations and congenital anomalies because cell growth is prolific and susceptible to damage in the rapid growth phase.
- The placenta allows some compounds of low molecular weight such as carbon monoxide or lipophilic chemicals such as ethanol and polycyclic aromatic hydrocarbons (PAHs) to pass through to the foetus.

Newborn babies

- Foetal lung fluid is rapidly cleared by the newborn's pulmonary lymphatic system, which becomes a primary route for absorption of airborne pollutants.
- Newborn babies have a highly permeable gastrointestinal tract and chemicals in breast milk, formulas and tap water are ingested by this route.
- Baby skin is highly permeable. A baby absorbs up to three times the amount of a chemical absorbed by an adult for the same area of skin.

First three years

- The nervous system is developed during the first years of life and has little capacity to repair structural damage. This is why young children are at greatest risk from exposure to chemicals such as lead and mercury.
- Children drink more water, eat more food and breathe more air than adults in relation to their body weight and are therefore potentially exposed to more chemicals.

31 '*Children's Health and the Environment: A review of evidence*', European Environment Agency and the WHO Regional Office for Europe, Environmental Issue Report No 29 ISBN 92-9167-412-5 (2002)

- Children's metabolic pathways are immature and their ability to detoxify and excrete chemicals differs from adults. In general, children are less able to metabolise chemicals.
- Children's hands-to-mouth behaviour increases their risk of exposure to chemicals found in dust (*see Toxic fire retardants discovered in dust taken from computers in offices and schools, page 18*), soil and carpets.
- Children's closer proximity to the ground increases exposure to chemicals in the lower layers of the air such as pesticides.
- Children's diet is a source of exposure due to the higher rate of calorie intake per body kilogram weight. Any food additive therefore constitutes a higher dose for an infant. Legal levels of food additives are calculated on the basis of a lifetime exposure for an adult.

School-age children and adolescents

- Exploration of new environments is likely to bring children and adolescents in contact with new sources of contamination.
- School grounds and classrooms may be contaminated eg lead, asbestos, soil contamination, industrial emissions close by, pesticides etc.
- Indoor air quality in classrooms is notoriously bad, especially if unflued gas heaters are present.
- Toxic arts and crafts products may be used.
- Chemical exposure in adolescents can disrupt maturation of organs and systems, especially the reproductive system, skeleton and muscles.

Effects of chemical pollutants on children's health

Many scientific papers confirm the concern that exposure to household chemicals such as pesticides and solvents can make children sick. (*see Further Reading*). What's missing however is a meta-analysis of research findings, which draws conclusions about the significance and size of the problem.

What is known is that in industrialised countries the pattern of childhood disease has changed dramatically in the last century. The older infectious diseases have largely been controlled, but the major illnesses now faced by children are chronic and disabling.

Diseases such as asthma, leukaemia, brain cancer, learning and behaviour disorders and birth defects are increasing at alarming rates.[32] Exposure to chemical pollutants commonly found inside our homes, plays a role in the development of these diseases.

In an attempt to better understand the impacts of chemical exposures and other environmental factors on children, the U.S. government has embarked on an ambitious research project - *The National Children's Study.*[33]

The Study was established under the *Children's Health Act 2000*[34] and is being conducted by the National Institute of Child Health and Human Development and a consortium of federal agencies.

The study will examine the effects of environmental influences on the health and development of more than 100,000 children across the United States, following them from before birth until age 21. The goal of the study is to improve the health and well-being of children.

While the study will certainly produce very useful and important data sometime in the far future, there is an overwhelming sense that information that is currently available could be put to better use in efforts to protect children from the health impacts of chemical exposures now.

32 *Children's Health and the Environment: A New Agenda for Prevention Research, Landrigan et al, Environmental Health* Perspectives Supplements, Vol 106, No S3 June 1998
33 [USA] The National Children's Study, http://www.nationalchildrensstudy.gov/about/mission/overview.cfm
34 [USA] *Children's Health Act of 2000* http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=106_cong_bills&docid=f:h4365enr.txt

Toxic chemicals and their known health impacts

Dioxins
by-products of PVC, industrial bleaching, and incineration, they cause cancer and are toxic to the hormonal system.

PCBs
once used in industrial insulators, they accumulate up the food chain and cause cancer and nervous system problems.

