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Aerial photograph of St. Helens and Georges Bay, Break O'Day

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Editorial:

The audit reported in this edition of the Journal is significant for two reasons. First, it lays bare both the complexity and extent of the risks associated with the use of man made chemicals in catchments. The author, in successfully teasing out complex issues relating to legislation, water monitoring and toxicology has been able to show the causes and consequences of dysfunction on the part of those responsible for human and environmental health. One cannot help feeling for them as they struggle with their task. It is our hope that this audit may provide insights that assist our governments and communities to implement innovative risk management strategies for water catchments.

The second significant contribution this audit makes concerns the ability of community members to take on complex and difficult issues. The work of the Break O' Day Catchment Risk Group has been outstanding. They have supported the excellent work of Dr. Bleaney, who continues to show leadership and vision. This contribution is, in our view, as significant and important as any other.

Once again community has shown that its ability and the knowledge it produces are of high quality and valid. Just what is needed as we enter the new era of community led change.

The Editorial team

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**Risk Awareness and Incident Response Capability in Water
Catchments in North Eastern Tasmania, Australia
– A Community Based Audit**

By

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Abstract

The results of a two-year community based audit conducted in North East Tasmania, Australia, are presented. The audit examines the ability of Local, State and Federal authorities to effectively manage water catchments. Official government bodies at local, state and national levels all have a role to play in identifying and managing risks associated with the quality and supply of water for human consumption, commercial use and environmental maintenance of riverine and estuarine systems.

Events during 2003 to 2005 led to community concern at what was believed to be serious dysfunction within and between the various authorities responsible for public and environmental health. In 2003 a spray helicopter carrying pesticides for a forestry operation crashed near a river in the upper water catchment of the township of St Helens. The crash was followed by a “one in a hundred years” flood event. Shortly thereafter, massive mortalities occurred in farmed oysters and other species downstream in Georges Bay. The mortalities have remained unexplained to date. During 2004 the author completed an initial investigation of issues surrounding the helicopter crash which led to the publication of an audit report in 2004. The numerous issues of concern raised at that time highlighted the need for further investigation. Of particular concern was the manner in which authorities responded to incidents that could have led to significant impacts. It was clear that official bodies were not aware of the risks associated with chemical usage within the catchments above St Helens.

The principal focus of the inquiry reported in this paper was to explore the underlying causes for the failure to identify and manage risks associated with chemicals usage in the catchments.

This paper proposes that forestry and other activities in the catchment contribute to ongoing risks that require analysis and the design of mitigation strategies. The author argues that the authorities are ill prepared for future incidents and that they have failed to act on publicly funded professional advice from experts and community members during the past 3 years. Furthermore, dysfunction at local Council, State, and Federal Government levels indicates that water catchments and their ecosystems remain unprotected. These findings are highly significant not just for St Helens, but also for the other catchments within Tasmania and perhaps Australia as a whole.

Recommendations for a new way forward are proposed.

The inquiry process and outcomes reported in this paper builds upon the emerging tradition of community involvement in environmental decision-making².

Key words: chemical contamination, pesticides in water catchments, pesticide monitoring, Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines, Australian Drinking Water Guidelines (ADWG), biotoxicity test, endocrine disruptor, immunotoxicity, epigenetic changes, genotoxic chemicals, risk assessment, health and ecosystem monitoring, drinking water, Environmental Management Pollution Control Act, Department of Primary Industry and Water, Break O'Day Council, Department of Health and Human Services, Public Health, community based audit, APVMA, National Water Quality Management Strategy, National Water Initiative, State Policy on Water Quality Management, AUSRIVAS, Forest Practices Act, Forest Practices Authority, atrazine, triazines, alpha-cypermethrin, precautionary principle, Tasmania, St Helens.

² Tattersall, P.J. 1991, 'Community Based Sampling – what is it?', *Organic Growing*, vol. 16, no. 3, pp.2-3.

Introduction

The issue of water contamination is a global problem. In Australia, as with many other countries, adequate access to clean water is becoming an increasing challenge, not only from the perspective of human needs, but also the needs of the wider environment. It is now understood that human activity continues to have substantial impacts on natural systems throughout the world. The most recent example appears to be the negative impacts arising from the ensemble of phenomena known as climate change. Knowledge about the impacts of human activity on the fragile Australian landscape (and its ecological systems) has been available for many years (Williams 1961; Ecologically Sustainable Development Steering Committee, 1992)³. It is now clear that human impacts are many and varied, with concerns over the use of synthetically made chemicals continuing to be expressed by communities both here in Australia and throughout the world. As fresh water continues to become increasingly scarce, and with the intensity of human activity on the rise, these concerns will not abate, particularly where there is clear evidence of negative impacts. As suggested earlier, it is not only human health and welfare that may be at risk, but natural ecosystems are also under threat.

Pollution of groundwater, stream water, and estuarine systems is of great concern both in Australia and globally. The European Union (E.U.) has acknowledged problems caused by pesticides⁴ in water catchments, including groundwater contamination (Environmental News Network 2006). Many E.U. countries have introduced legislation banning the use of certain pesticides, such as atrazine⁵, in an attempt to ensure safe water for human consumption and agriculture. In Australia the use of pesticides in water catchments continues to be legally permitted. In some instances the authorities have increased the health value⁶ of certain pesticides, e.g.

³ The Australian National Strategy for Ecologically Sustainable Development (Ecologically Sustainable Development Steering Committee 1992) defined ESD as “development which aims to meet the need of Australians today, while conserving our ecosystems to the benefit of future generations”.

⁴ The term pesticide in this paper means all chemical substances used to kill or repel pests, and examples include herbicides (plants), insecticides, fungicides, algacides, arachnicides (spiders), and miticides.

⁵ Atrazine is a pervasive environmental contaminant. It is one of the most significant water pollutants world wide.

⁶ A ‘health value’ is defined as a numerical value based on 10% of the Allowable Daily Intake (ADI) of a pesticide. An ADI is calculated for an adult weight of 70kg for a daily water consumption of 2 litres, (Australian Drinking water Guidelines 6, 2004), (NHMRC 10-11 April 2003).

atrazine (a member of the triazine⁷ group of pesticides). It is of concern that on the one hand the Australian Pesticides & Veterinarian Medicines Authority (APVMA)⁸ has increased the health value of certain pesticides (e.g. atrazine from 20 to 40 ppb in 2004) in our drinking water, while on the other the Australian Drinking Water Guidelines (ADWG)⁹ state that, “*little information is available on the effects of human exposure to organic and inorganic compounds, including pesticides, at the concentration likely to occur in water*”. This apparent anomaly (and there are many others) raises concerns relating to legitimacy of the codes, regulations and guidelines that resource managers and community are either obliged or compelled to follow. The significance of this for human and environmental toxicology will be discussed further on in this paper.

A range of pesticides is used to support forestry and agricultural management practices within the State. Several communities across Tasmania have shown that their water supplies have been polluted by pesticides (Bleaney 2005; Eastman & Walsh 2006) and that impacts of forestry activities continue to place significant risks on water yield and quality (Gschwendtner et al 2001).

⁷ Triazines, including atrazine and simazine, are selective herbicides used to control broadleaf and grassy weeds.

⁸ The APVMA defines its roles and functions as: *‘The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an Australian government authority responsible for the assessment and registration of pesticides and veterinary medicines and for their regulation up to and including the point of retail sale. The APVMA administers the National Registration Scheme for Agricultural and Veterinary Chemicals (NRS) in partnership with the States and Territories and with the active involvement of other Australian government agencies.*

Our role is to independently evaluate the safety and performance of chemical products intended for sale, making sure that the health and safety of people, animals and the environment are protected. Only products that meet these high standards are allowed to be supplied. We also do not register products if their use is likely to jeopardise trade or they don't work.

To ensure that only products that meet APVMA requirements are actually supplied, we constantly monitor the market for compliance. The APVMA also reviews older chemicals to make sure that they continue to meet contemporary high standards’

http://www.apvma.gov.au/about_us/subpage_about.shtml.

⁹ These are nationally based guidelines for drinking water quality, put in place by the Australian Government and are part of the National Water Quality Management Strategy. The ADWG strategy aims to, “achieve sustainable use of the nation’s water resources by protecting and enhancing their quality while maintaining economic and social development”.

<http://www.environment.gov.au/water/quality/nwqms/>

Industrial Forestry¹⁰ is now a prominent feature in many of the water catchments in Tasmania, with further expansion mooted in the near future (Gunns Integrated Impact Statement, July 2006¹¹). Many communities continue to express concern over what some believe is an industry that has become far too dominant and acts to the detriment of the health and economic fortunes of the State (Gschwendtner et al 2001; Dockray 2001; Dockray et al 2001; Nicklason et al 2004).

