REPORT OF DR ANDREW HARPER'S PRESENTATION TO THE ENVIRONMENTAL HEALTH FORUM: A DISCUSSION OF MULTIPLE CHEMICAL SENSITIVITY (MCS)

Dr Harper has been pivotal in assisting workers in WA to gain recognition of chemical induced injury, particular those affected by emissions at the Alcoa Wagerup plant. A plume from a liquor burning plant frequently enveloped an outside area where workers were then exposed to fumes on a regular but intermittent basis, depending on weather conditions. Many of these men became progressively more ill after each episode of emission exposure and gradually over time, many did not recover between episodes. Their symptoms were varied and systemic and fulfilled the criteria for Multiple Chemical Sensitivity, as proposed by Dr Mark Cullen in 19986, an American Occupational Health Physician, who in fact the Principal Medical consultant for Alcoa world wide and also gave evidence at the Inquiry. The Inquiry accepted that these workers had been severely debilitated by the emissions exposure which had seemed to cause their symptoms. Although scientific and diagnostic evidence for their condition was lacking, the inquiry felt that their stories, as presented to different doctors, were consistent with a common causality and called on Alcoa to accept liability and rehabilitate them.

Multiple Chemical Sensitivity is a controversial condition, which can occur in many occupations, not just those typically thought to be associated with chemical exposure. The generalised nature of symptoms made it difficult to define a set of precise clinical criteria for diagnosis - these symptoms include mucous membrane symptoms (eyes, nose, mouthy, pharynx), respiratory symptoms, palpitations, skin rashes, joint pains, urinary symptoms particularly frequency, generalised fatigue and sensitivity to very common chemicals such as chlorine, perfumes, smoke etc. The obvious controversy is why some people get sick and others don't. It appears that there are vulnerable sub populations in the community (perhaps relating to genetic variability), but that the total numbers of people being affected by MCS appears to be increasing. As MCS does not yet have an ICD code, it is difficult to collect epidemiological data on its incidence and prevalence, which some authors put at 10% of the population to varying degrees.

Dr Harper pointed out that science is lagging behind the condition, as commonly occurs in medicine, where understanding can follow the event. There is however mounting evidence of the biological effects of many organic compounds, as can be measured in blood via markers of cellular damage. For example, the frequency of chromosomal aberrations in peripheral blood lymphocytes (as a bio marker of genotoxic damage) of non smoking bus drivers was much greater than in a group postal workers, in a study from Copenhagen in 1999.

Recently, elevations of nitric oxide/peroxynitrite and neural sensitisation has been proposed as a central mechanism for the exquisite sensitivity to organic solvents apparently induced by previous chemical exposure. (See a paper by Dr Martin Pall from the School of Molecular Biosciences, Washington State University at www.ehp.niehs.nih.gov/members/2003/5935/5935.html#intro.) This is thought to provide possible answers to the puzzling aspects of MCS including fatigue, neural symptoms and biochemical effects. He anticipates that further research will result in science catching up and the dilemma of MCS will become a syndrome that can be confirmed by diagnostic tests. He emphasized that factors such as precedent population growth, energy intensive technology, unregulated synthetic chemical production with an emphasis on short term gains rather than long term costs has led to a situation where the rate of change is outstripping the rate of scientific understanding of health effects in this area. However, he emphasized that we cannot defer social action in the face of mounting although incomplete evidence and that standing by and waiting would result in great and potentially irreversible health consequences. He reiterated that the precautionary principle must apply where possible and that community members and NGOs need to remain vigilant for the emergence of future public health hazards.
Mr Chris Phillips  
Barrister and Solicitor  
P.O. Box 448  
Bunbury. 6230

Dear Sir,  
re:  
Ref: CLP:MDE 92/02

Thank you for referring this case to me and for furnishing various reports and statements.

From the information provided it is my understanding that suffers from the following symptoms: burning patches on the skin, sore throat, fevers, menstrual irregularity, headaches, poor concentration, loss of memory and problem solving difficulties, reduced IQ, loss of grip strength and manual speed of dexterity, impairment in attention span, intermittent severe fatigue, irritability and emotional lability.