Organochlorine pesticides
include the persistent organic pollutants; DDT, dieldrin, aldrin, endrin, heptachlor, chlordane and mirex, which accumulate up the food chain and cause cancer and reproductive effects.

Polybrominated diphenylethers (PBDEs) a form of brominated flame retardants
found in plastics for computer casings, white goods, car interiors, carpets, polyurethane foams in furniture and bedding and disrupt thyroid hormones, mimic oestrogen and are linked with cancer and reproductive damage.

Perfluorochemicals
perfluorooctane sulfonate (PFOS) / perfluorooctanoic acids (PFOA) found in clothing, cosmetics and non-stick coatings for cookware, also form as degradation products of small polymers ('telomers') used in fire-fighting foams, and in soil, stain and grease-resistant coatings on carpets, textiles, paper, and leather. All perfluorochemicals have the potential to degrade back to PFOS, which does not appear to degrade further. PFOS is highly bio-accumulative and has been shown to cause cancer, liver damage and development and reproductive effects.

Organophosphate insecticide metabolites
breakdown products of organophosphate pesticides like chlorpyrifos and malathion are potent nervous system poisons.

Phthalates
used as plasticisers and in personal products, such as perfumes, lotions, babies teething rings' and tubing used in hospitals to deliver medications, they are suspected endocrine disrupters and cause reproductive effects.

Metals
lead, organomercury, organotin from industrial emissions, food residues, lead in paint and leaded petrol, can cause mental retardation and learning disabilities.

Volatile and semi-volatile organic chemicals (VOCs)
- industrial solvents in petrol, paints and household products are toxic to the nervous system, and some like benzene cause cancer.

HOW INDOOR AIR POLLUTION HAPPENS

Indoor air starts out as outdoor air and then gets dirtier. Inside buildings there are a multitude of chemicals found in all kinds of products such as building materials, paints, adhesives, varnishes, sealants, furnishings, electrical goods, cleaners, pesticides, personal care products and unflued gas appliances, to name a few.

Fumes off-gas from these products at room temperatures and build up in poorly ventilated rooms, creating a hazardous brew, which can harm people's health. As people in industrialised nations are spending more and more time indoors they are exposed to greater amounts of these indoor pollutants.

On average, the Australian population now spends approximately 57% of its time at home, 14% at work/school, 5% in transit, 2% shopping (likely to include indoor environments) and 18% recreating (likely to include indoor environments).[35]

Over the past several decades, indoor air pollutants have dramatically increased due to the proliferation in use, and types, of synthetic building materials, finishes and furnishings, coupled with construction of more tightly sealed buildings with reduced ventilation rates in order to save energy.

What people do inside buildings also contributes to the bad air. Chemically formulated personal care products such as perfumes, hairspray and deodorants release chemicals into the air as do pesticides and household cleaners.

Inside our homes and workplaces we are exposed to chemical pollutants in the air by breathing them, as residues in food and water and, by absorbing them from surfaces through the skin. The majority of chemical pollutants inside come from construction materials, furnishings and appliances as well as pest control, cleaning and personal care products.

Significance of VOCs as indoor air pollutants

Volatile organic compounds (VOCs) and formaldehyde are significant indoor air pollutants because they occur in such a wide range of building products, such as pressed-wood panels, paints, adhesives and sealants.

Essentially VOCs are chemicals that evaporate or 'off-gas' into the atmosphere at room temperature or when heat is applied. 'Organic' refers to the fact that they contain carbon.

Paint for example is a commonly used product with high levels of VOCs. The paint industry contributes significantly to the total load of VOCs released to the atmosphere each year, which in turn contributes to photochemical smog.

When paint is applied to a surface it is in a liquid form then, as the volatile solvent becomes a gas (evaporates), the non-volatile portion of the paint is left on the surface. Some types of paints, even long after they appear dry, will emit residual chemicals into the atmosphere.

Formaldehyde is also strictly speaking a VOC, but is often singled out for special mention because it is such a significant indoor pollutant in its own right. Formaldehyde and formaldehyde derivatives are present in a wide variety of consumer products.

Formaldehyde can be very dangerous, simply because it is ever present in our surroundings. It is a strong irritant, known to cause watery eyes, sinus irritation, abdominal problems and nausea. Formaldehyde has also been labelled a probable human carcinogen.