The primary focus of this paper relates to the risks¹² associated with chemical usage by the forest and agriculture industries in water catchments, with particular focus on the Break O' Day (BOD) Municipality, situated in North East Tasmania, Australia (see Figure 1). Of particular concern are upper catchments, where water collects as runoff after rainfall or is released from groundwater reserves. To date there has been little in the way of risk assessment by the authorities in relation to pesticide use and management within the Break O' Day catchments. This, along with events discussed later in this paper, has placed the community and the environment at what the author argues to be an unreasonable risk of damage and possible loss. These issues initiated a community inquiry into the nature and extent of risks associated with pesticide use in the catchments.

This paper presents the findings of this inquiry, the aim of which was to critically evaluate the ability of our authorities to both quantify and manage the risks associated with chemical usage in the water catchments from which the Break O' Day community and its industries draw water.

The inquiry was conducted using a Community Based Auditing (CBA) approach (Tattersall 2003(a); Gschwendtner et al 2001). CBA involves a process of critical investigation where community members gather information which is then interpreted in terms of community expectations, legislation, regulation, guidelines, and the principles of sustainability and best practice.

This audit proposes recommendations for improvement in the methods authorities use to manage the risks associated with chemical usage in water

¹⁰ Defined here as large scale clearing of forests for the purpose of establishing monoculture plantations that involves the use of a range of management practices including fertilizers, pesticides, and high-intensity burn-offs. The net result is often significant disturbance to potentially fragile ecosystems, including water catchments.

¹¹ Gunns is a private Tasmanian timber company that has put forward a proposal to build a pulp mill in northern Tasmania.

¹² Risk in this context is taken to mean the likelihood of negative impact on human or environment health as a result of the use of pesticide formulations or mixtures.

catchments in the St. Helens area of North Eastern Tasmania and beyond. The audit presents and critically analyses the roles and functions of Local, State, and Federal authorities that responded to questions during the inquiry.



Fig 1 Tasmania, Australia's island state, 42 degrees South. [base map by TASMAPP]

Context for the Inquiry and Statement of the Issues

Background Information

Pesticides - a National Responsibility?

Two reports provide a valuable summary and recommendations on pesticide use in Australia. The first, the *Report of the Senate Select Committee on Agricultural and Veterinary Chemicals in 1990* (Report of the Senate Select Committee 1990) contained 45 recommendations relating to the then current legislation and regulatory system. It also identified the need for a nationally unified approach to pesticide use. Key points included the following: investigation of the efficacy of non-chemical management systems, including integrated pest management and biological control; evaluation of the social, health, and environmental impacts of chemicals; and improvements in training of those involved in pesticide management, including end users. The report concluded that individual users of farm chemicals must accept the challenge and the responsibility of using agricultural and veterinary chemicals safely and judiciously and in a manner that would safeguard other people and the environment.

The second report, *Pesticide Use in Australia, 2002* (Radcliffe 2002) was a review of the above mentioned Senate Select Committee Report 1990 designed to provide a succinct update for policy makers. It detailed developments in regulation, use, and monitoring of current pesticide issues in Australia. Included in its executive summary is a recommendation that Australia resolves to establish a comprehensive and integrated pesticide use reporting system in order to assure the integrity of the quality of its agricultural produce. The Report recommended that the issue should be addressed jointly by Commonwealth, States and Territories, pesticide agencies, the chemical industry, and peak commodity-based producer organizations, in conjunction with community representatives. It further recommended that, “*any pesticide-use reporting system should be established with the capability of providing inputs for an economically rigorous cost: benefit analysis of the value of pesticide use in production systems, and the value of regulatory changes which may be proposed from future regulatory policies*”.

Radcliffe 2002

This recommendation is important as pesticides are unique toxic chemicals in that they are designed to kill, repel or otherwise harm living organisms (U.S. EPA 2005(b); Cox and Surgam 2006) and are regulated to allow intentional application to the environment.

In terms of the use and management of pesticides in Break O’Day, it remains clear that recommendations made at the national level are not being adopted at the “local level”. Furthermore, it is clear that gaps and inconsistencies exist in the way pesticides are both used and controlled in Break O’Day. Accordingly, the above reports and a number of incidents involving pesticides and water serve to open up discussion and debate in the local community.

Break O’Day Catchments - Pesticide Use in Forestry Operations

Over the past 10 years the area of land used by forestry plantations has increased by some 30 fold in the George River catchment. Pesticides and various additives¹³, often in combinations, are applied aerially and by ground methods onto these plantations during their growth to mitigate against damage caused by competition from weeds and insects. 1080¹⁴ baits are also laid in an attempt to decrease numbers of browsing animals (e.g. wallaby and kangaroo). Simazine (a member of the triazine family of herbicides) contamination was reported in the South George catchment in 1994 (*pers. comms.* C. McKean, G. Nicklason and Berris Hansbury June 2004). At that time, calls to stop aerial spraying of pesticides by the forest industry were made by the local community and the BOD Council (BODC).

Both Federal and State Governments acknowledge that pesticide drift to non-target areas does occur when pesticides are applied by spray methods. Details are to be found in *Operating Principles and Proposed Registration Requirements in Relation to Spray Drift Risk, 3rd Draft*¹⁵ APVMA. Further information can be found in *Rationale for The Agriculture, Silviculture and Veterinary Chemicals Council (ASCHEM)*

¹³ Solvents, surfactants, adjuvants, and other chemicals (collectively termed excipients) used to supposedly increase the efficacy of pesticides by changing droplet size and the ability of the spray to stick to target surfaces. (U.S. EPA 2005a) They are mostly biologically active and their efficacy has recently been seriously questioned by APVMA (APVMA Spray Drift Meeting Canberra, August 2006).

¹⁴ A poison (sodium fluoracetate) mixed with ground bait used to kill browsing native animals considered as pests by forestry industries.

¹⁵ Report can be located at http://www.apvma.gov.au/users/spray_drift_risk.pdf.

Recommendations on the Review of Code of Practice of Aerial Spraying, Tasmania, 2006 (ASCHEM 2006).

The terrain in many catchments in Break O' Day is hilly, often steeply contoured, containing many streams, springs, and ephemeral watercourses, and is subject to rapidly changing wind and weather conditions, thus exacerbating the risks of over spray into non-target areas, such as watercourses. Several incidents over the past five years have, in the author's view, possibly contributed to economic losses for the local aquaculture industry and may have put the health of the community at risk (Scammell 2004). The potential for contamination by agricultural and forestry activities throughout the catchment has also concerned many residents for some time. Bleaney (2004) had raised some issues in 2002 relating to the possible chemical contamination of the George River.

A Community Group is Formed

In light of the ongoing community concern and unresolved issues a community group, Break O' Day Catchment Risk Group, (the Group) was formed in 2004. The aim of the Group was to bring local knowledge and expertise into the assessment and management of risks in the main catchments of BOD Municipality. This paper reports on the findings of recent investigations conducted by the Group.

Trigger Issue

The issues relating to pesticide usage in Break O' Day catchments were brought to a head in December 2003 when a helicopter, ostensibly carrying only the insecticide alpha-cypermethrin,¹⁶ crashed approximately 250m uphill from the South George River, a tributary of the George River (see Figure 2). The resultant spill of insecticide (and possibly aviation fuel) caused concern within the community as it was perceived that the incident was not managed effectively by authorities through the use of the authorized Incident Communication Protocol (ICP)¹⁷. Investigation by the community determined that there was no site decontamination and no advice given to the public regarding possible water contamination, including contamination of drinking water (Bleaney 2004). There was no pesticide monitoring of drinking water in the river system by authorities following the helicopter crash, until July 2004.

¹⁶A synthetic pyrethroid insecticide used to control beetles and other insects considered as pests in plantation forests.

¹⁷ Bleaney (2004) discusses the failure in instigating the (ICP) Incident Communication Protocol. The ICP sets out the roles and functions of the various authorities in relation to their response to incidents.



Fig 2
Location of crash site (grid reference 756264) South Georges River 29km in a straight line West of St Helens TASMAR 1:250000 Northeast Tasmania, Lands Department, 1980)

It is notable that 16 weeks after the crash and 11 weeks after a major flood (January 2004), an investigation by Department of Primary Industries, Water and Environment (DPIWE)¹⁸ found alpha-cypermethrin, atrazine, simazine, terbacil¹⁹ and chlorothalonil²⁰ in significant amounts at the crash site (See Appendix 1). The official explanation of this, given by the Registrar for Chemical Products (DPIWE), was that the helicopter spray tank had probably ruptured on impact and chemicals built up on the inside of the tank had leaked out.

