AMA

THE TASMANIAN BRANCH
OF
THE AUSTRALIAN MEDICAL ASSOCIATION

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22 July 2004

Secretary
Senate Rural and Regional Affairs and Transport Committee
Room SG 62
Parliament House
Canberra ACT 2600

TASMANIAN BRANCH OF THE AUSTRALIAN MEDICAL ASSOCIATION

The Tasmanian Branch of the AMA has adopted a position whereby we have called for the cessation of aerial spraying in Tasmanian water catchments after oysters were killed in St Helens. We have addressed the issue with Tasmanian State Government in the context of the maintenance of public health.

Dr Michael Aizen, the President of the Tasmanian Branch of the AMA, after discussion with Senator Hefferman has requested that papers the AMA used in adopting the public health position be forwarded to your committee.

The papers are enclosed.

Rodney Cameron-Tucker
Executive Officer

Enclosures:

1. AMA Media release
2. Fax from Dr Alison Blearney dated 16/7/2004
3. Fax from Dr Alison Blearney dated 19/7/2004
4. Faxes from Dr Alison Blearney dated 20/7/2004
5. AMA letter to Minister for Health and Human Services dated 21 July 2004

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MEDIA RELEASE

AERIAL SPRAYING AND PUBLIC HEALTH

AMA Tasmania calls for an immediate halt in the use of aerial borne sprays in Tasmania's water catchments. The risk issues raised by Dr Scammell requires the user of aerial chemicals to prove that they will not affect Tasmanian public health.

Dr Marcus Scammell noted in his report that "there appears to be a risk to human health as contamination of local drinking water supplies is possible" by aerial spraying of chemicals. The AMA Tasmania views this as a sobering public health statement by the Chief Scientist of the Sydney Water Board.

Dr Aizen, President of the AMA Tasmania, stated "The State Government should take this scientific report seriously and therefore adopt the well known scientific precautionary principle and that of reverse onus." The AMA expects that the Government act today as the report raised the point that there is a reasonable proof of harm to Tasmanians.

"We do not know the full picture of chemicals being introduced into our water catchments and how the combination of chemicals may produce unpredictable outcomes. The AMA does not want government action to commence only after Tasmanians have been diagnosed with public health problems."

The AMA believes that the producer of the apparent risk bears responsibility for public safety therefore the AMA calls for an immediate cessation of aerial spraying.

Dr Aizen notes that spraying chemicals in water catchments is a public health issue and should not be categorised as only a Forestry practice issue.

Dr Aizen is available on 03 63360555 for further comment.

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FAX COVER SHEET

DATE 16/7/04

TO Rodney Cameron-Tucker - AMA/CEO

FAX NUMBER 62236469

FROM Dr. Alison Bleaney

PAGES 6 **including cover sheet.**

RE Chemical Contamination of Water Catchments

Dr Alison Bleaney
OBE MBChB FACRRM

4 Bayview Avenue,
Binalong Bay, Tas 7216

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St Helens Tas 7216

Email: sthelensmedc@vision.net.au
Tel: (03) 6376 8351 Fax: (03) 6376 1888

Rodney Cameron-Tucker
CEO / AMA

15 Jul 2004

Dear Rodney

Re: Chemical Contamination of Water Catchments.

I am seeking AMA support to find a way to introduce legislation at State and Federal level to ensure the provision of non-contaminated drinking water Australia wide, specifically to ensure the precautionary principal in the use of toxic chemicals in water catchment areas.

I have become aware of the problem through recent investigations into the use of toxic chemicals in the water catchments of the Georges River. This has been highlighted by the mass mortality of oysters in the Georges Bay in Feb. 2004, a report of which is available on: www.tflc.com.au Go to home page, press enter and click onto percival report in address book. Delete percival and enter scammell_ report_07.04.htm, and press enter.

I also enclose my comments on this very serious public health issue.

I look forward to your comments and would be grateful for the opportunity of discussing this matter with you.

Yours sincerely,

Alison Bleaney

Alison Bleaney

(2)

(1) There is evidence that toxic chemicals such as herbicides, pesticides and fungacides are contaminating our water supplies & it is possible that serious ill health could eventuate from drinking this water.

(2) It is extremely difficult to obtain accurate information as to the types, quantity & combinations of chemical being used in our water catchment.
Furthermore it is not possible at present in Oz to test for these chemicals in water to known toxic levels.
It is impossible to detect low level poisoning by these chemicals in humans.

[signature]

These chemicals have the potential to damage all systems of the body producing multiple symptoms which are difficult to identify + diagnose. Some of these chemicals are known human carcinogens.
We also know that children + vulnerable adults have an increased risk from these chemicals by a factor of 10.

(4) We now know that combinations of chemicals in what were once considered to be "safe levels" can produce quite unpredictable toxic effects. Also, some of the chemicals (eg atrazine) at "safe levels" when mixed with other substances,

such as nitrates, have the potential to cause major, unpredictable damage to systems such as the nervous ~~system~~, immune + endocrine systems.

(5) There is no information available ~~on~~ to on long term low level poisoning by these chemicals to humans.

(6) At present - the burden of proof of harm rests with the harmed.

(7) Therefore my conclusion is that the precautionary principle should be implemented immediately + there should be an immediate halt to the use of ~~these~~ chemicals in our water catchments.

8

4 Main Points

1. The precautionary principle (Do not act without reasonable proof of harmlessness) should apply.

2. The principle of reverse onus (the producer bears the responsibility for safety) should apply

3. There should be zero discharge & residual contamination by toxic chemicals

4. Clean (~~that~~ is closed) production processes must be enforced.

SPRAYED ... Environmental Problems Georges Bay, Tasmania

The aerial spraying (using helicopters) of plantation timbers appears to be responsible for large-scale losses of commercial oyster following heavy rainfall events. The normal environmental protection methods do not appear to be in place and no policing of the State's own Forestry Code of Practice appears to be occurring. More disturbingly, the problems associated with oysters also correlate with tumours and mortality in Tasmanian Devils. Further there appears to be a risk to human health as contamination of local drinking water supplies is also possible ...

The Tasmanian issue appears to be a symptom of a general breakdown in environmental protection and human health protection processes at every level of government ... **Dr MARCUS SCAMMELL**

CHIEF SCIENTIST SYDNEY WATER BOARD.

NOT FORESTRY ISSUE

CONCERN SHOULDN'T WAIT UNTIL HUMAN INCIDENT TO REACT.

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FAX COVER SHEET

DATE......19/7/04......

TO......Rodney Cameron-Tucker.

FAX NUMBER......622 364 69......

FROM......Alison Bleaney......

PAGES......Lots!......**including cover sheet.**

RE......Had a talk c̄ Dr Roscoe Taylor.
He, at this stage, despite all the evidence + the fact that as of now, we
(1) have no full knowledge of what chemicals in what quantity & what combinations are being used in the catchments.
(2) the oysters are yet again (sick) after < 20 rain at Pyengana (Catchment)
(3) there is a major public health issue/risk from drinking the water

+ he says he has no evidence that aerial spraying is a risk that should be ceased as from now.

Alison

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FAX COVER SHEET

DATE 19/7/04

TO Dr. Roscoe Taylor

FAX NUMBER 6222 7407

FROM Dr. Alison Bleaney

PAGES 1 **including cover sheet.**

RE Chemical Contamination of Water Catchments

Further to our conversation this morning & on further reflection, I confirm my position on the matter. The onus of responsibility for proving that these chemicals are harmless should rest with the producer, the user + the regulator. I request that you confirm your statement to me during our conversation that you do not believe the precautionary principle should apply as of now + that the ~~aerial~~ spraying of chemicals in water catchments should continue.

A Bleaney

cc. Marcus Scammell.
cc. AMA.

STATE POLICY ON WATER QUALITY MANAGEMENT 1997

CONTENTS

A strategy to ensure acceptable waste disposal practices from boats, including recreational craft will be developed and implemented. The strategy will include, but not be limited, to:

(a) a requirement to fit holding tanks for sewage in all new commercial and recreational craft which are of greater than 20 tonnes displacement; and

(b) the development and implementation of a voluntary code of practice describing best practice environmental management in relation to the disposal of raw sewage and other wastes from boats.