It is consistent with my understanding of the exposures suffered by that she is now sensitive to a broad range of synthetic chemicals found in common use. It has been reported that various symptoms of are exacerbated upon exposure to petrol fumes, dry cleaning fluid fumes, perfumes and other everyday chemical fumes. These compounds all contain cocktails of various hydrocarbon chemicals, including in some cases, members of the aldehyde family, such as formaldehyde.

It is common in such cases that the person develops a sensitivity to these chemicals and to other related chemicals. In this way they experience a spreading phenomenon, so when the individual is exposed to the original chemicals, or related chemicals, they show signs of toxicity, even at low concentrations. The chemical that causes the initial sensitivity is called the "sensitising" or "inducing agent". The chemicals that produce symptoms at very low levels are called "triggering agents" and can often be related back to a chronic or acute exposure to some 'sensitising' chemical. It is well known, for example, that there is a common cross sensitisation of formaldehyde to the other aldehydes, thereby enabling all the aldehydes to act as triggering agents.

Chemical exposure is endemic in our modern society through the widespread use of petroleum based products and the fact that the number and
concentration of the chemicals we are exposed to is increasing. Formaldehyde, for example, is commonly found in products as diverse as particle board, wall paper, glues, varnishes, carpets, personal care products and cosmetics.

People who suffer adverse symptoms on exposure to low concentrations of one or many chemicals are said to have multiple chemical sensitivity (MCS). These people often experience a gradual decline in health. In all cases there is a breakdown in the body's ability to cope with the multitude of exposures that previously caused no damage. The development of multiple chemical sensitivity often results from persistent chemical exposure or high acute exposure, and goes through a classical pattern of adaptation, heightened sensitivity and spreading of sensitivity to other chemicals.

Adaptation: Also called acclimatisation and addiction, is related to the masking of symptoms after some period of exposure. Cigarette smoking provides a good example of adaptation. When a person first starts smoking they may encounter symptoms such as eye and throat irritation. After some time these ‘warning signals’ disappear and only the pleasurable effects remain. After continued exposure the person may require increased quantities of the drug to get the same pleasurable effects.

Sensitising: When people quit smoking they often find that they become hyper-sensitive to cigarette smoke. This indicates that some lasting damage has been done to the body's coping mechanisms for those chemicals. After a period of adaptation, the immune and enzymes detoxification systems may be weakened or depleted. These systems may react abnormally when placed under additional stress.

Spreading: Many people who suffer from MCS often experience a spreading phenomenon, becoming sensitive to an increased number of chemicals.

The New Jersey State Health Department has proposed the following operational definition of multiple chemical sensitivity:

"The patient with multiple chemical sensitivities can be discovered by removal from the suspected offending agents and by re-challenge, after an appropriate interval, under strictly controlled environmental conditions. Causality is inferred by the clearing of symptoms with removal from the offending environment and recurrence of symptoms with specific challenge."

MCS patients display a wide range of symptoms. The expression of these symptoms may vary dramatically from one individual to the next. Symptoms include acute chest pains, sore throat, lymph node pain and tenderness, headache, myalgia and joint pain. Neurological and psychiatric disorders such as difficulties in concentrating and comprehension, memory loss and depression are common. Some patients also report feeling cold, a lack of coordination, tremors, fevers, disturbance of sleep patterns, and the onset
of various allergies. Furthermore, the severity of the symptoms may vary from day to day. A task that is easy one day may be impossible the next.

HEALTH EFFECTS ON ...

It is consistent with my understanding of glutaraldehyde that the symptoms you have described, such as skin rash, increased allergic response, respiratory complaints and neuropsychological impairment, can be attributed to exposure to glutaraldehyde and are consistent with chronic toxic encephalopathy.

This is based on my research into aldehydes over the past five years and my understanding of literature on the effects of glutaraldehyde and extensive literature on the health effects of the other aldehydes, particularly formaldehyde. Following is some relevant information on glutaraldehyde which may help your case.

Health Effects of Glutaraldehyde

While relatively little is known about the health effects of glutaraldehyde, and much of what is known, particularly in regard to the health effects on the respiratory system has only recently been elicited, it is considered a strong sensitising agent and a potent allergen.

It is also very important to bear in mind that while relatively little is known about the health effects, glutaraldehyde is considered to behave in a similar way to the other aldehydes. Many of the aldehyde family, including glutaraldehyde, resemble formaldehyde in that they can sensitisate and elicit allergic contact dermatitis, produce skin and eye irritation and elicit respiratory sensitisation. In support of this, the United States National Institute for Occupational Safety and Health (NIOSH), suggest that glutaraldehydes chemical reactivity and mutagenic activities are similar to the other aldehydes.