In the immediate aftermath of the January 2004 flood there was a 90% mortality of intertidal oysters and other species in Georges Bay²¹. The mortalities were located approximately five kilometres downstream from the St Helens drinking water intake. Various theories have been put forward as to the cause of this oyster mortality including excess freshwater, poor oyster husbandry, and pesticides washed down the George River by the flood.

The flood was the result a “one in a hundred year” rainfall event, and was the first rain since the helicopter crash in December 2003. It was put forward by the Group that pesticides recently sprayed in the catchment and those that had been deposited on the ground at the time of the crash may have washed with topsoil into the river and down into Georges Bay. It was hypothesised that oysters, being filter feeders, ingested pesticide, which were adsorbed onto suspended soil particles and other detritus (Bleaney 2004). The significance of adsorption of pesticides by aquatic sediments is both well documented and understood (Amweg et al 2005; Burton and Landrum 2003).

However, despite the investigations and reports produced by the authorities following the helicopter crash and the subsequent flood event²²,

¹⁸ A Tasmanian Government Department - DPIWE - Department. of Primary Industry, Water and Environment. On 5/4/2006, the Environmental Division became part of the new Tourism, Arts and the Environment. DPIWE’s planning functions (Resource Planning and Development Commission, the Resource Management and Planning Appeal Tribunal, and the Planning Branch) were transferred to the Dept. of Justice. The remainder of the Agency’s operational divisions formed the renamed Dept. of Primary Industries and Water – DPIW.

¹⁹ A selective herbicide and a member of the uracil group of chemicals. Used to control annual grasses and perennial and broad-leaved weeds. It is sprayed on soil surfaces just before or during the period of active weed growth.

²⁰ A broad spectrum organochlorine fungicide. It is NOT registered for use in the forestry industry in Tasmania.

²¹ The site of major oyster farming operations.

²² The Scammell Report and reply by DPIWE, and DPIW website.

questions still remain regarding the potential impacts resulting from pesticide use in the catchment. Monitoring of the river and drinking water for pesticide contamination by authorities did not start until July 2004, nor to our knowledge have the authorities conducted sediment analyses for pesticides in Georges Bay. In the author's view, although cause and effect have not been established, the events warrant the need for further investigations.

It was clear to the Group that questions remained regarding the ability of the relevant authorities to deal with incidents such as the helicopter crash in a timely manner. The published Community Based Audit (Bleaney 2004) of the emerging issues surrounding the helicopter crash included several recommendations for improvements to emergency response, risk assessment, and root cause analysis on the part of the authorities. Copies of the audit were sent to Local, State, and Federal authorities. In the light of emerging concerns and questions the Group commenced a further inquiry, the results of which are reported in this paper.

Methodology and Methods Used in this Inquiry

Methodology

A form of action research was used to guide the inquiry process (Stringer 1996). Members of the inquiry team met with trainers from the Tasmanian Community Resource Auditors Inc. (TCRA) group as part of structured training to assist with development of the inquiry process and final reporting²³. There was ongoing support during the project, with facilitators supporting the author during analysis, reflection and action. Several meetings were held between the Author and TCRA facilitators over a period of two years, the aim of which was to assist with creation of reports, letters and final report manuscript.

Methods

Data gathering. During the course of inquiry information was obtained from three main areas, referred to herein as Parts 1, 2 and 3. Part 1 includes information obtained from senior government officials (e.g. ministers and bureaucrats) and local government officials. The primary methods for data gathering consisted of the exchange of written correspondence, collection and analysis of studies and reports, and the acquisition of verbal information from a number of key informants. Part 2

²³ See back cover of Upper Catchment Issues Tasmania (ISSN1444-9560), vol 3, no.1 for explanation of roles and functions of the Tasmanian Community Resource Auditors.

includes historical information relating to water issues and pesticides usage. Water monitoring strategies were examined as well as the impact of aerial spraying in the catchments within Break O’Day Municipality. Part 3 presents the results from community based testing as well as findings from commissioned reports. Data from the literature is brought into the discussion as well.

The complexity of the inquiry meant data gathering and analysis tended to occur together. This was most evident in Parts 2 and 3, whereas Part 1 tended to display a clearer delineation between data gathering and analysis.

Data analysis. This involved the examination of documents and written replies from selected information sources. The primary aim of the analysis process was twofold. The first was to determine the nature of the approach to water management in the State of Tasmania. The second was to determine the true effectiveness of such a system by comparing it to a number of ‘best practice’ frameworks, including that of the National Water Quality Management Strategy²⁴ (NWQMS).

Data Gathering and Analysis

Part 1: Data from Government Ministers and Officials

On November 23, 2004, the Group wrote to all relevant Local and State Government Departments and Ministers having a responsibility for water management. The Group asked specific questions regarding departmental roles and functions with respect to risk assessment and water catchment management, especially with regard to environment and human health impacts. Following an analysis of the replies received, the Group wrote to the authorities again on April 11, 2005, asking for specific details regarding risk assessment and management plans. The responses received are presented below along with the Group’s comments and interpretations.

²⁴ NWQMS - an Australian standard for water quality. Principles include ESD, integrated approach to water quality management, community involvement, water resource management including establishment of environmental values and development of management plans, and government endorsement of the water quality policy objectives. National guidelines have been drawn up which allow for developing these water quality standards. These are: The Australian Drinking Water Guidelines (ADWG), The Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality, and The Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ). ARMCANZ was wound up in 2001 and replaced by Primary Industries Ministerial Council (PIMC) to develop and promote sustainable innovative and profitable agriculture, fisheries/aquaculture, and food and forestry industries. The Product Safety and Integrity Committee (PSIC) advises PIMC on issues relating to the safety and integrity of primary produce.

Bryan Green, Tasmanian Minister for Infrastructure, Energy and Resources, had responsibility for overseeing the Forest Practices Board during the period of the helicopter crash. He wrote, “*DIER per se does not have any role or function in risk assessment or management in relation to the impacts on human and ecological health of activities including forestry*”. He also stated that the Forest Practices Board (FPB)²⁵ also reported to him as the responsible Minister. He referred the Group’s original letter to the Minister for Environment and Planning. On May 6, 2005, he referred the issues of specific risk assessment and management approaches to Steven Kons, as Minister for Primary Industry and Water.

It was clear that the Department for Infrastructure, Energy and Resources (DIER) did not consider that they played any role in producing risk assessments despite possible impacts from forestry operations on water resources and quality. The Department of Mineral Resources had responsibility for groundwater quality at this time.

Steven Kons, Tasmanian Minister for Primary Industry and Water, replied on January 6, 2005, informing us that his Department’s roles and functions were detailed in their 2003/2004 Annual Report. The Report gave a “broad brush” overview but did not provide detailed answers to the questions asked. He also informed us that the Chemical Management Branch and the Water Resources Division might be relevant to the Group. Much correspondence had taken place between these Departmental Divisions and members of the community (including the Group) prior to this reply, but these Divisions could not demonstrate a rational, comprehensive approach to catchment risk assessment. Minister Kons’ Department replied to us on April 19, 2005, promising to reply to the issues brought forward in the Group’s letter of April 11, 2005. The Group has not received a reply at the time of this publication. This would suggest that his Department does not have a process for risk assessment of water catchments.

During data gathering the Group was made aware of a letter Minister Kons wrote to a concerned community member (Mr. George Walker) on November 9, 2004, stating that, “*The responsible use of forest herbicides in accordance with the current legislation presents little risk to contamination of our waterways*”. He also stated that the Australian Pesticides and Veterinary Medicines Authority’s (APVMA) review of atrazine in 2002 had found that, “*it is unlikely that atrazine use in*

²⁵ The Forest Practices Board (currently Forest Practices Authority) is a statutory authority responsible for overseeing the Forest Practices Act.

accordance with the label recommendations, paying particular attention to environmental restrictions, will contaminate waterways to any extent likely to present hazard to the environment or to human beings through the consumption of contaminated drinking water.” He further stated that, “The Agriculture, Silviculture and Veterinary Chemicals Council (ASCHEM)²⁶ is considering how Tasmania’s water monitoring programs might be coordinated and improved to give a frequency and quality of monitoring that ensures any risks to water quality from chemical spraying in agriculture and forestry are appropriately identified, assessed and controlled.” (Appendix 2).