(c) an analysis of the circumstances in which facilities to pump out holding tanks should be installed at wharfs and marinas etc.

42. Marine farming

42.1
Areas designated for marine farming should be chosen such that marine farms are sited and can be operated to provide sustainable environmental outcomes.

42.2
Areas designated for marine farming should be protected from adverse changes in water quality arising from adjacent land based activities or activities in the adjacent coastal area.

42.3
Marine farming operations should be managed and regulated as required to ensure that they do not prevent the achievement of recognised water quality objectives outside of marine farming leases.

43. Discharge of ballast water

43.1
The State Government will continue to actively support the development of a comprehensive national and international strategy to reduce the risk of the introduction and spread of exotic organisms from ballast water discharges through the establishment of a state Ballast Water Management Group.

43.2
In accordance with the National Coastal Ballast Water Guidelines, responsible authorities shall, within 3 years of this Policy coming into operation, prepare Port Management Plans for all Tasmanian ports receiving coastal shipping.

44. Pesticide application in streams

44.1
Any person proposing to use chemicals to control pests (including weeds) in streams or along stream banks should first investigate, and, wherever practical, use non-chemical means of control unless it can be demonstrated that chemical control poses a lesser net environmental risk than other practical options.

44.2

Where chemical control of pests (including weeds) in streams or along stream banks is used in accordance with clause 44.1, the chemicals used must be registered or approved under the Agvet Code of Tasmania and used in accordance with the *Agricultural and Veterinary Chemicals (Control of Use) Act 1996.*

PART 5 MONITORING

45. Responsibility for monitoring

45.1
Monitoring is a critical component of water quality management and authorities responsible for resource management and environment protection should ensure that adequate monitoring is carried out to determine whether water quality objectives are being achieved.

45.2
The responsibility for monitoring should be determined in accordance with the following principles:

(a) The operators of activities which give rise to significant point sources of pollutants have a responsibility to monitor their effluent(s) for pollutants, and contribute to the ambient monitoring of the receiving waters, including baseline monitoring. These responsibilities should be reflected in the conditions attached to permits as and where appropriate. Monitoring requirements should be proportional to the level of environmental risk and, as a secondary consideration, take account of the economic costs of monitoring.

(b) Significant contributors to diffuse source pollution should contribute, directly or indirectly, to ambient monitoring of the receiving waters.

(c) Water resource managers should contribute to baseline monitoring of ambient water quality as a component of their management responsibility and on behalf of water users and beneficiaries.

(d) Community-based monitoring organisations should be incorporated into monitoring programs wherever practical.

46. Co-ordination and Quality Control

46.1
The State Government shall ensure that appropriate mechanisms are in place to co-ordinate ambient water quality monitoring programs to maximise their benefits.

46.2
Monitoring programs should be designed and conducted in such a manner as to facilitate the use of the data collected for State of the Environment Reporting.

46.3

Authorities responsible for carrying out or approving monitoring programs and data storage should ensure that programs meet acceptable standards in terms of quality assurance for the design and conduct of programs, and analysis and storage of results.

47. Public access to data

47.1
Information on the quality of public water resources should be publicly available, and the State Government should facilitate appropriate mechanisms to achieve this objective, including the provision of regular public reports.

48. Use of monitoring data

48.1
Water quality data should be used by resource managers, other decision-makers and the community, to review the extent to which water quality objectives are being achieved, and where they are not, to devise strategies and programs to achieve the objectives.

PART 6 - REVIEW

49. Review of Policy

49.1
This Policy will be reviewed three years after it comes into operation and at intervals of no longer than five years thereafter.

49.2
Implementation of this Policy will be reviewed annually by the Minister.

Health Stream Article - Issue 28 December 2002

Australian Drinking Water Guidelines Rolling Revision

On 2 November 2002, the National Health and Medical Research Council (**NHMRC**) and the Natural Resource Management Ministerial Council (NRMMC) released the current revisions to the **Australian Drinking Water Guidelines** incorporating the *Framework for Management of Drinking Water Quality* for three months public consultation.

The **Australian Drinking Water Guidelines** (the **Guidelines**) recognise the primary importance of a preventive multibarrier approach for minimising health risk in **water** supply systems, however it has been observed that in practice there has been a heavy reliance on the numerical guideline values and monitoring these for compliance without sufficient recognition of the importance of overall system management for assuring safe **water**. *Framework for Management of Drinking Water Quality* (the Framework) was developed to emphasise a more preventive approach in which greater attention and better measures of control are provided for system management, and to foster a more holistic approach to, and understanding of, **drinking water** quality management.

In the **Australian water** industry, risk management and quality management are increasingly been used as a means of assuring **drinking water** quality by increasing focus on more preventive approaches. The Framework is a quality management approach designed specifically for **drinking water** supply systems. It provides a preventive risk management strategy from catchment to consumer, and includes principles of established systems such as ISO 9001 (Quality Management), AS/NZS 4360 (Risk Management) and the Hazard Analysis and Critical Control Point (HACCP) system which is used in the food industry but applies them in a **drinking** supply context to support consistent and comprehensive implementation.

The Framework provides holistic guidance on a wide range of issues that should be considered for management of **drinking water** quality. Its foundation is to promote an understanding of the entire **water** supply system, the hazards and events that can compromise **drinking water** quality and safety, and the development of effective preventive measures to control the hazards, including the application of multiple barriers and the establishment of Critical Control Points to reduce exposures to hazards.

Additionally, the optimisation and continuous control of operations are seen as crucial components as even short periods of suboptimal system performance can represent serious risk to public health. Effective control is achieved through the establishment of operating procedures, a monitoring protocol for operational performance, including the selection of appropriate parameters and criteria, and the corrective actions to control excursions from established criteria.

The Framework addresses not only the technical issues of **water** supply but also aspects such as corporate commitment, communication, training and relationships with other stakeholders and with consumers. The principles of management outlined in the Framework are intended to be applicable for all water supply systems regardless of size and system complexity. It allows sufficient flexibility for individual systems to implement it in a manner that suits their own circumstances, needs and preferences.

Framework for Management of Drinking Water Quality was released for public consultation in mid-2001 and since this time the entire **Australian Drinking Water Guidelines** document has been restructured and reorganised to improve clarity and incorporate the Framework's twelve elements and guidance as its central focus.

The **Guidelines** are now organised into five parts:

Introduction
Chapter 1 - Guiding Principles
Part I - Management of Drinking Water Quality
Chapter 2 - Framework for Management of **Drinking Water** Quality: Overview
Chapter 3 - Framework for Management of **Drinking Water** Quality: The Twelve Elements
Chapter 4 - Framework for Management of **Drinking Water** Quality: Application to Small **Water** Supplies
Part II - Description of Water Quality
Chapter 5 - Microbial Quality of **Drinking Water**
Chapter 6 - Physical and Chemical Quality of **Drinking Water**
Chapter 7 - Radiological Quality of **Drinking Water**
Chapter 8 - **Drinking Water** Treatment Chemicals (under development)
Part III - Monitoring
Chapter 9 - Overview of Monitoring
Chapter 10 - Monitoring for Specific Characteristics
Part IV - Procedural Sheets
Part V - Fact Sheets
Appendix - Additional Guidance on Elements 2 and 3 of the Framework for Management of **Drinking Water** Quality

Making a Submission

You are invited to make a submission to the **NHMRC** about the draft **Guidelines**. A copy of the revised **Guidelines** incorporating the Framework for Management of **Drinking Water** Quality can be downloaded from the **NHMRC** website: www.health.gov.au/**nhmrc**/advice/pdf/waterqly.pdf

or

obtained by contacting Phil Callan: Fax +61 (0)2 6289 9898

0262899898

1.9 Community Consultation

Drinking water supplies to which the public has access should be safe and of good quality, and communities have the right to participate in policy-making decisions on how this is to be achieved. Effective communication with consumers should include public participation in the water authority's decision-making process.

Water Authorities should consult with the community on the establishment of levels of service, and on programs for the maintenance and/or improvement of water quality. Discussions should cover existing water reticulation problems and options for future expenditure.