Peer reviewed research has found that people are exposed to much higher levels of VOCs and formaldehyde for 6-12 months in a newly constructed or renovated building. In a recent CSIRO study of 27 Melbourne homes for instance, it was discovered that VOC concentrations in established homes were about 8 times higher than outdoor levels, but in new homes they were a staggering 200 times higher.[36]

High levels of VOCs are also found inside new cars, especially those that reach the market soon after manufacture. Levels of VOCs can be high enough to cause sensory irritation and performance and memory impairments, which is a serious health and safety issue largely being ignored by regulators and car manufacturers.[37]

35 *State of Knowledge Report: Air Toxics and Indoor Air Quality In Australia,* Environment Australia, 2001 ISBN 0642547394 http://www.deh.gov.au/atmosphere/airtoxics/publications/sok/chapter9.html.

The costs of indoor air pollution

The US Environment Protection Agency has made assessments of the costs of indoor air pollution and found that the costs were in the tens of billions of dollars per year.

The major types of economic costs associated with indoor air pollution were direct medical costs for: people whose health is affected by poor indoor air quality and who receive treatment; lost productivity from absence due to illness; decreased efficiency on the job; and, materials and equipment damages due to exposure to indoor air pollutants.[38]

In Australia, the CSIRO estimates the economic cost of indoor air pollution to be as high as $12 billion a year in ill health and lost productivity.[39]

Asthma alone places a significant burden on the Australian community in terms of health, social, economic and emotional costs. More than 60,000 Australians are admitted to hospital annually due to asthma. Asthma is a major cause of school absenteeism, child emergency department attendance and admission to hospital. Data suggests that up to 60% of asthma deaths may be associated with avoidable factors.[40]

Known triggers of asthma include common chemical indoor air pollutants such as: tobacco smoke; fresh paint; aerosols such as hair sprays, deodorants, furniture polish, oven cleaners; perfumes and perfumed products such as room fresheners; household cleaning products; and, fumes and vapors from hobby and craft projects. The role chemical pollutants play in causing asthma is unclear.

Chemical culprits inside our homes

The following Table summarises common sources of indoor air pollutants. It is not intended to be a comprehensive list, but is an overview of the types of chemicals likely to be found in Australian homes and buildings that may cause health problems.

The information was compiled from two main sources:- *Table of 42 Common Toxic Chemicals and their Effects*[41] and *Indoor Air Quality Guidelines for Sydney Olympic Facilities*.[42] Where possible, safer alternatives have also been suggested.

36 *Controlling Indoor Air Pollution by Product Labels for Emissions from Building Materials and Contents,* S. Brown, CSIRO Building, Construction & Engineering, 9th International Conference on Durability of Building Materials and Components 2002
37 *Volatile Organic Compounds (VOCs) in New Car Interiors,* S. Brown & M. Cheng, 15th International Clean Air & Environment Conference, Sydney CASANZ 2000
38 U.S. Environment Protection Agency http://www.epa.gov/iaq/pubs/targetng.html
39 http://www.cmit.csiro.au/innovation/2002-02/greenlabel.htm
40 Australian Government Department of Health and Aging http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-pq-asthma-index.htm#overview
41 *Table of 42 Common Toxic Chemicals and their Effects,* S.C. Rowat (1998), http://www.rowatworks.com/Science/Tox_Chem_Table.html
42 *Indoor Air Quality Guidelines for Sydney Olympic Facilities,* CSIRO BCE Technical Report TR97/3 (1998), J.Immig, S.Rish & S.K. Brown