This reply suggests a move toward risk assessment but at the same time appears to lack a clear methodology. It seems the Minister is suggesting that risks to water quality should be identified. However the Australian and New Zealand Environment Conservation Council (2000) (ANZECC)²⁷ Guidelines for Fresh and Marine Water Quality²⁸ already provide a framework for water quality management. They state that there must be an understanding of the links between human activity and environmental quality and that the goals for management must be unambiguous. They go on to state that water monitoring programs come only at the end of this process and are used to ensure that water quality objectives are met. In any case it was clear from the Minister’s answers that the State Government has a considerable way to go to adequately address the risk issues in relation to pesticide usage and management in the catchments. The risk

²⁶ A body reporting to the Tasmanian Government regarding the use and regulation of chemicals associated with these industries and management of the associated risk. Consists of the directors of the Department of Public Health, Department of Primary Industry and Water, and Department of the Environment, <http://www.dpiw.tas.gov.au/inter/nsf/WebPages/EGIL-52R9FF?open>.

²⁷ The Australian and New Zealand Environment Conservation Council (ANZECC) was a Ministerial Council that operated between 1991 and 2001. ANZECC provided a forum for member governments to develop coordinated policies about national and international environment and conservation issues. ANZECC was replaced in 2001. Natural resource management matters were moved to the Natural Resource Management Ministerial Council (NRMMC). Environment protection matters were moved to the Environment Protection and Heritage Council (EPHC) <http://www.environment.gov.au/about/councils/anzecc/index.html>.

²⁸ This document updates the Australian Water Quality Guidelines for Fresh and Marine Waters released in 1992 (Australian and New Zealand Environment Conservation Council 2000). Specifically, this document: outlines the important principles, objectives and philosophical basis underpinning the development and application of the guidelines. It also outlines the management framework recommended for applying the water quality guidelines to the natural and semi-natural marine and fresh water resources in Australia and New Zealand. The document provides a summary of the water quality guidelines proposed to protect and manage the environmental values supported by the water resources. (www.environment.gov.au/water/quality/nwqms/volume1.html).

assessment process could begin with an audit of chemical usage (including pesticides) in all areas of the catchments.

David Llewellyn, Tasmanian Minister for Health and Human Services, replied on December 24, 2004. He advised us that the Department of Human Health Services (DHHS)²⁹ in general only provides advice on the protection of public health to the proponent of certain activities or new developments where a Health Impact Assessment (HIA) is considered necessary. A HIA is required for activities that require an Environmental Impact Assessment under the Environmental Management and Pollution Control Act (EMPCA)³⁰. He also stated that the DHHS has no statutory powers to impose conditions or veto an activity or development. He explained that there is no provision under EMPCA for examining an existing activity.

In his written reply of May 4, 2005, Minister Llewellyn stated that Tasmanian State Ministers Steven Kons and Judy Jackson should address specific risk assessment and management plans. He further stated that DHHS was in the final stages of developing new Drinking Water Guidelines for Tasmania, which would require water suppliers to develop a Drinking Water Quality Management Plan for each drinking water supply under its control. The Minister stated that such plans must identify any significant hazard in the supply system that might affect the quality of the water or pose a risk to the health of its consumers.

The Minister's reply suggested that there were positive developments underway in relation to water quality management. It was also of interest to note his comments in relation to Ministers Kons' area of responsibility, particularly given Minister Kons' limited response to the Group's inquiries. In terms of Departmental roles and functions, the Minister's reply outlines a complex and convoluted system of Acts, regulations and departmental initiatives.

In view of the apparent regulatory dysfunction evident during the inquiry a briefing paper collated by Drs. Scammell and Bleaney on the above issues was presented to the Australian Medical Association (AMA) Public Health Committee in February 2005. The paper dealt primarily with the use of pesticides in drinking water catchments and potential adverse human health effects, with particular reference to the George River catchment. It

²⁹ A Tasmanian Government Department. Amongst many other statewide services, it provides public and environmental health services for diverse population groups.

³⁰ A Tasmanian Act, the Environmental Management and Pollution Control Act, 1994.

called for further investigation and the immediate implementation of the Precautionary Principle³¹ with regard to catchment activities. In the AMA media release following the Public Health Committee deliberations, the Committee, despite noting methodological flaws in the briefing paper, recommended minimising agricultural and industrial activities in water catchments and independent monitoring of environmental and human health impacts. Dr Aizen stated: “*When an activity raises threats of harm to the environment or human health, precautionary measures should be taken.*” (Australian Medical Association 2005). Despite this important development, there was little recognition, nor action on the part of State Authorities in relation to these issues.

As a guide, the Group suggests that the state authorities employ epidemiological monitoring³², including long-term data collection, as an appropriate way to investigate adverse health effects arising from pesticide use in the catchments. The Group is not aware of any health monitoring by DHHS in catchments, and would be very keen to see this type of monitoring used, especially as part of a rigorous approach to risk management in catchments that provide water resources for human consumption.

Judy Jackson, Tasmanian Minister for Environment and Planning, had not responded by April 2005 (5 months after our letter had been sent). The Group then sent her another letter asking for details of her Department’s roles and functions in the assessment and application of catchment based risk management. Her office had not replied to the Group’s inquiries by the date of her retirement in February 2006.

Although the Group understood that the Environment Division within the Department would have a role in the oversight of regulations relating to chemical use in water catchments, it remained unclear as to the nature of specific roles and functions in respect of risk assessment. This point is discussed further on in this paper.

³¹ The Precautionary Principle was adopted under the Intergovernmental Agreement on the Environment (Ecologically Sustainable Development Steering Committee 1992) to which Tasmania is a signatory. Basically, the Precautionary Principle holds that when an activity threatens harm to human health or the environment, precautionary measures should be taken, even if cause-and-effect relationships are not fully established scientifically. The process of applying this principle must be open, informed, and democratic, and must include potentially affected parties.

³² Epidemiological methods are most commonly used to investigate the causes of adverse health effects of a complex nature; i.e. not direct cause-and-effect mechanisms, with the possibility of several interdependent mechanisms.

Tony Walker, Health Officer, BODC, did not reply until April 11, 2005, when he advised that consideration of any risk management of a waterway would be related to the incident in question. The Group asked, in a letter dated April 29, 2005, for current risk assessment methodology for the catchments. He replied on May 16, 2005, stating that there were no current risk assessment or management plans for water catchments, although changes were pending for the new Tasmanian Drinking Water Guidelines (TDWG)³³. He also provided a copy of the Incident Communication Protocol (ICP)³⁴.

On August 3, 2005, the Group asked Tony Walker for a definition of “significant incident” specified in the ICP and for a date when the new TDWG would be implemented. His reply of August 11, 2005, stated that:

- *“The amended Drinking Water Guidelines have not advanced to any extent. If you would like a specific timetable you should contact the Director of Public Health.*
- *I have advised on a number of occasions Council does not have Risk Assessment Management plans in place for catchment.*
- *“Significant Incident” is not defined in the “Incident Communication Protocol”.*
- *I would assume that once an incident came to the attention of the appropriate authority, be it Council, DHHS or DPIWE, the decision would be made quite quickly if the incident was deemed to be “significant”. We would normally assume the worst until such time as it was shown otherwise.*
- *I know we have debated the helicopter crash at length, the fact is council was not advised of the incident. It is not a matter of changing process on Council’s behalf, I would certainly hope if a similar incident did occur all the effected (sic) agencies would be notified. If the helicopter crash is an example, I would have most certainly seen such an incident as significant and notified all relevant agencies as such an incident should draw upon the expertise’s (sic) of a wide range of personnel at both DHHS and DPIWE.”*

Mr Walker’s response demonstrated that BODC had still not come to grips with the need for catchment risk assessment, nor appreciated the consequences of untimely, ineffective management of hazardous or

³³ The Tasmanian version of the Australian Drinking Water Guidelines

³⁴ The ICP is a protocol for responding to a range of incident types. The protocol was developed by State and Local authorities.

“significant” events in the catchment. Furthermore there was no attempt to define “significant incident” or update the ICP. Accordingly, the Group decided that further inquiry was needed.

The Group’s inquiry involved examination of historical documentation relating to any advice given or offered to BODC in relation to risk management, and in particular its relation to statutory or regulatory obligations. A letter dated 12 February, 2002, from Mr Warren Jones (General Manager Environment Division, DPIWE) to Mr David Morcom (General Manager BODC), attention Mr Tony Walker, specifically details Council and State Government responsibilities and liabilities under EMPCA 1994.

The letter states:

“The Department is advised that a Council which is aware that persons conducting business in its municipality are suffering damage because of pollution there and which has the capacity to prevent or mitigate that pollution which it does not exercise, would at least be at risk of liability to the business operator either for breach of statutory duty or because of a duty of care which it owes to the operator.