Decisions and agreed levels of service should be based on estimates of risk and cost, as well as on local knowledge of the source water (including the degree of catchment protection), treatment processes employed, history of the distribution system, and the quality assurance program exercised over its operation. Consumer needs and expectations will influence the extent to which each community will adopt the guidelines. One community for example, might choose to tolerate aesthetic problems, while another may choose to pay for treatment to bring the water quality within normally accepted limits.

Decisions about drinking water quality cannot be taken in isolation from the other aspects of water supply that compete for limited financial resources. The two major decisions to be made are the levels of services to be adopted, and the time frame within which those levels can be achieved.

In many cases, considerable expenditure may be required to achieve the desired levels of service for water quality and this may be of a magnitude that could restrict other water supply development works, at least for a period. If a balance of quantity and quality works is to proceed, then the water quality improvement works will have to be phased in gradually over a number of years. The choice of the phase-in period depends on the relative priorities accorded to water quantity and quality.

Water quality priorities will depend on the impact of quality improvements on public health and on aesthetic considerations (taste, colour, odour). Public health, that is the safety of supplies, should take a higher priority than aesthetics, despite consumer preferences.

Consumers should also be involved in considering options for effective and acceptable monitoring and reporting on performance, and on the frequency of such reporting. The following should be available to the public.

- A Drinking Water Management Plan, which should provide details of system management, monitoring, performance assessment, reporting, planned improvements, contingency plans and levels of service.

- Annual reports, which should summarise performance over the preceding year against the guidelines or agreed levels of service.

- Contingency plans for emergency situations, including procedures for notification when water quality poses a health risk. These plans should cater for potential natural disasters (e.g. earthquakes, floods, lightning damage to electrical equipment), accidents (e.g. spills in the catchment or incorrect dosing of chemicals), damage to treatment plants and distribution systems, and human actions (strikes, sabotage). They should clearly specify coordination responsibilities, communication and notification plans, and plans for providing emergency water supplies.

1.7 Guaranteeing the Safety of Water Supplies

Although the implied emphasis of these guidelines is on regular testing for a variety of water quality characteristics, such tests should be regarded as only one step in a broader monitoring and surveillance program to ensure that water is safe to drink. Testing does not effectively guarantee the safety of water supplies, as it is quite possible that contamination will occur between sampling events and will be missed by the testing program.

Many other steps can and should be taken to guarantee the safety of water supplies, including:

- the use of effective barriers to prevent contamination of the water supply system (see Chapter 2);
- regular inspections of catchment areas to identify the chemicals being used, and how they are applied;
- registration of chemicals such as pesticides and other toxic organic and inorganic compounds;
- control of industrial, mining, forestry, agricultural and human activities within catchment boundaries;
- an effective maintenance program for plant and equipment used in the water supply system;
- management of activities in the distribution system to ensure cross connections do not occur;
- choice and use of approved water treatment chemicals;
- use of approved materials in contact with drinking water;
- use of appropriately skilled and trained personnel in the operation of water supply systems;
- public awareness and education programs so that people know what is being done to protect their water supply, and whom to contact if unauthorised activities are suspected.

If all these steps are taken, it will be possible to have a high degree of confidence in the safety of the water supply. Testing can then properly be used as a final check that the steps are working, and to determine natural variations in water quality.

1.8 Levels of Service

Today, with corporatisation of water authorities and the recognition of the need for greater community consultation, levels of service for water quality are being developed encompassing both health and aesthetic characteristics.

Where water authorities have been corporatised, the government will usually issue an operating licence with specific performance measures covering water quality.

Further information is provided in the National Water Quality Management Strategy paper *Implementation Guidelines*.

Studies have shown that concentrates of some chlorinated drinking-water supplies are mutagenic to some strains of test bacteria. These effects were consistently found with samples of surface water that had a high content of natural organic compounds at the time of chlorination. A significant proportion of the increased mutagenicity has been attributed to a chlorinated furanone known as MX.

The International Agency for Research on Cancer (IARC) has reviewed the available data and concluded that there is inadequate evidence to determine the carcinogenicity of chlorinated drinking water to humans (Group 3).

Action to reduce the concentration of disinfection by-products is encouraged, but disinfection itself must not be compromised: the risk posed by disinfection by-products is considerably smaller than the risk posed by the presence of pathogenic micro-organisms in water which has not been disinfected.

Other Organic Compounds
Naturally occurring organic compounds are not generally of human health concern, except for certain specific toxins (see Fact Sheet no. 17 on Cyanobacteria). Other than disinfection by-products, organic contaminants resulting from human activity are not normally detected in Australian drinking water. They have, however, been detected at times in supplies in North America and Europe, usually following an accidental spill or discharge into a water source or, on rare occasions, from air-borne contamination of rain, and fact sheets and guidelines are provided in case similar incidents should occur in Australia.

3.3.3 Pesticides

For the purpose of these Guidelines `pesticides' include agricultural chemicals such as insecticides, herbicides, nematicides, rodenticides, and miticides.

The National Registration Authority for Agricultural and Veterinary Chemicals (NRA) is responsible for assessing all pesticides prior to registration which allows sale and use in Australia. For registration, data required on the pesticide include information on the proposed use, the toxicity, and the residues that might result from proper use. When the pesticide is registered, a safe level of exposure, conditions of use and maximum levels of residues for water are determined. This mechanism allows the formulation of appropriate guideline levels for pesticides in drinking water and a process for their revision which includes public consultation.

Pesticides should only be authorised for use in water or water catchment areas where necessary. Pesticides not authorised for such uses should not be present in drinking water. Where pesticides are registered for use in water catchment areas, levels are set which take into account safety and good water management practice.

Contamination of drinking water by pesticides may occur occasionally as a result of accidental spills, misadventure, or emergency use of pesticides. In such cases, prompt action may be required by public health officials. There may also be times when persistent or widespread contamination occurs.

Values for pesticides have been divided into two categories:

- Guideline Value
These values are intended for use by regulatory authorities for surveillance and enforcement purposes, and provide a mechanism to measure compliance with approved label directions.

For pesticides which are not approved for use in water or water catchment areas the guideline value is set at or about the limit of determination (LOD). This value is the level at which the pesticide can be reliably detected using practicable readily available and validated analytical methods.

Where a pesticide is approved for use in water or water catchment areas the guideline value is set at a level which is consistent with good water management practice and which would not result in any significant risk to health of the consumer over a lifetime of consumption.

If a pesticide is detected at or above the guideline value, steps should be taken to determine the source and to stop further contamination. Exceeding the guideline value indicates that undesirable contamination of drinking water has occurred; it does not necessarily indicate a hazard to public health. If contamination occurs, the advice of the relevant health authority should be sought.

- Health Value
These values are intended for use by health authorities in managing the health risks associated with inadvertent exposure such as a spill or mis-use of a pesticide.

The values are derived from the Acceptable Daily Intake (ADI) and set at about 10% of the ADI for an adult weight of 70 kg for a daily water consumption of 2 litres. The health values are very conservative, include a range of safety factors, and always err on the side of safety.

3.3.4 Approach Used in Derivation of Guidelines for Chemicals

The guideline value for each organic and inorganic chemical is the concentration that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption and is consistent with water of good quality.

The health related guideline values are very conservative, and are calculated using a range of safety factors. They always err on the side of safety, particularly where scientific data are inconclusive or where the only data available are from animal studies.

Where aesthetic considerations, including taste and odour, corrosion, and stains on sanitary ware and laundry, dictate a more stringent guideline than that required to protect health, then both values are quoted. Health considerations may be of less concern in such cases (although they must still be considered), as water which is aesthetically unacceptable is less likely to be consumed.

For most chemicals, it has not been possible to estimate the higher concentrations that would affect health over shorter periods, and so short-term guideline values have generally not been set. Given the very conservative nature of the guidelines however, deviations from the guideline values over a short period do not necessarily mean that the water is unsuitable for consumption. The amount by which and the period for which any guideline value could be exceeded without causing concern will depend on the chemical involved and other factors such as the risks and benefits to public health.

Each excursion beyond a guideline value should, however, be a trigger for further action.

Chemicals fall into two categories based on health effects:

- those where the effects are observed only above a certain threshold dose, with no effects observed at doses below this threshold;
- those that do not appear to have a threshold.

Sources of Data Used

Human data
Little information is available on the effects of human exposure to organic and inorganic compounds, including pesticides, at the concentrations likely to occur in water. Occasionally there are useful epidemiological data, and where available, these have been the primary consideration in setting the guideline value.