MATERIAL SOURCE	POTENTIALLY HARMFUL CHEMICALS	SAFER ALTERNATIVES
Fabrics & furnishings		
Synthetic foams	Residual styrene, vinyl acetate, isocyanate, hydrocarbon blowing agents, formaldehyde, stain and fire proofing	Second hand or well aired items
Reconstituted wood products	*(see Construction Materials)*	Solid timber
Curtain & furniture fabric, mattresses	Stain resistant coatings, water repellants, fire retardants, moth proofing, vinyl acetate, plasticiser, formaldehyde	Untreated natural fibres eg hemp, organic cotton, organic wool, linen, rubber.
Paints		
Acrylic (water-based)	Glycols (ethylene and propylene), glycol ethers, alcohols, formaldehyde, preservatives, amines (ammonium hydroxide, amino-2-methyl propanol), monomers, volatile plasticisers, fungicides such as aromatic mercury compounds	Untreated wax or water-based stain No VOC or low VOC paints (check other ingredients such as fungicides)
Enamel (petroleum solvent-based)	Aliphatic & aromatic hydrocarbons (toluene, xylene), ketones (acetone, methyl ethyl ketone), alcohols (butanol, ethanol), esters (n-propyl acetate, butyl acetate) free monomers, volatile plasticisers, fungicides such as aromatic mercury compounds	Lime wash Plant-based paints ** NB When removing old paint always test for lead contamination. If lead contamination is present seek professional advice*.
Surface finishes		
Wood coatings	Urethane, isocyanates, urea formaldehyde, volatile plasticisers, residual solvents, free monomers	Plant-based products containing natural oils waxes and water-based stains
Stains, varnishes	Volatile organic compounds	Untreated wax or water-based stain Low VOC products
Vinyl wall coverings	Formaldehyde, n-hexane, isohexane, toluene, xylenes, nonane, trimethyl benzene, decane, undecane	Avoid, or use natural materials applied with tacks or staples not glue
Sealants & adhesives		
Acrylic	Formaldehyde preservatives, polyurethane (PUR) amines, glycol ethers, alcohols, plasticisers	Screws, bolts, nails, staples Natural resins
Oil based	Alcohols, ketones, hydrocarbons, plasticisers, free monomers	Low VOC, water- based emulsions

MATERIAL SOURCE	POTENTIALLY HARMFUL CHEMICALS	SAFER ALTERNATIVES
Carpets		
Backing Underlay adhesives Stain repellent Pest treatments	Residual formaldehyde, isocynates, vinyl acetate, chloride, butene, styrene-butadiene rubber backing 4-phenylcyclohexane (4-PC), hydrocarbon solvents, preservatives	No carpets Natural fibre floor coverings Tack instead of glue Rugs
Construction materials		
Particle board Medium density Fibreboard (MDF) Plywood / Chipboard	Preservatives, phenol - formaldehyde adhesives, binding agents, urea-formaldehyde	Solid timber Ceramic tiles Glass Metals
CCA	Copper Chrome Arsenate	Avoid - to be banned
Appliances		
Computers Printers Photocopiers Televisions Air conditioners	Brominated flame retardants (BFRs) Ozone during operation	Source BFR-free electrical equipment Good ventilation or separate ventilation if required
Unflued gas heaters & cookers, kerosene heaters	Nitrogen oxides (NOX) & other combustion products	Flued gas appliances Good ventilation
Personal care		
Insect repellents	Synthetic pyrethroids, DEET	Natural oil-based products, protective clothing
Perfumes Perfumed soaps Deodorants Shaving creams Cosmetics Shampoo/conditioner	Hydrocarbon propellants in aerosol sprays Synthetic fragrances Sodium lauryl sulphate	Manual pump sprayed products or roll-ons Unscented products Certified organic products 100% natural oils Free from sodium lauryl sulphate
Nail polish remover and nail polishes	Acetone	Avoid
Sun block	PABA (phased out)	Physical sun protection eg hat, sun protection shirts, sun shelters, parasols
Pesticides		
Insect repellents	Naphthalene Residual insecticides	Natural oils such as lavender Good storage practices
Household pest & garden sprays	Hydrocarbon carriers, alcohols, active insecticidal ingredients eg organophosphates, carbamates, pyrethroids, fungicides	Flyscreens, insect excluders, mosquito nets, sticky traps, botanical insecticides eg neem or pyrethrum, hygiene, organic gardening methods

WAY FORWARD ON INDOOR AIR POLLUTION

Experts in the field of indoor air quality recognise that the most effective strategy for minimising chemical pollution is to stop it at its source. Other strategies include increased ventilation rates and the addition of air cleaning devices, which may be more effective in existing structures.[43]

The Commonwealth Department of Health and Aging recently published a *Guide to Healthy Homes and Indoor Air Quality.*[44] The guide is useful in terms of identifying sources of indoor air pollution and their health effects, but the solutions section places an incredible burden on the householder to solve the problem.