The Department is also advised that, where the State Crown and Local Government have a similar duty, it could be that both would be held liable, or it could be that the State would be solely liable if it could be established that realistically it was in the best position to address the risk.”

In light of the above specific advice given by Mr W. Jones to BODC, it is even more difficult to understand why BODC has not acknowledged its statutory obligations and duty of care by undertaking risk assessments in its catchments.

Discussion of information gathered in Part 1.

During the past two years, the Group has discovered many discrepancies and inconsistencies between government policy objectives and what actually happens ‘on the ground’. The following highlights the key discrepancies and their significance, while at the same time describes the sheer complexity of water management legislation and regulation within the State.

The principal legislation governing water resource management is the State Policy on Water Quality Management 1997 (located at www.dpiw.tas.gov.au), Water Management Act 1999 (located at

www.dpiw.tas.gov.au), and the Environmental Management and Pollution Control Act 1994 (located at www.dpiw.tas.gov.au).

The State Policy on Water Quality Management applies to all waters other than privately owned water. The Policy basically adopts the NWQMS (see footnote 24) and was specifically designed to implement this Strategy. Tasmania became a signatory to the National Water Initiative (NWI)³⁵ in June 2005. The Policy implements the NWQMS under a value setting approach, largely devoid of structured risk assessment using Protected Environmental Values (PEVs)³⁶. Water quality objectives are defined as those that protect the agreed PEVs. In the group's view, therein lies a weakness in ensuring that risk is appropriately quantified. The question then, is how to include all relevant information in order to facilitate informed decision-making - the point where values and science meet³⁷.

Surface and groundwater, despite the fact that they are inexorably linked, have, up until 2006, been managed by two different State Government departments. Interlinked with this were a number of layers of responsibility from State to local government level (Appendix 3). Mineral Resources Tasmania (part of The Department of Infrastructure, Energy and Resources (DIER)) was responsible for groundwater management and had a responsibility to ensure its quality was not a threat to public health. Surface water was, and remains the responsibility of the Department of Primary Industry and Water (DPIW-refer footnote 18). DPIW also controls the use of, regulates, and polices pesticide use in Tasmania. DPIW administers the Environmental Management Pollution Control Act 1994 (EMPCA)³⁸. This situation must surely place a high administrative burden on departmental resources and at the same time create difficulties regarding the independence of some Departmental processes. It follows

³⁵ A joint Federal, States and Territories agreement, developed in 2004 (Council of Australian Governments) to develop a co-ordinated response to the nation's water crisis and protect water. It specifically refers to water trading, water planning issues such as interception and environmental requirements, and secure water access.

³⁶ Water quality defined at a location, depending on where the water has come from and where it is in the catchment e.g. pristine upper catchment, downstream recreational water, aquaculture.

³⁷ Examples of participatory inquiry and decision making include Post Normal Science and Participatory Action Research (Stringer, E.T. 1996; Gallopin, G., Funtowicz, S., O'Connor, M., and Ravetz, J. 2001)

³⁸ **EMPCA Part 1** objective **1(a)** to promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity, including **2(b)** safeguarding the life-supporting capacity of air, water, soil and ecosystems and **2(c)** avoiding, remedying or mitigating any adverse effects of activities on the environment. **Part 2 3(h)** to adopt a precautionary approach when using environmental risk to ensure that all aspects of environmental quality, including ecosystem sustainability and integrity and beneficial uses of the environment, are considered in assessing, and making decisions in relation to the environment.

that where there is potential for conflict of interest, there should be appropriate safeguards in place, which can be tested via independent audit.

Another layer of regulation which effects water quality involves the role of the Forest Practices Authority in overseeing Forest Practices Plans (refer footnote 25) subject to the Forest Practice Code 2000. Forest Practices Plans contain provisions to protect environmental and human health. Approved Forest Practices Plans are deemed compliant with EMPCA. However, documented Community Based Audits have shown contamination of water on a number of occasions (Eastman 2005). Note should be made that despite many documented breaches of “best practice” chemical use in agriculture and forestry, no prosecutions have been undertaken in the last 10 years (ASCHEM 2006).

The matter of water monitoring is an interesting case where the DHHS, through Public Health, does not conduct any direct water monitoring and places the responsibility for drinking and recreational waters (through the Public Health Act 1977) on the local councils or major water suppliers. Sections of the Waterworks Clauses Act³⁹ also impose an obligation for reticulated water on councils. They must provide, *“a supply of pure and wholesome (clean, free from obvious suspended matter and free from toxic substances, pathogenic organisms in amounts harmful to human) water sufficient for the domestic use of all the inhabitants of the water district.”*

Individuals who use non-reticulated water (water drawn from rivers, springs, bores, and water collected in rainwater tanks) for domestic and farming use are responsible for their own water quality. Councils, water bodies, and Public Health do not appear to have any legal obligations with regard to non-reticulated water supplies. Any pollution of these water sources would appear to be subject to EMPCA regulations.

In terms of local government responsibilities, a municipal council must notify the Director of Public Health if it believes that water quality could pose a threat to public health⁴⁰ (Section 128(1) of the Public Health Act). Under the Act, municipal councils must monitor quality of water within their municipal area (Section 130 of the Act) in accordance with the

³⁹ The Tasmanian Act.

⁴⁰ Note should be taken of following section in EMPCA:

EMPCA S20A(2) imposes upon a Council a statutory obligation, in relation to activities which are not prescribed activities, to “use its best endeavours to prevent or control acts or omissions which cause or are capable of causing pollution”.

Australian Drinking Water Guidelines (ADWG)⁴¹ and provide a report detailing these results to the Director of Public Health each year. The ADWG states: *“Although guideline values have been provided for a large number of pesticides, most are unlikely to be present in the Australian drinking water supplies. Monitoring should be undertaken for those pesticides that have been detected in the source water, or where local usage suggests that they might be detected.... For pesticides which are not approved for use in water or water catchments areas, the guideline value is set at or about the limit of determination. This value is the level at which pesticides 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. The guidelines should never be seen as a licence to degrade the quality of a drinking water supply to the guideline value.”*

www.nhmrc.gov.au/publications/synopses/eh19syn.htm

The Department of Public Health (DHHS) publishes an annual drinking water report for Tasmania. Local Councils struggle for the finance, resources, and expertise to conduct appropriate catchment risk assessments and water evaluation. Despite this, BODC has a legal responsibility for drinking water quality and if there are insufficient resources to fulfil its responsibilities in this important area it would appear both logical and a matter of duty of care that Council should inform the Director of Public Health of this situation. Public Health (Department of Human Health Services) is the department with overarching responsibility for Tasmania's drinking water quality. It is interesting to note that the Tasmanian Annual Drinking Water Reports have, up until November 2005, only reported bacteriological results and that the new Tasmanian Drinking Water Quality Guidelines 2005 (TDWQG) (Department of Human Health Services

⁴¹ www.nhmrc.gov.au/publications/synopses/eh19syn.htm .

(Tasmania) 2005) does not require mandatory testing or reporting of pesticides in water.

Once again dysfunction is evident between the various bodies overseeing water quality. In this case two national guidelines recommend monitoring of pesticides as a final step in performance monitoring, based on their likely occurrence in water, yet local government seems to lack the wherewithal to implement appropriate risk assessments or appropriate monitoring programs. While we see local councils, Public Health and DPIW continue with a limited random sampling program primarily aimed at the detection of individual pesticides in water, there appears to be little in the way of interpretive frameworks to assess toxic risks that may result from the presence of two or more pesticides. It is recognised that mixtures of pesticides and/or other chemicals such as fertilisers and excipients can result in enhanced toxicity and difficulty in predicting toxicological effects.

The nationally recognised ANZECC guidelines offer specific advice on how the problem of chemical mixtures should be treated. This applies to drinking water, recreational water, and water used for food production, including aquaculture. The guidelines advocate several approaches to toxicity assessment, including biological monitoring.

One such type of monitoring program currently undertaken is the AUSRIVAS⁴² (Krasnicki and Read 2001). The approach has been recognised as a key indicator for biological trend assessments in Tasmania and is used as the major benchmark for the protection of aquatic ecosystems in catchments. Initial studies showed that AUSRIVAS was unable to detect impacts on waterways emanating from plantation forestry (Krasnicki and Read 2001). In spite of this limitation, AUSRIVAS has been incorporated into impact assessments, assessment of the environmental benefit of environmental flows, and “State of the River”⁴³

⁴² AUSRIVAS (Australian River Assessment Scheme) is a rapid standard method for rating the ecological health of freshwaters by biological monitoring (Tasmania is using macro invertebrates) and habitat assessment. The scoring system is responsive to a variety of environmental effects including water quality habitat condition and changes in river flow and is incorporated into Government reporting systems as “The State of the River”, which is now known as “Waterways Monitoring Reports”.