Animal data
In the absence of human data, experiments on laboratory animals provide toxicological data on the effects of exposure to chemical agents. Ideally, these are long-term studies involving ingestion of the compound dissolved in water or present in food, rather than inhalation or dermal exposure studies. It should be understood that for expediency such studies are conducted at concentrations that are relatively high in comparison to the concentrations likely in drinking water. Furthermore, the most sensitive animal species and the most sensitive group within that species is used to increase the likelihood of observing a toxicological effect.

Effects of exposure to chemicals in experimental animals are generally classified in the following broad categories:

- organ specific
- neurological/behavioural
- reproductive/developmental
- carcinogenic/mutagenic.

Effects may be prolonged or short-term, reversible or irreversible, immediate or delayed, single or multiple. The nature, number, severity, incidence, and/or prevalence of specific effects generally increase with increasing dose. Adequately designed and conducted experimental studies in animals can usually provide an exposure level below which adverse effects are not seen.

Interpreting these data and extrapolating from them to human populations can be difficult, as health effects vary with dose, route of exposure (e.g. ingestion, inhalation, or skin absorption), frequency or duration of exposure, and the species, sex and age of the exposed population. This can require appropriate expertise and prudent judgement (for example see IPCS, 1978)

Derivation of Guideline Values for Substances for which a Threshold Exists
Where appropriate human data are available these have been utilised in the derivation of the guideline value.

In the absence of human data the guideline value is generally based on the highest dose that causes no adverse effects in long-term experiments on laboratory animals, and is calculated using the following formula:

$$\text{Guideline} = \frac{\text{animal dose} \times \text{human weight} \times \text{proportion of intake from water}}{\text{volume of water consumed} \times \text{safety factor}}$$

In using this equation, it is necessary to make assumptions about the amount of water consumed per day, average body weight, and the proportion of total intake that can be attributed to water consumption, and to decide on an appropriate safety factor. Clearly the figures selected will all

ATRAZINE *(Revised 2001)* **Fact Sheet No. 103**

Guideline

Atrazine should not be detected in drinking water. If present in drinking water, atrazine would not be a health concern unless the concentration exceeded 0.04 mg/L.

If it is detected, then remedial action should be taken to stop contamination. The practical limit of determination is 0.0001 mg/L.

General Description

Atrazine is used as a selective pre- and post-emergent herbicide for the control of weeds in a number of crops. It is also used in forestry and for non-selective weed control on non-crop areas.

Atrazine can be degraded in surface water by photolysis and the action of micro-organisms. Hydrolysis and microbial degradation also take place in soil, the extent depending mainly on temperature, moisture and pH. Half-lives of 20-50 days have been reported under laboratory conditions at 20-25°C (IPCS, 1996). Degradation half-lives of atrazine in soil ranged from 12 to 213 days over a wide geographical range of forestry sites in Australia; degradation rates were primarily dependent upon soil temperature (FHMG, 2000).

Due to its mobility in soil, atrazine has been found in surface and groundwater in the vicinity of agricultural areas, and may occur at higher concentrations in agricultural run-off. It has also been found in some drinking water supplies in a number of countries. There is quite an extensive database on atrazine levels in soil and water (eg. IARC, 1991).

Atrazine metabolites have been found in plants grown in soil treated with atrazine, and in ground and surface water, but atrazine has not been found on food crops.

Following best practice when using herbicides should prevent atrazine being present in the drinking water supply. The 1997 review of atrazine by the National Registration Authority for Agricultural and Veterinary Chemicals (NRA, 1997) imposed significant restrictions on the use of atrazine around water catchment areas; these restrictions are detailed on product labels.

Typical Values in Australian Drinking Water

Atrazine has rarely been found in Australian reticulated supplies. It has been reported in groundwater supplies at concentrations up to 0.002 mg/L in an area where atrazine was used over a 10-year period to suppress weed growth in irrigation channels (at application rates of 2-4 kg per hectare per year).

From available monitoring data, it appears that the major metabolites of atrazine (desethylatrazine, desisopropylatrazine, diaminochlorotriazine, hydroxyatrazine) may constitute approximately 50% of the total atrazine-derived triazine compounds in some ground and surface water samples (Lerch et al, 1998). This has been taken into account in deriving the guideline value.

Treatment of Drinking Water

Atrazine can be removed from drinking water using activated carbon.

Measurement

Atrazine can be extracted from water using a non-polar solvent (such as pentane) or by solid phase extraction, and analysed with gas chromatography using nitrogen-phosphorus detection (AOAC Method 991.07, 1990). The limit of determination is approximately 0.0001 mg/L.

Health Considerations

Studies in humans and animals indicate that orally administered atrazine is well absorbed from the gastrointestinal tract and that the majority is metabolised in the body and rapidly eliminated in the urine. Other studies have shown that dermally applied doses of atrazine undergo only limited absorption through the skin (ca. 10%) (IARC, 1991; NRA, 1997).

No signs or symptoms of poisoning in humans have been reported from ingestion of atrazine. Acute toxicological studies in laboratory animals suggest that atrazine and its major metabolites are not highly hazardous substances, and other rodent studies have shown that they are not teratogenic or embryotoxic (HSDB, 1999; IARC, 1991; NRA, 1997). Atrazine does not have any adverse effects on the reproductive cycle of rats (NRA, 1997).

In regard to cancer studies, a public health assessment of atrazine performed by the Therapeutic Goods Administration of the Department of Health and Aged Care, as part of Australia's Existing Chemicals Review Program (ECRP), concluded that atrazine was not a genotoxic carcinogen and that an earlier onset of mammary tumours in the Sprague-Dawley strain of rats at high doses was due to an hormonal effect. The pattern of hormone levels (oestrogen) in ageing SD rats differs from another rat strain tested (Fischer-344) and from that in humans and hence the atrazine effect in SD rats is unlikely to be an appropriate surrogate for the assessment of human risk for mammary tumour development (NRA, 1997). Consistent with Australia's review of atrazine, the International Agency for Research on Cancer concluded (IARC, 1999) that, despite there being sufficient evidence in animals for the carcinogenicity of atrazine, there is strong evidence that its mechanism of cancer induction is not relevant to humans. Hence, atrazine was reported as not classifiable as to its carcinogenicity to humans (IARC Classification Group 3).

Derivation of Guideline

The health-based guideline value of 0.04 mg/L for atrazine was determined as follows:

$$0.04\ mg/L = \frac{0.005\ mg/kg\ body\ weight\ per\ day \times 70\ kg \times 0.5}{2\ L/day \times 2}$$

where:

- 0.005 mg/kg body weight per day is the acceptable daily intake (ADI) determined by the Therapeutic Goods Administration (NRA, 1997);
- 70 kg is taken as the average weight of an adult;
- 0.5 is a proportionality factor based on the conservative assumption that at least 50% of the ADI will arise from the consumption of drinking water; atrazine has not been detected in the Australian food supply;
- 2 L/day is the estimated amount (maximum) of water consumed by an adult.
- 2 is an extra safety factor to take into consideration the likely presence of metabolites of atrazine which have a similar toxicity profile to parent atrazine and which may constitute about 50% of the total atrazine-derived compounds;.

The ADI value also includes a safety factor of 100 (10 for interspecies variation, and 10 for human variability).

The WHO guideline value of 0.002 mg/L was determined using an additional safety factor of 10 for potential oncogenicity. The data were not considered adequate to include this factor in the derivation of the Australian guideline value.

Because of the use pattern of these herbicides (just before or after crop emergence) it was considered unlikely that residues would be present in food. The 1992 Australian Market Basket Survey (AMBS) (NFA*, 1992,) reported assays for atrazine and simazine in meat and cereal foods. No residues of either herbicide were detected. This finding is in agreement with US data; in over 30 years of use, atrazine has not been detected in edible portions of plants or livestock nor has it been detected in American market-basket surveys (NRA, 1997). Thus it may be concluded that exposure of the population to atrazine in food is very unlikely.

(*Now the Australia New Zealand Food Authority, or ANZFA)

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(Hard copies of the summary review may be obtained from the NRA, or full copies of the review are available at the following website: http://www.nra.gov.au/chemrev/chemrev.shtml .The toxicology and public health component of this review was conducted by the Therapeutic Goods Administration of the Department of Health and Aged Care.)