The National Health and Medical Research Council (NHMRC) has recommended interim national indoor air quality goals for a number of common indoor air pollutants. These are carbon monoxide, formaldehyde, lead, ozone, radon, sulfates, sulfur dioxides, total suspended particulates and total volatile organic compounds.[45]

However researchers have found, particularly in new houses or homes with unflued gas heating, that health-based environmental exposure goals are regularly exceeded by significant margins, particularly for VOCs, formaldehyde, carbon monoxide and nitrogen dioxide.

In the absence of any comprehensive Australian scheme to systematically test and label products, and a set of enforceable indoor air quality goals based on health standards which protect children from chemical pollutants, it remains effectively impossible for the community to minimise indoor air pollution through the most effective method of product choice and source reduction.

There are no incentives for industry to phase out toxic chemicals under a 'permissive' regulatory regime. Fundamental changes are needed to ensure green chemistry is promoted.

How Australia compares with international initiatives

Other countries are much further down the path of implementing schemes to assess and address chemical indoor air pollution through source reduction.

One way of determining what chemicals are emitted from materials is to measure them in a specialised laboratory which measures off-gasing over a period of time. To the author's knowledge at the time of writing, the only laboratory in Australia equipped to measure such emissions from products is based at the CSIRO in Victoria.[46]

Finland
The Finnish Ministry of Environment operates a voluntary scheme called *Classification of Indoor Climate, Construction, and Finishing Materials*. This scheme supplements the building code and applies to a wide range of products. Emissions are tested in a chamber at 28 days after manufacture and must conform to criteria defining total volatile organic compounds (TVOC), formaldehyde, ammonia, carcinogens and odour. Around 20%, or 300 products, now meet the criteria.[47]

Germany
The German Federal Environment Agency operates an ecological labelling scheme, *The Blue Angel*[48], with about 710 companies and 3,800 products using this environmental label. About half of the consumers in West Germany and almost a third in East Germany take it into account when they go shopping.

Indoor pollution emissions are considered alongside other environmental targets such as resource use, recycling, and global impact. An enhanced assessment scheme for product emissions is currently being considered by a committee looking into the health evaluation of building products.

43 S.K. Brown, *Controlling Indoor Air Pollution by Product Labels for Emissions from Building Materials and Contents,* 9th International Conference on Durability of Building Materials and Components (2002)
44 Australian Government Department of Health and Aging, Healthy Homes: *A guide to indoor air quality in the home for buyers, builders and renovators 2004 ISBN 0 642 82121 6*
45 *State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia*, Environment Australia, (2001) ISBN 0642547394
46 CSIRO Manufacturing & Infrastructure Technoilogy, Highett Victoria http://www.cmit.csiro.au/research/special/green/
47 Finland's voluntary scheme, Classification of Indoor Climate, Construction and Finishing Materials, http://www.rts.fi/M1classified.htm
48 Germany's Federal Environment Agency, Ecological label scheme, http://www.blauer-engel.de

USA
In the USA, the Underwriters Laboratories Inc are developing health-based consensus standards for indoor air quality, with test methods and emission criteria, for residential and commercial buildings. According to the website however not a great deal appears to have happened since 1998 and it is uncertain whether the initiative is still being pursued.[49]

The Carpet and Rug Institute operates a voluntary *Green Label* scheme along with a *Seal of Approval* program for carpet cleaning products and a *Carpet America Recovery Effort* for market based solutions to recycle old carpets.[50]

Netherlands Building Decree
After consulting the building industry the Dutch government decided in February 1998 to implement sustainability requirements in the *Dutch Building Decree*[52] by the year 2001.

Part of these requirements is the material-based environmental performance profile of a building. Environmental aspects relating to the indoor climate during the lifespan of a building and the building elements used, like formaldehyde, asbestos, volatile organic compounds or radon are generally included as part of the assessment method.