⁴³ The State of River Reports provided information on the quality, quantity and ecosystem health of Tasmanian waterways up until 2003. Since then the Waterways Monitoring Reports report on the data collected from Tasmania’s rivers and streams as part of the Baseline Monitoring Network. Waterways Monitoring Reports, which have superseded State of Rivers Reports are a compilation of data from routine monitoring and investigative studies designed to describe the condition of

reporting, all of which form key indicators of management performance of those catchments studied. While AUSRIVAS may make an important contribution to our overall knowledge of biological trends, the heavy reliance by authorities on this particular assessment process, as opposed to a more all encompassing approach, which could incorporate toxicological testing is concerning. AUSRIVAS, as the cornerstone of Tasmanian waterways assessment, is limited in scope and lacks the ability to assess impacts from the forestry industry, which operates in substantial areas of Tasmanian catchments.

The ANZECC guidelines recommend a more pro-active and in-depth approach to water management based on risk assessment. The guidelines state *“where a chemical is to be used in an environment of particular socio-political or ecological importance, it is better to undertake toxicity testing with that chemical on species relevant to that environment. It is best to do this before the chemical is introduced.”*

A recently published Community Based Audit on the Recovery Plan⁴⁴ process for the vulnerable listed *Astacopsis gouldi*⁴⁵ - the Tasmanian Giant Freshwater Lobster (Eastman & Walsh 2006) - found that threats to this species continue from the introduction of known toxic chemicals into their environment. The audit critically examined the current management prescriptions developed for this species in light of the Recovery Team's⁴⁶ consistent call for research into the downstream effects of upper catchment logging practices, including the use of chemicals known to cause mortality in this species. The audit uncovered a lack of rational risk assessment, non-integration of information between the bodies responsible for management of *Astacopsis gouldi* habitat, and failure by authorities to regulate the usage of chemicals adjacent to waterways upstream of the habitat of this species.

water quality, hydrology, river habitat and riverine health at a catchment scale. The information from these four areas are analysed and reported in an integrated way to help identify issues for management and formulate potential actions that might alleviate problems in the future, www.dpiw.tas.gov.au/inter.nsf/WebPages/JMUY-5C76P7?open.

⁴⁴ A Recovery Plan is a document drawn up under Federal and State Threatened Species legislation to provide adequate management for a listed species to ensure the maintenance or recovery of populations under threat.

⁴⁵ This iconic species is the largest freshwater lobster in the world. Specimens have been recorded up to 6.5 kilos in weight and occurs only in select catchments of Northern Tasmania.

⁴⁶ The Recovery Team is a group of individuals appointed by the lead agency responsible for developing a recovery plan to assist in the development and implementation of the Plan.

In a taxpayer funded process such as the development of a Recovery Plan for *Astacopsis gouldi*, it begs the question as to why the ANZECC guidelines, in relation to toxicity testing, have not been followed and why key studies into potential forestry impacts on habitat, called for by the Recovery Team for nine years, had not been undertaken.

Part 2 Chemical usage in the catchment

Introduction

The States and Territories are responsible for controlling the use of pesticides after they are sold by manufacturers and retailers. In Tasmania, the Agricultural and Veterinary Chemicals (Control of Use) Act 1995 imposes duties on the users of pesticides to use registered projects in accordance with approved label directions or off-label permits issued by the APVMA. In respect of spray drift, users of pesticides have a duty to ensure their spraying operations do not adversely affect people or the environment, including water quality. This part of the Act is administered by the Spray Information and Referral Unit (DPIW). The Unit investigates complaints and incidents reported to it. The level of investigation by the Unit, including the decision of whether to monitor particular waterways as part of the investigation, is considered on a case-by-case basis depending on the nature and seriousness of the reported event.

History of pesticide usage in the catchment

Prior to 1994, triazine pesticides were consistently used by forestry industries in the George River catchment and other catchments in the North East of Tasmania. On two occasions in 1994 simazine was detected in the South George River, amongst others (Hobart, University of Tasmania Laboratory, *Waters- BOD Municipality Report No 5387 28/7/1994 and 5631 4/10/1994*).

In response to community concerns, the BODC sought support from both State and Federal Governments in 1994 to stop aerial application of pesticides by the forestry industry in the catchments. Communication took place between Mayor Legge and Senator Faulkner, as well as a number of State Ministers and politicians during September 1994. State or Federal politicians did not support the concerns. The community continued to express its concerns.

Between 1997 and 2004 there was no testing for pesticide contamination of river water despite a 30-fold increase in the plantation acreages in the

upper catchments. In response to community pressure, DPIWE undertook monthly grab sampling of the George River water from July 2004 to June 2005, and tested for the presence of 15 chemicals. It was interesting to note that in the report produced by the Department of Public Health detailing the results of the first sampling, atrazine and simazine were listed as, “*not been used for some years*”. This was despite atrazine having been found at the helicopter crash site in 2003 (Report by R Taylor, Director of Public Health, entitled, “Report on St Helen’s [sic] Water Supply & Sampling for Pesticides/Herbicides”, 29 July, 2004).

In August 2004, members of the community who lived in the upper and mid catchment of the George River saw helicopters spraying chemicals and were concerned about spray drift contamination of the George River. By consulting adjacent landowners⁴⁷, the Group established that the helicopters were spraying pesticides and determined the products⁴⁸ that had been used. The investigations showed that:

1. multiple products were being sprayed in combinations, including simazine; and
2. there was no consensus between BODC and the relevant Government Departments as to what pesticides were being used in the catchments (Appendix 4⁴⁹).

The above once again highlights the lack of coordination and information exchange between the departments and agencies responsible for managing public water resources. This further demonstrates an ongoing breakdown in communication between the authorities and the community. By the same token, the political climate appears to offer little opportunity for meaningful public input into the management of water resources and furthermore, there seems to be no process to engage the community in relation to water quality.

Water monitoring takes a new direction

Between July 2004 and July 2005 no pesticides had been found in the George River pesticide monitoring program undertaken by DPIWE.

⁴⁷ Letters of notification of spray events (detailing products to be used where, when) were obtained from adjacent landowners.

⁴⁸ Product (when used with regard to pesticides) - combination of active pesticide(s) and excipient(s) as marketed commercially.

⁴⁹ This was a communication (memo) from Dr Scammell to Roscoe Taylor, Director of Public Health – Tasmania.

Therefore, in July 2005 DPIWE changed its protocol for water sampling frequency from monthly to quarterly, and currently test for 19 individual pesticides⁵⁰.

From July 2004, DPIWE instigated a program of automated floodwater sampling from selected rivers across Tasmania, including the George River. Samples are tested for the same 19 pesticides as in the quarterly grab sampling, but using an automatic sampling method triggered by a rise in the water level of the river. Advice from environmental monitoring experts indicates that such a sampling strategy would, in all probability, miss the first flush (*pers. comms.* Marcus Scammell Feb. 2005). For example, the automatic sampling device on the George River is set to collect floodwater samples when the river level rises to approximately 1.8 metres above the baseline flow level. Depending on the level of the river prior to the flood, a significant amount of rise could occur before the automatic sampling system is triggered, thus missing the 'first flush'.

There were no flood water results published on the DPIW website for the George River between December 2005 and Sept 2006, despite the oyster leases in Georges Bay being closed on several occasions during this period. It was discovered that closure was due to marked increases in the amount of freshwater (i.e. rain) coming down the river. The Group is puzzled by the lack of floodwater reporting and is still unsure how to interpret the data on the DPIW website, as many of the dates do not correlate with the oyster lease closures and some data remain absent.

Although pesticides have not recently been recorded by DPIW in the quarterly grab sample Pesticide Monitoring Program in the George River, pesticides have been recorded in other Tasmanian rivers during the past two years⁵¹. Four rivers were found to contain pesticides in the routine random quarterly grab sample testing in July 2006. The actual products used have not been made public. Pesticides listed as having been detected were: MCPA⁵² in the Duck River (North West Tasmania), simazine in the Brid River (North East Tasmania), atrazine in the Jordan River (South East Tasmania), and simazine and 2,4-D⁵³ were found in the Rubicon River

⁵⁰ To be found at www.dpiw.tas.gov.au and search under heading 'Water'.

⁵¹ www.dpiw.tas.gov.au Water - Pesticide Monitoring in Water Catchments program.

⁵² A systemic postemergence phenoxy herbicide used to control annual and perennial weeds, in agriculture and forestry industries. No guideline value is set for this pesticide as it is not supposed to be found in drinking waters. Chemical name is (4-chloro-2-methylphenoxy) acetic acid.