Derivation of Guideline

The health-based guideline value for xylenes in drinking water was determined as follows:

$$0.6\ mg/L = \frac{250\ mg/kg\ body\ weight\ per\ day \times 70\ kg \times 0.1}{2\ L/day \times 1000} \times \frac{5}{7}$$

where:

- 250 mg/kg body weight per day is the No Effect Level based on a 2-year gavage study using rats (NTP, 1986);
- 70 kg is the average weight of an adult;
- 0.1 is the proportion of total daily intake attributable to the consumption of water;
- 2 L/day is the average amount of water consumed by an adult;
- 1000 is the safety factor in using the results of an animal study as a basis for human exposure (10 for interspecies variations, 10 for intraspecies variations, and 10 for the limited toxicological end-point);
- 5/7 is used to convert data based on a 5 day per week feeding study to a 7-day week equivalent.

This health-based guideline value exceeds the taste threshold of xylenes in water of 0.02 mg/L. The WHO guideline value of 0.5 mg/L was based on an adult body weight of 60 kg. The difference in guideline values is not significant.

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FAX COVER SHEET

DATE........20/7/04........

TO........AMA — Rodney Cameron-Tucker 6223646 / Michael Arzen

FAX NUMBER........ 6336 0550

FROM........Alison Bleaney........

PAGES........................**including cover sheet.**

RE 7.30 Report + Coverage in Examiner was very good.

I feel we need to support Public Health in providing him with "evidence" (his words) that he can stop aerial spraying as of now.

I enclose scientific papers list that I have sent to him, along with the full paper from Dr. Zeliger which is

really quite succinct + exact in its conclusions.

How would the National AMA feel about voicing its support - now that 7.30 report has gone nationally ??

Added // The Report of the Senate Select Com. is scathing in its condemnation of lack of policy of law protocols + states quite categorically on evidence provided that spraying should be banned [illegible] forestry industry in proper ... dramatically, it's all area

20. JUL. 2004 9:19 ST HELENS MEDICAL CENTER
ST HELENS MEDICAL CE

Georges Bay Medical Practice Service Co Pty Ltd

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PO Box 294
St Helens Tas 7216

To Dr. Roscoe Taylor FAX. 62264770. (1)
Fr Dr Alison Bleaney 19/7/04

Papers that detail problems c̄ (1) aerial spraying done by appropriate methods that still allows chemical contamination of waterways

PE Davies, LSJ Cook, + JL Barton. Aust J. Mar Freshwater Res 1994 - 45 - 209 - 26.
Triazine Herbicide contamination of Tas. Streams. Sources, Concentrations + Effects on Biota. (quoted in Scammell Report)

Barton, J.L + Davies PE (1993) Buffer strips + streamwater contamination by atrazine + pyrethroids aerially applied to Eucalyptus nitens plantations (Aust Forestry)

Davies, PE + Cook LSJ (1993) Catastrophic invertebrate drift + sublethal effects on brown trout, Salmo trutta, caused by cypermethrin spraying on a Tasmanian stream. Aquatic toxicology (Amster)

(2) problems c̄ chemical combinations in v.v. low concentrations + unexpected effects found

Dr. Harold I. Zeliger - Archives of Envir Health Jan 2003
IARC Monograph Vol 53 - triazine - Italy - linked to ovarian ca.
" - USA - " "
non Hodgkins lymphoma

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(2)

Howard C.V. (1997) Synergistic Effects of Chemical Mixtures – can we rely on traditional toxicology? Ecologist, 27.5 Sept/Oct 1997.

Van der Gaag. N. – Pick your poison – the price we pay for using pesticides. New Internationalist 323: 9-11. May 00 p11.

Blain. P.G. – Adverse Health Effects after low level exposure to organophosphates – Occup Envir Med 2001

Crinnion. W.J.: Environmental Med., Part I – The Human Burden of Envir. Toxins & their common Health Effects. Alt. Med. Review 5. 52-63, Jan 00

The Facts on Pesticides: New Internationalist 323 18-19. May '00.

This is the information/evidence that you requested – in addition to fax sent 19/7/04. detailing "Report of the Senate Select Committee on Agric. + Vet. Chemicals in Aus. 1990." (Copy available in Library)

Alison Bleaney.

Archives of Environmental Health, Jan. 2003, by Harold I. Zeliger

ABSTRACT. Exposures to chemical mixtures have reportedly produced unexpected effects. Examination of new case studies, as well as those previously reported, shows that when the human body is exposed to mixtures of chemicals that include lipophilic and hydrophilic species, the lipophiles facilitate the absorption of the hydrophiles at enhanced levels and produce effects that are not expected from an individual chemical. These effects include enhanced acute and chronic responses, low-level concentration response, and unexpected target organ attack. Octanol:water partition coefficients are predictive of relative lipophilicity and hydrophilicity. The findings have implications for safe drinking water standards, air quality standards, safe industrial and environmental exposure levels, product formulation, product labeling, and protocols for toxicity testing of chemical products.

<Key words: additive effects, Aerospace Syndrome, chemical mixtures, hydrophilic chemicals, lipophilic chemicals, low-level exposure, octanol:water partition coefficient, potentiation, synergistic effects, Sick Building Syndrome, toxic chemicals, toxicity of chemical mixtures>

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A REVIEW OF THE TOXICOLOGICAL LITERATURE reveals that exposure to chemicals can produce unexpected effects. (1,2) Some chemical exposures have resulted in unpredicted target organ attack (3,4); others have shown effects much greater than anticipated from the known etiology. (5-7) Many researchers have been baffled by the unexpected effects observed following exposure of individuals to low levels of chemical toxins. (8-10) This investigator also has noted such effects, and for a long time was unable to understand or explain them. A study of published and observed effects, however, has revealed that all of these unusual effects have a common thread: The exposures have always occurred in response to mixtures of chemicals--not to individual compounds.

Many published studies describe the combined effects of exposure to chemical mixtures. These effects can be additive, antagonistic, synergistic, or potentiated. (1,6,11-14) Most of the studies address relatively high exposure levels--either at or exceeding established threshold limit values (TLVs). The few studies that report unusual effects from exposure to low-level chemical mixtures concede that unknown factors may contribute to the observed effects. (8,10,15)

All of the cases cited in the literature, and those reported for the first time here, describe unusual and unpredicted effects, and the chemical mixtures that produced such effects contained at least 1 relatively lipophilic chemical and 1 relatively hydrophilic chemical. The relative differences in lipophilicity and hydrophilicity are reflected by the octanol:water partition coefficients of the chemicals, [K.sub.ow]. (16)

[K.sub.ow] is indicative of the relative lipophilic character of a given chemical. It is defined as the ratio of that quantity of chemical dissolved in the octanol phase to that dissolved in the water phase of an octanol-water mixture. It is expressed as a logarithm of the number because there exists a wide range in [K.sub.ow] for different compounds. The values have no units. The [K.sub.ow] data reported herein range from less than -1.0 to more than 6.0. Higher values indicate more lipophilic character, and lower values indicate more hydrophilic

1/06/04

character.