Denmark and Norway
The *Indoor Climate Labelling* (ICL) scheme[51] operates voluntarily, although Building Codes in both countries recommend its use. The scheme aims to provide the users with a tool to select more indoor friendly products and to give everybody a tool for better understanding of the impact of products on the indoor climate

At present 10 areas are defined:

- Ceiling and wall systems
- Carpets
- Interior doors and folding partitions
- Resilient Flooring, Wood-Based Floors and Laminated Floors
- Oils for Wood Floors
- Windows and Exterior Doors
- Kitchen, Bath and Wardrobe Cabinets
- Furniture
- Interior paint
- Cable trunking systems

Certificates are issued to companies giving them the right to label their products with the logo and the words “The Indoor Climate Label”.

Builders, architects and others can use the scheme in several ways:

- By specifying indoor climate labelled products, when available
- By choosing the best among the indoor climate labelled products
- By evaluating the air quality in the building on basis of the indoor-relevant time-values for the products

The indoor climate label includes the following:

Emission
All products are declared with a time-value stated in days – the declared indoor-relevant time-value. The time-value is determined on basis of the time, it takes the most slowly emitting individual substances to reach below the odour and irritation threshold for the substance.

Particle Emission
Ceiling products are classified for particle emission determined by sedimentary dust consisting of particles including fibres in the first period of the use of the product.

Indoor-Relevant Guidelines
The company prepares guidelines with regard to projecting, transport, storage, assembly, cleaning and maintenance, which are to be followed in order not to reduce the indoor-relevant properties of the products in practice in relation to the certificate.

49 USA Underwriters Laboratories Inc. http://www.ul.com/eph/iaq/index.htm
50 USA Carpet and Rug Institute http://www.carpet-rug.org/
51 Danish Indoor Climate Labelling scheme, http://www.danishtechnology.dk/building/13268,1?hilite=Indoor%20Climate%20Labelling
52 Netherlands Building Decree, http://www2.vrom.nl/pagina.html?id=7439

What a low pollution indoor environment might look like

As part of their education and information campaign on air toxics, the Victorian EPA proposed the 'ideal house'[53].

The features of the 'ideal house' include the qualities that are widely recognised as best practice when addressing indoor air quality. Some of these features may sound simple enough, but in practice would currently be difficult to achieve due to limited availability of such products or services.

In addition to these features other common sources of chemical pollution to be avoided in a healthy house would include synthetic pesticides, carpets, toxic cleaning chemicals and personal care products, car exhaust fumes from attached garages and some furnishings.

The 'ideal house' would have the following features:

- Built on land that had minimal levels of radon emissions;
- Designed to allow natural ventilation of around 1.5 air changes per hour in all weather conditions, while maintaining a comfortable temperature and relative humidity of 50% or less;
- Constructed of natural wood products or brick, with no reconstituted wood-based panels used in construction or furnishings;
- Joinery would be done without the use of solvents and caulking compounds;
- Surfaces would be finished with low-emission coatings (eg zero-VOC paints, based on comparisons of manufacturers' material and safety data sheets);
- Heating and cooking appliances would be maintained correctly and operated with local exhaust ventilation and venting outdoors;
- No asbestos, or other materials containing respirable fibres, would be used; and
- No tobacco smoking would take place, and any wood-burning heater would be fully enclosed, with effective draught and no leaks in the flue.

Conclusion

This report clearly shows that indoor air pollution is a significant problem for the entire community. Children in particular are at greatest risk because of their unique sensitivity.

There have never been so many chemical pollutants inside our homes and we are spending more time indoors than ever before. There are signs that exposure to this chemical cocktail is seriously impacting our health. Some widely used bio-accumulative chemicals are turning up in breast milk and our blood.

While there is growing level of community awareness and concern about indoor chemical pollution, the regulatory and industry response in Australia has been inadequate.

Other countries are much further down the path of putting in place assessment and labelling schemes to drive green chemistry and make safer products identifiable in the marketplace.

A central problem is the 'permissive' nature of the chemical regulatory regime, which assumes there are 'safe levels' of toxic chemicals that we can all be exposed to. Children's unique vulnerability has never adequately been factored into health standards.

New European legislation for chemical regulation will introduce an entirely new paradigm, which will ensure safer chemicals and products are introduced onto the market faster and dangerous ones are quickly removed.

There are significant opportunities for industry leaders to sponsor and promote research into safer chemicals and products to ensure the air inside our homes gets cleaner and not more toxic.

Based on these findings it is clear that solving the problem of chemical pollution indoors will require fundamental changes and an integrated approach.