⁵³ A systemic chlorinated phenoxy herbicide used to control broadleaf weeds in agriculture and forestry industries.

(Northern Tasmania) at the tidal limit. None of this testing was seemingly related to known pesticide use or a rainfall event.

As these test results were quite alarming, it was decided to expand the inquiry in order to explore the concerns arising from the above findings. The author wrote to the Tasmanian Premier on 8 September, 2006, with copies to the leaders of both Opposition Parties, about these and other issues relating to the Pesticide Monitoring Program (Appendix 5). The Premier was selected as the primary contact, as water management issues involve four different Government Departments. Questions were asked regarding remedial actions, protocols for follow up testing, lack of floodwater results and matters of public confidence in relation to river water quality.

A reply was received from Minister Llewellyn (Minister for Health and Human Services) on 7 November 2006 (Appendix 6). He did not answer many of the questions, but did state: *“This program is helping to develop a greater understanding of the broad impact of agricultural and forestry pesticides usage on water quality in Tasmania.”* He also stated: *“However, the program is not designed to account for total pesticide load; only that fraction in solution, which is typically available for drinking water.”*

The Minister’s statements suggest that water samples are only analysed for soluble pesticides, i.e. ‘that fraction in solution’. In other words, it would appear the analysis methods used under the Pesticide Monitoring Program are capable of analysing only those pesticides soluble or dissolved in water. However, it is well known that many pesticides do not dissolve per se, but are sorbed (bonded) onto particulate matter suspended in water. These bonded pesticides may represent a significant contribution to the total pesticide concentration within a given water sample and therefore should be considered. Knowledge of pesticide concentrations in the sediments (suspended and that which settles out) within a water sample may be vitally important in assessing risks throughout water delivery systems (i.e. from riverine to the consumer’s tap). Therefore, what constitutes the “water sample” has a profound influence on the way results from analysis would be interpreted and reported.

By way of example, highly adsorbed pesticides (i.e. those that stick firmly to particulate matter) such as alpha-cypermethrin and glyphosate⁵⁴, and the triazines to a lesser extent, will not be measured in testing regimes that look only at dissolved pesticides. Furthermore, should the water-borne sediment settle in riverine and estuarine areas there could be the potential for significant toxic exposures to bottom feeders and filter feeders such as oysters. There may be impacts on species throughout riverine and ocean food chains. For example, the problems now being seen within the Platypus population, (severe tissue ulceration due to fungal infection), could be associated with low-level exposure to toxic substances such as pesticides. The treatment of drinking water by water management bodies, could also allow previously adsorbed pesticides on particulate matter already present in the raw water to be released into the reticulated water. This possible risk to human health needs careful investigation.

But the problems do not end there. Water samples are being collected for laboratory testing in glass bottles (communication from Mike Johnson, Analytical Services Tasmania 14 December, 2006). This may result in the removal of pesticides, such as glyphosate in solution, by adsorption onto the glass⁵⁵.

Aerial spraying in the catchments

Over many years aerial application of pesticides has been a contentious issue in Tasmania, with numerous documented incidents of overspray and contamination of waterways. The situation is no different in Break O' Day Municipality, as evidenced by the degree of public concern following the helicopter crash in 2003. Driven by community concern, the Group produced a submission to the 2006 Review of Code of Practice of Aerial Spraying in Tasmania. The submission was lodged with the then DPIWE, who were managing the State level review. Final review of recommendations was conducted by the Agricultural, Silvicultural and Veterinary Chemicals (ASCHEM) Council⁵⁶. The areas of concern

⁵⁴ A broad-spectrum, non-selective systemic herbicide used for control of annual and perennial plants i.e. grasses, broad-leaved weeds, and woody plants. It is strongly adsorbed to soil. Even though it is highly soluble in water, it is strongly adsorbed to suspended particulate (organic and mineral) matter.

⁵⁵ Information source regarding adsorption of glyphosate onto glass was obtained from a National Association of Testing Authorities Laboratory (see footnote 59), Sydney (*pers. comm.* - sampling methodology for water samples containing glyphosate).

⁵⁶ One function of ASCHEM is to develop or approve codes of practice in relation to the handling, of chemical products and the monitoring of residues in water supplies, food and fibre.

expressed in this submission related to the numerous problems and pitfalls with aerial application of pesticides, particularly in high rainfall catchment areas. Drawing on data from experiences and research around the world, the Group found that issues of policing and risk management loomed large. The Group concluded that aerial application of pesticides in catchments should be banned.

Following the release of the Rationale for the ASCHEM Recommendations in 2006, which came out of the 2006 Review of Code of Practice of Aerial Spraying in Tasmania, the Group wrote to Minister Llewellyn on 18 August 2006 regarding its concerns in relation to the ASCHEM Recommendations (yet to be implemented in Tasmania) on aerial spraying. The key concerns expressed by the Group centred on the lack of detail and substance within many of the recommendations. There were also concerns regarding practicalities of implementation.

In his reply the Minister stated:

“There are a considerable number of questions and issues raised by the Group, which go further than can be simply addressed through return correspondence. I suggest an appropriate way to address these matters is for you to discuss them with the Registrar of Chemical Products and I have forwarded your correspondence to John Mollison in anticipation of that discussion.”

He went on to state that he believed the recommended ten metre waterway buffer (as in ASCHEM Recommendation 6) would be regarded as zero tolerance zones for pesticides, i.e. *“absolute protection from spray drift”*. He has not stated how this could eventuate in practice. While the Group would welcome a “zero tolerance” spray drift zone around waterways, it is unclear at this time (nearly one year after the release of the recommendations) just how this could be implemented and policed.

Part 3 Community Based Testing and Literature Review

The aforementioned evidence and arguments suggest that there has been little recognition, nor affirmative action, on the part of Local or State authorities in acknowledging that water contamination is a real threat to community and ecosystem health as well as economic and lifestyle factors.

Given the apparent inability, or unwillingness, of the responsible authorities to tackle the matters of risk assessment or root cause analysis, the community group decided to mount its own environmental monitoring program aimed at assessing the toxicity of water and sediments. The key

focus of community concerns centered on the potential for the public to be adversely affected by low level toxicity in the water supply⁵⁷, as well as ongoing impacts on the local oyster industry. It was felt that oyster health could be seen as an indicator of water quality problems when looking at the overall health of the catchment.

In January 2005, the community commissioned a bio-assay⁵⁸ of water samples, including the surface layer of the South George River and the George River at the water intake pipe for St Helens water supply. The samples of water showed toxicity. At the time of sampling the river was presumably fed by groundwater, due to negligible rainfall in the preceding weeks. A repeat bio-assay in March 2005, conducted by a National Association of Testing Authorities⁵⁹ accredited laboratory, again demonstrated water toxicity to *Ceriodaphnia* (freshwater flea), oyster larvae and sea urchin larvae. Sea urchin larvae are used as an indicator for human cell division. Duplicate samples given to DPIWE verified the results for toxicity to *Ceriodaphnia*. These further tests had been proposed under the community inquiry. DPIWE and the Director of Public Health, Tasmania⁶⁰ gave assurances that the toxins found were naturally occurring eucalypt oils derived from vegetation in the upper catchment. There have been no publicly available Government sponsored reports regarding comprehensive toxin identification and evaluation tests that demonstrate the validity of this statement.

Tasmanian Public Health and BODC remain satisfied that the George River is safe in providing potable water for St Helens. The water is also

⁵⁷ By way of example of the investigative process, in June 2005 a pesticide was found in a river water sample in the north west of the state. The detection of atrazine above the ADWG guideline value in the Rubicon River, at its tidal limit, in a random routine grab sample was reported and investigated by DPIWE. This showed that aerial spraying of a forestry coupe 10kms away was the likely source. Spraying had been found to have been carried out correctly according to the Code of Practice of Aerial Spraying with appropriate buffer zones around waterways. The Registrar of Chemical Products (Tasmania) stated that no action was therefore deemed necessary. A repeat grab sample of water from the Rubicon in Sept 2005 was reported by DPIWE as finding no atrazine. This is an admission by a government representative that government regulations and controls do not prevent pesticide contamination of our waterways and drinking water sources. Even when the level of pesticide found was above the guideline value, no indication was given as to how the contamination would cease. Sampling continues quarterly yet there is no water management plan in place for the Rubicon to identify and review catchment issues which impact on water quality and quantity

⁵⁸ The method involves testing of water on several species of sensitive aquatic fauna (oyster and sea urchin larvae were used on this occasion).

⁵⁹ A national proficiency accreditation body that accredits laboratories.