Mucous membranes coat most body tissues and serve as the body's primary barrier to absorption of chemicals. (17) It is well established that lipophilic chemicals can penetrate mucous membranes much more readily than can hydrophilic chemicals, (1) and mucous membrane barriers thus protect the body from absorbing hydrophilic chemicals. (18) Lipophilic chemicals can promote the permeation of hydrophilic chemicals, and are routinely employed in drug delivery systems. (19-21) Manganaro noted that most drugs do not penetrate epithelial barriers at rates sufficient for clinical usefulness without the use of permeability enhancers. (20) He quantitatively related the effects of permeabilizers on the in vitro penetration of propanolol through porcine buccal epithelium. (21)

The relationship between mucous membrane permeability and [K.sub.ow] can be seen from the literature. Kitagawa and Sato (19) reported that permeability coefficients across excised guinea pig dorsal skin increased directly with increased [K.sub.ow] for a homologous series of parabens. Potts and Guy (22) noted that skin permeability is a function of [K.sub.ow]. Boman and Maibach (23) determined that the percutaneous absorption of hydrophile butanol (low [K.sub.ow]) increased by simultaneous exposure to an ionic surfactant lipophile (higher [K.sub.ow]). Siegel (24,25) reported that an increase in lipid solubility produced an increased permeability in the oral mucosa of New Zealand rabbits and rats. Siegel's permeation constants correlate exactly with [K.sub.ow] values. Geyer et al. (26) reported a quantitative correlation between [K.sub.ow] and the bioaccumulation potential of organic chemicals by green alga. Scheuplein and Ross (27) reported that skin permeability was increased after treatment with nonpolar solvents, and that permeability constants for a homologous series of alcohols were a function of carbon number. This relationship corresponds exactly to increasing [K.sub.ow] values. Witte et al. (18) determined that subtoxic concentrations of membrane-damaging compounds enhanced the cytotoxicity of hydrophilic xenobiotics. Witte postulated that combinations of lipophilic and hydrophilic compounds would show synergistic effects resulting from membrane damage by lipophilic species and increased uptake of hydrophilic species. The data reported demonstrated a linear relationship between the logarithm of the no-observed-effect concentration (NOEC) and the [K.sub.ow] value. The higher the [K.sub.ow], the lower the log NOEC, and the greater the toxicity of the mixture.

It is proposed herein that the heretofore unexpected effects of exposure to mixtures of chemicals should be expected when at least 1 is a lipophile (higher [K.sub.ow]) that facilitates the absorption of at least 1 hydrophile (lower [K.sub.ow]) in the mixture. As a result of the facilitated absorption, chemicals that alone would be innocuous are absorbed at levels that produce toxic effects. Hence, one observes enhanced effects of exposure to such chemical mixtures at relatively high concentrations, and at low levels of exposure effects are absent! It is also proposed that the combination of lipophile and hydrophile can target organs not attacked by the individual chemicals, and such combinations can produce effects that are not anticipated from the known toxicology of the individual chemicals.

Materials and Method

This is an empirical study based on an analysis of 23 case studies, 20 of which have been reported previously in the literature. Medical evaluations and industrial hygiene data for the previously published cases were accepted as published. For the 3 case studies reported herein for the 1st time, the human health effects noted were diagnosed by appropriate clinical examinations, and industrial hygiene data were generated in accordance with accepted protocols.

Experimental [K.sub.ow] values for compounds were used when available; otherwise, calculated values were used. (16) All calculated values are identified with an asterisk.

Herein, low-level exposures represent exposures to concentrations below the published TLV, permissible exposure level (PEL), or maximum contamination level (MCL); and high-level exposures are those that exceed the TLV, PEL, or MCL.

Results

The following studies of groups of individuals are representative of the exposure effects noted. In all instances, the [K.sub.ow] values are given in brackets that follow the chemical name.

Group 1. Burkhart et al. (28) described a 39-member group that reported respiratory symptoms within hours of exposure to a reformulated aerosol spray leather protector. (28) The reformulated product contained isobutane [2.76], ethyl acetate [0.73], n-heptane [4.66], and fluoroaliphatics [0.75]. Most patients reported symptoms immediately, or within minutes of application. Some of those exposed had used the product outdoors where ventilation was good. Clearly, the clinical response of many, if not most, of those exposed cannot be explained by the published data for the individual chemicals. Similar results have been reported by Van Essen. (29)

Group 2. Cone and Sult (30) reported a "mystery illness" that affected 17 workers who complained of central nervous system (CNS) and respiratory symptoms following fumigation of a casino with a mixture of carbamate propoxur [1.52], coumaphos [4.13], 1,1,1-trichloroethane [2.49], methylene chloride [1.25], xylene [3.15], and acetone [-0.24]. Industrial hygiene evaluation revealed only trace quantities of the chemicals noted, yet pesticide poisoning symptoms were observed.

Group 3. Dossing and Ranek (15) reported on 3 previously healthy workers who were hospitalized with liver injury following 2-4 mo of exposure to a mixture of carbon disulfide [1.94], toluene [2.73], methanol [-0.77], and trace quantities of other organic compounds. Concentrations of all species were below PELs, and hepatotoxicity was not predicted. The authors suggested that "liver injury was caused by the combined action of organic solvents." A synergistic and hepatotoxic reaction was suspected.

Groups 4 and 5. Mutti et al. (31) described CNS effects that resulted from exposure of shoemakers to n-hexane [3.90], cyclohexane [3.44], methylethyl ketone (MEK) [0.29], and ethyl acetate [0.73]. All 4 chemicals were present in concentrations below TLVs when measured in the workers' breathing zones. Valentini et al. (32) reported peripheral neurotoxicity following exposure of a shoemaker to MEK [0.29], ethyl acetate [0.73], cyclohexane [3.44], n-heptane [4.66], and isomers of hexane and cyclohexane. All exposures were below the TLV. The authors hypothesized that MEK might have potentiated the neurotoxicity of n-heptane, just as it does for n-hexane. Both of these studies demonstrated the onset of neurotoxic effects from exposures to low-level chemical concentrations.

Group 6. In a case studied by this investigator, low levels of an applied herbicide/pesticide mix were drawn into the uptake air of a commercial building. Several individuals immediately reported CNS and respiratory symptoms, and 1 sustained permanent respiratory injury. The chemical mix contained (2,4-dichlorophenoxy) acetic acid (2,4-D) [0.65], 2-(2-methyl-4-chlorophenoxy) propionic acid (MCPP) [3.13], 3,6-dichloro-o-anisic acid (Dicamba) [1.13], solvent naphtha with 14% naphthalene [3.30], and dinitroaniline [1.29]--all of which were at concentrations far below the TLV.

Group 7. Horowitz et al. (33) reported peripheral nervous system chronic effects in farmers who applied pesticide solutions. Many of the solutions used were xylene [3.15] solutions of methyl parathion [2.86], tetraethylpyrophosphate [0.45], and azinphos-methyl [2.75] pesticides. The levels of exposure for each of these chemicals were below those that would induce acute or subacute symptomology. Here, too, it is believed that the xylene solvent facilitated the absorption of greater-than-expected quantities of the pesticides. Blain (34) described central and peripheral nervous system effects associated with low-level exposures to organophosphates. Blain did not identify specific pesticides or solvents, but one can safely assume that given the pesticides were organophosphates, they were dissolved in solvents with relatively high [K.sub.ow] values.

Group 8. Kilburn et al. (4) reported respiratory and neurobehavioral symptoms, as well as disturbed mental or neurologic function, in histology technicians as a result of their exposure to formaldehyde [0.35], chloroform [1.97], toluene [2.73], xylene [3.15], and ethanol [-0.31]. Kilburn's study was the 1st report of such neurological symptoms that could be attributed to these chemicals.

Group 9. Lee et al. (8) described pulmonary and upper respiratory tract symptoms among newspaper pressmen exposed to solvents. He attributed the prevalence of symptoms to a combination of solvent and lubricant exposure, even though exposures were below PELs. The chemicals included aliphatic hydrocarbons, glycol ethers, isopropanol, limonene, naphtha, oils, and varnishes. These chemicals have [K.sub.ow] values ranging from 0.05 to 4.57.

Group 10. In 1980, 21 workers at a large printing ink company reported eye and skin irritation, headache, dyspnea, and nausea symptoms that occurred while they were at work. The National Institute for Occupational Safety and Health (35) investigated and found methanol [0.77], ethanol [-0.31], isopropanol [0.05], MEK [0.29], methylisobutyl ketone [1.19], ethyl acetate [0.73], n-propyl acetate [1.24], toluene [2.73], xylene [3.15], and benzophenone [3.18]. All were measured at concentrations well below the recommended PELs.

Group 11. White et al. (36) reported acute and chronic CNS effects among workers in the screen-printing industry. Investigation revealed that these workers were exposed to toluene [2.73], MEK [0.29], mineral spirits (a mixture of compounds with [K.sub.ow] in the 3.0-4.0 range), methylene chloride [1.25], and acetic acid [-

0.17]. All exposures were at concentrations below TLVs.