53 see http://www.deh.gov.au/atmosphere/airtoxics/publications/sok/chapter9.html

RESOURCES

National Chemical Information Gateway
www.deh.gov.au/chemicals-gateway

An Australian federal government resource designed to help find useful information about chemicals as quickly and easily as possible. Information has been arranged into topics to help focus searches including: household chemicals; exposure, safety and treatment; chemicals and the environment; chemicals and human health; chemicals in hobbies and the arts.

Toxicity and Exposure Assessment for Children's Health (TEACH)
http://cfpub.epa.gov/teach/

TEACH, a project of the U.S. EPA, is a new searchable database containing overviews of scientific literature in the field of children's environmental health risks from chemical exposure. TEACH currently contains over 1,400 references from January 1972 to January 2003. These references cover information on environmental contaminants that potentially impact children's health and are updated annually.

Children's Environmental Health – Intergenerational Equity In Action
http://www.oztoxics.org/ntn/index.html

The unique vulnerability of children to hazardous chemicals is now well recognised by both the United Nations and the World Health Organisation and international programs are now trying to address this problem. National Toxics Network would like to see Australia develop and implement similar policy relating to the environmental rights of children. Protecting the health of vulnerable sub-populations, and intergenerational equity need to be built in to the 'day to day' core environment business.

Toxic Chemicals in Your Environment
www.tec.org.au/member/tec/projects/tcye/

Total Environment Centre developed TCYE has comprehensive information on greening workplaces, sustainable agriculture, community spaces, healthy schools and homes. It contains a comprehensive database of toxic chemical profiles for commonly used chemicals.

Children's Environmental Health Network
www.cehn.org

A USA based multi-disciplinary organisation whose mission is to protect the fetus and the child from environmental health hazards and promote a healthy environment. The website has an extensive database of other organisations working on children's environmental health issues that is very useful.

Community Toolbox for Children's Environmental Health
www.communitytoolbox.org

A USA-based organisation, Community Toolbox for Children's Environmental Health seeks to build the organisational capacity and sustainability of parent and other community-based organisations working to eliminate children's environmental health threats, such as lead poisoning, in communities at highest risk.

INCHES
http://www.inchesnetwork.net

INCHES is a global network of people and organizations interested in promoting the protection of children from environmental and safety hazards. INCHES represents many interests and will speak from the experience and expertise of members of the network, of science and of the best practices in policies and programs. Promoting children's health requires protecting them from harmful environmental exposures. These exposures include: harmful physical, chemical and biological microorganisms and pollutants in water, air, soil and food.

United States Environment Protection Agency
http://www.epa.gov/iaq/

USEPA website dedicated to information on indoor air quality with useful references to other resources.

The International Chemical Secretariat
www.chemsec.org

The International Chemical Secretariat in Sweden is a non-profit organisation dedicated to work towards a toxic free-environment. In order to achieve this, the Secretariat promotes the implementation of precautionary perspectives into international chemicals policies and practices.

IPCS INCHEM
http://www.inchem.org

IPCS INCHEM is a means of rapid access to internationally peer reviewed information on chemicals commonly used throughout the world, which may also occur as contaminants in the environment and food. It consolidates information from a number of inter-governmental organisations whose goal it is to assist in the sound management of chemicals.

THE HEALTHY HOUSE INSTITUTE
http://www.hhinst.com/index.html

The Healthy House Institute was started by John and Lynn Bower in 1992. It is an independent resource centre offering books and videos containing practical information for designers, architects, contractors, and homeowners interested in making houses healthy places in which to live. It differs from the green-building movement in that its focus is on human health, rather than planetary health. Both are important environmental issues and they are, in fact, often compatible, but not always.

FURTHER READING

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> **“In order to reduce the risks posed by chemicals, we need to look beyond risk management, safety levels and acceptable intake of toxic chemicals. Instead, the aim must be to achieve a toxic free environment by eliminating the use of chemicals with hazardous properties.”**
>
> **The International Chemical Secretariat, Sweden.**
> www.chemsec.org

> **“Where chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately.”**
>
> **UK Royal Commission on Environmental Pollution, 2003.**
> www.rcep.org.uk/chreport.htm

A collaborative project of the National Toxics Network and Total Environment Centre.