Acute symptoms

The most common effects of glutaraldehyde exposure usually result from the irritation of the mucous membranes of the upper respiratory passages and the eyes, and the sensitivity of the skin. There is a wide variety of physical symptoms resulting from this irritation. The irritation of the eyes and upper respiratory tract mostly result from unavoidable glutaraldehyde gas, while skin irritation (usually via liquids) generally occurs from direct skin contact. Although skin sensitisation has been reported from aerosol exposure. Glutaraldehyde is known to cause nasal and throat symptoms, nausea and headaches, flu-like symptoms and hives.
Skin Effects

Effects of glutaraldehyde on the skin, similar to the other members of the aldehyde family, are well known. Glutaraldehyde acts as a primary irritant on the skin, causing dermatitis-like reactions which may result in sensitisation. The skin effects of glutaraldehyde have particular significance for workers with continual exposure as contact dermatitis will likely result.

At high concentrations, acute contact dermatitis has been reported. Sensitisation, and spreading effects of sensitivity to allergies and other chemicals have also been reported. It is possible that immune function may be altered and permanent damage may be done after prolonged exposure to glutaraldehyde.

Respiratory Effects

Awareness of the respiratory effects of glutaraldehyde have only been recently highlighted in the international scientific literature, however, like the other aldehydes, glutaraldehyde causes direct irritation of the mucous membranes in the upper respiratory tract. Other effects observed are a prickling irritation of the throat, headache, excessive thirst, tearing and stinging of the eyes. Asthma-like symptoms have also been reported from irritant concentrations of glutaraldehyde.

Allergy

Glutaraldehyde, like formaldehyde, has been interpreted as having immunological effects which cause allergic sensitisation of the skin and respiratory tract. Patch tests to glutaraldehyde suggest an allergic rather than an irritant effect.

Neurobehavioral Effects

While this is an area little studied, some recent case studies in Sydney indicate that neurobehavioural effects do occur. These include headache, nausea, memory loss, anorexia and psychological changes. This is consistent with the numerous reports of the increased prevalence of headaches, nausea, memory loss, attention deficit, depression, indigestion and insomnia in people exposed to low concentrations of other aldehydes, most particularly formaldehyde. There is also evidence of the presence of psychological changes in groups exposed to formaldehyde in the air. Extrapolating from the known health effects of formaldehyde, other possible neurotoxic effects include impaired equilibrium and dexterity, especially in relation to long term occupational exposure.
Environmental Exposure

In regard to the other matters you have raised on potential exposure I would expect a room of dimensions 10 x12 feet with a major source of glutaraldehyde and without a specialised ventilation extraction system to lead to significant levels of glutaraldehyde in the air. Although I have not had the opportunity to inspect the premises. What also does not appear to have been considered is the variability in air conditioning systems and their varying ability even within a building to distribute and circulate fresh air and extract contaminated air. Due to the volatility of glutaraldehyde, the air surrounding areas where products containing glutaraldehyde are used can have quite high levels, particularly in confined spaces where there is little ventilation. Also due to its mass, it may pool in low areas of poor ventilation, such as around the bottom of tables. This concept is called ventilation effectiveness and unless special measures are taken, ventilation effectiveness is generally low in most rooms where desks and other furniture are in place.

It is also well established that stationary monitoring in one location in a room, at one point in time under a single set of circumstances, may not represent the true exposure of a person to that chemical. For example, personal breathing zone samples of glutaraldehyde in two hospitals ranged up to 1.5 and 1.98 mg/m³, while area sampling in one ranged up to 0.74 mg/m³. Personal exposure was considered to be greater than the levels recorded at stationary monitoring.

I trust that this information will assist you. Please do not hesitate to call should you require any explanation of this information, or if you are in need of further materials.

Yours Sincerely,

[Signature]

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Brief Curriculum Vitae  Peter Wayne Dingle

Personal Particulars

Date of Birth  2 February, 1957
Address  31 Snook Cres Hilton, 6163. W.A.
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Academic Qualifications

1974  Higher School Certificate (Year 12 Secondary)
      Coburg High School, Melbourne.
1979  Bachelor of Education (4 years) Rusden State College, Victoria
      Biology, Biochemistry, Environmental Studies.
1988  Bachelor of Science with first class Honours in Environmental
      Science.