Group 12. In 1988, more than half of approximately 200 employees working with composite plastic materials in 1 building of a large aircraft manufacturing company reported CNS, respiratory, heart, and gastrointestinal symptoms. Sparks et al. (37) investigated what was dubbed the "Aerospace Syndrome" and found the presence of phenol [1.46], formaldehyde [0.35], styrene [2.95], methylene chloride (1.25), methanol (-0.77), C9-C12 alkanes, and aromatics ([K.sub.ow] values 3.0-4.0), particulates, and epoxy resin. All exposures were at levels well below PEL. Sparks concluded that that "psychosocial factors in the workplace and community are likely to have been major contributors to this outbreak of illness."

Group 13. Koren et al. (38) studied "Sick Building Syndrome"--a set of symptoms associated with the air quality typically found in new homes and offices. Symptoms included eye, nose, and throat irritation; headache; mental fatigue; and respiratory distress. Fourteen people were exposed to a mixture of volatile organic chemicals characteristic of those found in new homes and offices. All chemicals were at concentrations far below levels considered hazardous. The 22 chemicals included aliphatic and aromatic hydrocarbons, aldehydes, ketones, alcohols, and esters. [K.sub.ow] values ranged from 0.05 to 5.74. Respiratory responses were noted immediately upon exposure, 4 hr later, and 18 hr later. Individual concentrations or additive effects could not account for the respiratory response.

Individual 14. In a case examined by the instant author, a 56-yr-old purchaser of a new yacht reported the onset of dyspnea, a tight chest, and coughing whenever she was in the closed cabin. Within 3 mo she developed permanent asthmatic symptoms. Ambient air measurements in the cabin showed the presence of formaldehyde [0.35], toluene [2.73], and benzene [2.13]--all at concentrations below those believed to produce respiratory effects.

Group 15. Gamble et al. (5) described respiratory effects on rubber workers exposed to resorcinol [0.80], formaldehyde [0.35], ammonia [-1.38], and particulates at levels far below the TLV. The exposures affected several organs. Acute decreases in lung function over a shift, difficulty breathing, itch, rash, chest tightness, burning eyes, persistent cough, and phlegm were noted. Gamble suggested that "formaldehyde carriers" carry formaldehyde deep into the lung, where it has a greater toxic effect.

Group 16. Harving et al. (39) tested volunteer subjects who were exposed to formaldehyde concentrations as high as 2.0 mg/[m.sup.3], which exceeded the PEL of 1.2 mg/[m.sup.3], and these levels did not cause lower-airway problems. No other chemicals were present in these individuals.

Group 17. Liu et al. (40) reported that occupational studies revealed that bronchial asthma resulted from exposure to formaldehyde at concentrations of less than 1.0 ppm. (Occupational exposures to formaldehyde are almost always accompanied by exposure to other chemicals.) However, these results, were not repeated in chamber tests with no other chemicals present.

Group 18. Alexandersson and Kolmondin-Hedman (3) reported on formaldehyde exposure in woodworkers. Very low levels of formaldehyde [0.35] produced dyspnea and other lower-lung symptoms; however, low levels of terpenes [4.57-4.83] were also present, as were dusts.

Individual 19. A carpet exposure case was examined by this investigator. Shortly after the installation of new carpeting in a home, a 40-yr-old woman experienced respiratory, CNS, and allergic symptoms. Her condition worsened until the carpet was removed. Sampling of the ambient air in the home revealed more than 80 different chemicals. These included formaldehyde [0.35], several other aldehydes, ketones, aliphatic and aromatic hydrocarbons, glycol ethers, organic acids, and alcohols. The concentrations of all species were well within levels considered safe for human exposure. The [K.sub.ow] values for the chemicals ranged from -0.31 to 5.74.

Groups 20 and 21 and individual 22. Brooks et al. (7) reported the onset of Reactive Airways Dysfunction Syndrome (RADS) in painters who applied vinyl latex primer in 1 instance and an oil-base enamel in another instance. The specific paints were not identified; however, a review of paint formulations shows that each had components that were relatively lipophilic and relatively hydrophilic. Brooks (7) also described an individual who developed RADS after applying a floor sealant that contained decane [5.01], ethylbenzene [3.15], toluene [2.73], xylene [3.15], and epichlorhydrin [0.45]. Although industrial hygiene evaluations were not performed in these 3 instances, it can be inferred that the exposure concentrations were relatively high because all individuals were working in enclosed environments.

Mice (group 23). Porter et al. (41) found that, although there was little or no observed biological effect of nitrates [-4.39] alone--or of the pesticides Aldicarb [1.13] and Atrazine [2.61] alone--when they were consumed in drinking water at the MCLs for groundwater, the combination of pesticide and nitrate altered immune, endocrine, and nervous system parameters in mice.

Discussion

In each of the cases reported earlier, at least 1 relatively lipophilic (higher [K.sub.ow]) chemical and 1 relatively hydrophilic (lower [K.sub.ow]) chemical were present. The leather-treatment exposures described by Burkhart et al. (28) and Van Essen (29) are typical of hundreds of similar cases that were reported nationwide in the 1990s.

The pesticide exposure cases discussed by Cone and Sult, (30) Horowitz et al., (33) and the current investigator (group 6 herein) are exemplars of numerous reports of pesticide poisonings at low levels of exposure.

The hepatotoxic effects noted by Dossing and Ranek (15) are similar to those reported by Sontaniemi et al. (42) concerning painters and chemical industry workers who were exposed to low levels of chemicals (i.e., levels that did not exceed authorized concentrations). Sontaniemi (42) discussed mixtures of 20+ chemicals, including alcohols and ketones (low [K.sub.ow] values); esters, glycol ethers, and chlorinated hydrocarbons (intermediate [K.sub.ow] values); and aliphatic and aromatic hydrocarbons (high [K.sub.ow] values).

The neurological effects on shoemakers reported by Mutti et al. (31) and Valentini et al. (32) corresponded with the known potentiation of the effects of MEK with hexane. (14) What was of interest, however, was the presence of such an effect with low levels of exposure.

The description by Kilburn et al. (4) of neurobehavioral symptoms and disturbed mental function is of interest because it demonstrated effects from the mixture of chemicals that are not associated with the individual chemical species present. This is indicative of the unexpected effects that may result from exposure to mixtures of relatively lipophilic and relatively hydrophilic chemicals.

The work of Lee et al., (8) the National Institute of Occupational Safety and Health, (35) and White et al. (36) demonstrated the acute and chronic effects of printing industry solvents on those exposed to levels below the TLV. In all 3 cases, the mixtures contained relatively lipophilic and hydrophilic species. This investigator has examined several other printing industry exposure cases that produced similar CNS and respiratory symptoms.

The work of Sparks et al. (37) on "Aerospace Syndrome" is indicative of many industrial hygiene studies that do not provide evidence of a connection between exposure levels of individual chemical species and symptoms. What the authors did not consider were the combined effects of the various chemicals. Several relatively hydrophilic species (e.g., formaldehyde, methanol, methylene chloride), as well as numerous relatively lipophilic species (e.g., styrene, aliphatic and aromatic hydrocarbons) were present. Again, one observes effects of the mixture that are not associated with low-level concentrations of the individual chemical species.

The study by Koren et al. (38) of "Sick Building Syndrome" was interesting because it was indicative of many similar studies that have involved both the workplace and the home. The chemicals found included many that were relatively lipophilic, as well as many that were relatively hydrophilic. Combined, they produced CNS and respiratory effects. The symptoms reported in the current study are similar to those described in several other studies involving low-level exposures to mixtures of such chemicals from new carpeting. (43-46) As exemplified by Dietert and Hedge, (43) many of these studies have concluded that the concentration levels of the individual components are insufficient to produce toxic effects. The results reported earlier in group 19 suggest otherwise. As was the case in the "Aerospace Syndrome" study, sick building and new carpet exposure effects are often considered psychological and attributable to a sensory stimulus, such as odor. (9)

Formaldehyde is a widely used industrial chemical that enters the home environment as a component of insulation, carpeting, plywood, and particleboard. It is an upper respiratory irritant and a carcinogen. (47) Not surprisingly, therefore, it has been the subject of much scrutiny. Seven of the group studies described herein involved symptoms that resulted from exposure to formaldehyde. Five of these--groups 5, 14, 15, 18, and 19--were exposed to low-level exposure. In all these reports, exposures to formaldehyde were accompanied by simultaneous exposure to at least 1 other chemical that was more lipophilic than formaldehyde, and these exposures produced lower-airway symptoms. Gamble et al. (5) suggested that "formaldehyde carriers" carry the chemical deep into the lung, where it has greater effect. The study by Harving et al. (39) is significant in this regard. The researchers found that, when formaldehyde was tested alone, even exposures higher than TLV did not result in lower-airway problems for the volunteer subjects. The findings of Liu et al. (40) are consistent with this. They reported that occupational exposures to formaldehyde at concentrations below the TLV, when other chemicals were present, resulted in bronchial asthma, but that such results were not repeated in chamber tests where no other chemicals were present. The authors stated that occupational exposures to formaldehyde were almost always accompanied by exposure to other chemicals as well.

Brooks et al., in their classic paper, described the onset of Reactive Airways Dysfunction Syndrome. (7) Of the 10 cases cited, 7 involved chemical mixtures. Several of the cases involved paints and coatings whose chemical components, individually, are not known to induce RADS symptoms. A review of the chemical compositions of the products involved revealed that, in all 7 cases, exposures were to mixtures of relatively lipophilic and relatively hydrophilic chemicals.

The Porter et al. study (41) is the only one in which human exposure was not addressed. It is significant, however, because it demonstrated how wide-ranging the unexpected effects of exposure to even minute quantities of chemical mixtures of lipophiles and hydrophiles can be. It also serves as a warning on the dangers of drinking contaminated water.

Research by Witte et al. (16) established conclusively that lipophilic compounds enhance the toxicity of hydrophilic chemicals that, in themselves, have a low capacity to penetrate cell membranes (a low [K.sub.ow]), and that this enhancement effect increases with increased [K.sub.ow] values of the lipophiles. Although Porter et al. (41) did not mention [K.sub.ow] values, the research reported demonstrated the presence of unexpected effects resulting from exposures to mixtures of lipophiles and hydrophiles at very low concentrations (i.e., those permitted in drinking water). The studies presented above support these concepts in human exposure.

Conclusions

The present review of group studies demonstrated that exposures to chemical mixtures of differing lipophilicity may produce greater-than-anticipated effects--that is, more severe symptoms, unpredicted effects on organs not known to be affected by the individual components, and effects at concentrations much lower than those known to be harmful for the individual components. Therefore, concentrations of individual chemicals in a mixture to which one is exposed are not necessarily indicative of the ultimate effects. The quantities absorbed are of greater significance.

It is postulated that, in all exposures to mixtures of chemicals with varying [K.sub.ow] values, a lipophilic species promotes permeation of a hydrophilic species through a mucous membrane. This results in the absorption of greater quantities of hydrophilic species than would be absorbed if the lipophile were not present. The enhanced effects likely result from this greater absorption. Absorption may occur through the skin, by ingestion, or via inhalation. No mechanism for the action, once absorbed, is offered. However, once absorbed, the mixtures of chemicals may affect the body in ways not anticipated from the actions of single chemicals alone. The effects of the absorbed mixtures may be acute or chronic. The time from absorption until the onset of symptoms, the target organ(s), and the severity of the effect(s) cannot be predicted at this time.

These findings have several important implications. They show that exposure to chemical mixtures of differing [K.sub.ow] likely produce reactions that may not be associated with the individual chemicals. Persons who present with "strange" symptoms following exposure to chemical mixtures should not be assumed to have been exposed benignly--examples include individuals who present with symptoms following installation of new carpeting, or after use of a spray-applied pesticide product, or following exposure to a combination of solvents, mold, and mildew. What is important is that the effects be connected to the exposures, even if the symptoms do not correspond to the known effects of the individual chemicals.

The concentrations of the individual chemicals in a mixture to which one is exposed are not necessarily indicative of the ultimate effects. The quantities absorbed are of greater significance, and the amounts absorbed may be related to increased permeation of a relatively hydrophilic species aided by a relatively lipophilic species.

All low-level exposures to toxic chemicals that produced unanticipated effects were exposures to mixtures of chemicals that contained at least 1 relatively lipophilic and 1 relatively hydrophilic species. The reported group studies included both acute and chronic responses. Reactions to high-level concentrations are postulated to be greater--with more severe symptoms--due to the absorption of increased quantities of the chemicals.

The findings reported herein suggest that the TLV and PEL values for individual chemical species do not necessarily apply to mixtures. Accordingly, standards for drinking water and air quality may require revision, thus reflecting effects of chemical mixtures. The effects of exposures to chemicals, as well as to the actions of pharmaceutical products, may also require scrutiny, and some chemical products may require reformulation to produce safer products. The potential combined effects of simultaneous exposure to toxic chemicals and ingestion of food should also be addressed. Toxicities should be determined for mixtures, rather than for individual chemical species. Research in these areas is ongoing.

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www.yahoogroups.com/group/TasCleanWaterNetwork
For files relating to the current widespread contamination of Tasmania's drinking water go to: www.yahoogroups.com/files/TasCleanWaterNetwork

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FAX COVER SHEET

DATE 20/7/04

TO AMA

FAX NUMBER 62236469

FROM Alison Heaney

PAGES 2 **including cover sheet.**

RE For info – copy of media release from TCRA.

Cheers
Alison

TO: Alison Bleaney

From: Kim Eastman

tasmanian community resource auditors inc.

PRESS RELEASE

CHEMICALS USE IN UPPER CATCHMENTS

The thing that has not emerged in the current debate so far is the need for thorough risk assessment by those practicing chemical applications in the upper catchments. During the past 4 years or so the Tasmanian Community Resource Auditors Inc. has facilitated some 7 community based audits of forestry activities here in Tasmania (see Upper Catchment Issues Tasmania, ISSN 1444-9560 for more details). The results of the audits show a number of systemic failures in forestry management practices, including failure to conduct adequate risk assessments. Examples where failure has occurred include: chemicals use, road construction, water management, stream classification and species protection.

In regard to the present issues in the St. Helens catchment, it is fact that the helicopter did crash and, it would seem, little was done in relation to effective cleanup of spilt chemical or appropriate alerts to the community, including downstream business activities that were at risk. This incident and the issues flowing from it demonstrate that Forestry Tasmania, the Government and the Local Council are not in a state of preparedness for incidents such as the one we have seen. Why is this? It's simple, the "authorities" have not done their homework and ensured that the operations in the catchment have been supported by appropriate risk assessment.

What could be done? In the risk assessment process we rate the various risks in terms of likelihood, severity and location of incidents. Once completed the risk assessment process tells us about the probabilities of failure or an incident occurring. From this we can put in place strategies to minimise failures and at the same time develop protocols to deal with incidents should they occur. To use the helicopter incident as an example, we would look at the following "factors" : pilot training, weather conditions, hour of day, location of spraying operation, fuel and chemicals (including their chemical and physical properties) on board, seasonal conditions, and flying hours per day. Although incomplete, the example list does show how complex the assessment process can be. Complex, but highly essential given the considerations as to "what can go wrong" should there be a major incident!

The way the present issue is unfolding in the St. Helens catchment comes as no surprise to us here at TCRA, because we have seen similar and worse over the past 4 years. Much more needs to be done to ensure that community, the ultimate "responsible persons", get in to oversee those we have employed to manage our resources.

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TCRA Inc. is a non profit, non aligned organisation dedicated to supporting community intervention into the sustainable management of our collective resources.

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21 July 2004

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AERIAL SPRAYING IN WATER CATCHMENTS

Dear Mr Llewellyn

The Tasmanian Branch of the Australian Medical Association has grave concerns regarding aerial spraying of chemicals in water catchments and its implications on public health. Tasmanian guidelines for the management of water quality are contained within "State Policy on Water Quality Management 1997".

The AMA notes that paras 44 and 45 of the guidelines places specific environmental and monitoring responsibilities on the delivery of the chemicals. The deliverer is required to demonstrate the level of environmental risk posed by the proposed chemical and to provide the consequent level of monitoring. The on-going issue for the AMA is that any level of risk to public health that is posed by pesticides and other chemicals being sprayed in water catchments is unacceptable.

I strongly request that within paragraph 44 of the State Policy on Water Quality Management 1997 that non-pesticide methods be employed in water catchments.

With kind regards
Yours sincerely

Dr Michael Aizen
President