Employment Experience

1979-1982  Teaching Biology, Environmental Science, Chemistry and
          Geography (Victorian Secondary Schools).
1982-1985  Working as an agricultural technician in Israel and
          Netherlands
1985-1987  Relief teaching in Science and Mathematics (Western
          Australian Secondary Schools).
          Lecturing in Human Biology, Canning College.
1988-1989  Tutor in Environmental Science, Murdoch University, in
          Pollutants and Toxicology and Environmental Management.
1989-1990  Senior Tutor, Course Co-ordinator Environmental Science,
          Murdoch University, in Pollutants and Toxicology.
1990-1992  Lecturer (level A), Course Co-ordinator Environmental
          Science, Murdoch University, in Pollutants and Toxicology.
Research Experience

1988 Research into the human health and environmental effects of the use of organochlorine pesticides for termite and Argentine ant control in Western Australia

1989-91 Assessment of toxicity of air pollutants with particular emphasis on exposure routes. Formaldehyde in the Indoor Environment. This has involved researching and developing monitoring techniques to determine exposure assessment. Monitoring residential environments, office buildings, work environments and individuals through the use of personal monitors. Healthy Buildings. A pilot study investigating techniques for assessing the presence of 'Sick Building Syndrome' and 'Building Related Illness'.

Reports and Publications


Dingle, P, 1991. (Editor). Wetlands in the City of Wanneroo. Murdoch University, Perth W.A.


Dingle, P, 1992. Pollutants and Toxicology. Course reader Murdoch University. pp335

Presentations and Papers


Dingle, P 1992 Exposure of Cabinet Makers to Formaldehyde (In preparation)

Areas of Research and Professional Interest
Indoor Air Quality.
Environmental Toxicology.
Assessment of pollution pathways

Membership of Professional Associations
Environmental Institute of Australia.
Indoor Air International.
Clean Air.
A REPORT ON THE ILLNESS OF

When investigating causation of occupational diseases certain principles must be followed. They are:

1. The state of health of the individual prior to employment in the suggested hazardous work environment.

2. A detailed clinical history, examination and investigation of the individual, looking for all possible explanations for the state of ill health.

3. A detailed occupational history, examination and investigation paying particular attention (where appropriate) to temporal relations between hazard exposure and the symptoms of ill health.

4. A detailed history of the circumstances of exposure. This to involve a description of the workplace, measurement of the hazard concentration in the workplace, measurement of the exposure time and a description of the method of work in order to estimate the ‘dose’ of exposure.

5. An enquiry into exposures outside work which may be relevant.

6. A review of relevant literature to determine other cases of a similar nature which may indicate cause and effect.

7. A review of other non published data which may be of help.

Finally it must be recognised that in determining causation in occupational illness, circumstantial evidence frequently plays a key role and decisions are ultimately made on “shades of grey” or in legal terms the persuasiveness of the evidence.
FORMALDEHYDE: DO EXPOSURE SYMPTOMS WITH FORMALDEHYDE INDICATE A POTENTIAL HAZARD WITH GLUTARALDEHYDE?

Asthma and dermatitis have been extensively reported among workers exposed to formaldehyde, a chemical which has both use and a chemical structure similar to glutaraldehyde.

Two papers, one by Main and Hogan\textsuperscript{25} and another by Kilburn, Seidman and Washaw\textsuperscript{26} report symptoms of a more general nature which bear some similarity to symptoms occurring with glutaraldehyde.

The Main and Hogan paper noted:

- eye irritation
- nose irritation
- throat irritation
- atopy
- fatigue
- headache
- nausea.

The Kilburn, Seidman, Washaw paper noted:

- lack of concentration
- memory loss
- insomnia
- mood changes
- libido changes
- indigestion/nausea
- headache
- fatigue.

This study showed more neurobehavioural symptoms with increasing hours per day of formaldehyde exposure.

Formaldehyde has been used for many years longer than glutaraldehyde. Glutaraldehyde is a larger molecule than formaldehyde and could well as a consequence remain longer in the bloodstream and hence cross the blood brain barrier. It is likely that when improperly used in the workplace it will lead to problems similar to those which occur with formaldehyde.


Formaldehyde