⁶⁰ Dr. Taylor (at the time of publication) is Director of Public Health for the State of Tasmania.

sold and provided to those living in smaller communities around the area. Despite these assurances, the oysters in Georges Bay continue to experience problems, such as reduced growth rates, decreased shelf life, consistent pathological features, and high mortality rates (at times above 20%). These problems have been noted to occur in conjunction with middle catchment rainfall events of over 20mm, (Tasmanian oyster industry meeting, including S.Pyecroft and DPIWE, Campbelltown, Tasmania, February 2006).

It would appear that the quality of St Helens drinking water, particularly regarding toxicity and the potential for long-term human health effects, remains in question. There are also concerns about the ability of testing regimes (analytical and toxicological) to deal with the complexity of chemical interactions and changes occurring in aquatic systems. These matters will be more fully discussed later in this paper.

Commissioned Studies – What Do They Tell Us?

Many of the issues raised by Bleaney (2004) remain unaddressed by authorities. The Group argues that considerable public money has already been expended on numerous studies but these have not addressed the issues and questions arising from the oyster kill. It is the author's view that the Community Based Audit (Bleaney 2004) recommendations, which arose in these studies, should have alerted authorities, but instead they remain largely ignored. At the same time, a large amount of community time, money and effort has been expended in trying to persuade the authorities to take appropriate responsible action to investigate the problems identified and address the issues. There has been limited success to date.

Since 2002 a number of consultants have been engaged by DPIW to examine possible causes of oyster ill health in Georges Bay. The most recent study (Percival 2004)⁶¹ was commissioned by the then DPIWE to investigate oyster ill health and increased mortality, which had been ongoing for approximately 9 years. Percival identified a number of possible causal factors, including pesticides. Percival failed to identify the cause of the 2004 oyster mortality, but recommended investigation of catchment activities, including chemical usage. The following recommendations were made in the 2004 Percival Report:

⁶¹ The report is titled "Oyster Health in Georges Bay, Collation and Analysis of Data 2004" (Percival 2004).

1. *“Develop a structured, cooperative and coordinated approach to further investigation;*
2. *Linkage with the Natural Resource Management (NRM) Project being coordinated by the Georges Bay Water Quality Committee;*
3. *Targeted investigation program comprising an initial broad scale pilot program followed by a more focused ongoing program (this included an audit of chemical usage in the Georges catchment and a survey of the sediments throughout Georges Bay);*
4. *Preparation for timely structured investigation of flooding events; (includes looking for chemical substances, salinity, pH, and examination of any moribund, or recently dead wild species);*
5. *Collection of appropriate and uniform production data by oyster farmers;*
6. *Research trial investigating the effects of salinity, temperature, and suspended solids on oyster health;*
7. *Investigation by farmers of ways to minimize stress during handling and during flood events;*
8. *Seek to remedy any unacceptable inputs into Georges Bay, particularly where existing practices are unauthorised.”*

Failure by authorities to implement the recommendations of the 2004 Percival Report remains a source of concern for the Group.

The subsequent reports⁶², “Bringing Back the Bay” and “Establishment of an Integrated Water Quality Monitoring Framework for Georges Bay”, cite previous reports and discuss the need to implement the monitoring and testing as described by Percival (2004). They do not mention the toxicity tests undertaken by the Group or DPIWE, or the need to assess the biological impacts of the identified toxin. Despite these further reports, no integrated, comprehensive investigative action has been taken by Local or State Government.

In consideration of these matters, the Group has become increasingly concerned at the content of written responses, the approach taken, and the quality of work conducted by Local, State and Federal officials. There seems to be a lack of will to undertake a comprehensive, integrated approach to catchment management. This has led to the Group continuing

⁶² Reports by Camilla White, DPIWE, September 2005.

with their own research, such as fieldwork, information gathering (locally and nationally), and consultation with experts and literature reviews.

Pesticides - Toxicological considerations

General considerations

There appears to be little awareness, or understanding on the part of authorities here in Tasmania as to the toxic impact of many of the pesticides and chemicals used in catchments. This is reflected in a lack of risk assessment of the catchment, which in turn leads to inappropriate strategies and decision-making. That said, it is clear that a vast and diverse body of literature relating to toxicology and risk assessment exists. All that is needed now is initiative on the part of our authorities in taking the next steps, and following the already developed Australian Drinking Water Guidelines (ADWG) and ANZECC guidelines.

The discussion below introduces some of the concepts relating to possible mechanisms of pesticide transfer through riverine systems before introducing some of the relevant toxicological literature.

The literature reveals that the physicochemical behavior of pesticides can be both subtle and complex (Relyea 2005), leading in some cases to unexpected and difficult to predict outcomes. By way of example, many pyrethroids display interactions with aquatic sediments such that some can have half-lives of up to 163 days (Amweg et al 2005). Amweg et al (2005) indicate that analysis for pyrethroids in waters may be of very limited value as the chemical is adsorbed onto sediments. Accordingly, it could be argued that in the case of oysters, (which are filter feeders), these findings are highly significant, as they suggest that the authorities may have been looking in the wrong place for toxins that may have contributed to oyster deaths. Sediment analysis was also called for by Percival in 2004 and the community on other occasions (Bleaney 2004), but these calls have yet to be acted upon by authorities.

Risks posed by pesticides

There is a growing body of evidence which suggests that many of the chemicals now used in our catchments may well be posing significant human health risks. Animal studies show that exposure to extremely low levels of many commonly used pesticides, such as the pyrethroids and atrazine, have the capability to cause immune system dysfunction (Heilmann et al 2006; Repetto and Baliga 2003); endocrine disruption

(hormone imbalances) (Aksglaede et al 2006; Anway et al 2005; Birnbaum and Fenton 2003; Crews and McLachlan 2006; Hayes et al 2002 and Hayes et al 2006) and epigenetic changes (changes in the expression of a cell's genetic code by changing the on and off switching mechanism of its genes) (Crews and McLachlan 2006; Myers 2006) (*pers. comm.*- Cummins 2006)⁶³. It is well established, through medical research, that changes in gene expression play a significant role in various diseases and illnesses such as cardiovascular disease, cancers, and metabolic syndrome (obesity and diabetes) (Grun et al 2006; Lee et al 2006; Myers 2006). Research has suggested that neurological diseases, (neurodevelopmental and neurodegenerative diseases e.g. Parkinson's disease) are linked to pesticide exposure (Ascherio et al 2006; Colborn 2006). It is also well established that some pesticides can alter gene expression, including many of the genes shown by medical research to be involved in causing human diseases (Crews and McLachlan 2006; Myers 2006). Proof to date, however, stops short of demonstrating with absolute scientific certainty, that these pesticides are the ultimate cause of disease in humans. Extensive evidence of such harm has been shown in other animals.

Most of the animal experimentation has been done on laboratory mammals and rodents. Very little is known about the effect of pesticides and chemicals on native Australian wildlife (Radcliffe 2002).

Is immune suppression a factor in the fungal infection affecting the platypus population and also the aggressive facial tumour affecting large numbers of the Tasmanian Devil population?

Absence of proof of harm in humans is not evidence of safety, as almost no research has been undertaken on the net effect of systems disruption and dysfunction in humans over time. The research clearly shows that embryos and very young individuals are among the most susceptible groups, (Aksglaede et al 2006; Birnbaum and Fenton 2003; Bradman 2006; Newby and Howard 2006; Repetto and Baliga 2003; Myers (n.d.)) along with those already immuno-compromised (as in the sick and the elderly), with effects often not evident until decades later. Different individuals i.e. those genetically predisposed, have different susceptibilities to toxic substances (Newby and Howard 2006; Pesticide Action Network Pesticide Database 2006).

⁶³ Prof. Joseph Cummins, Professor Emeritus of Genetics, University of Western Ontario, Canada.

Another complicating factor is that while chemicals are nearly always encountered in real-life as mixtures, the effects of chemical mixtures have not been studied in any great detail (Cox and Surgam 2006; Pollak 1993). This also includes the lack of evaluation of the toxicity of pesticide products (pesticide plus additives and contaminants e.g. dioxin), as the toxicity of the tested active pesticide is often less and very different from that of the retail products (Cox and Surgam 2006; Oakes and Pollak 2000; Zeljezic et al 2006). Despite rigorous searching of the literature by the Group, it has been unsuccessful in locating any studies documenting the synergistic effects of chemical combinations on oysters (confirmed by *pers. comms.* with S. Pyecroft at an oyster industry meeting in Campbell Town, Tasmania, February 10, 2006). Accordingly, synergistic toxicity may not have been considered in any of the government sponsored investigations.

From the investigations conducted by the Group, it is clear that the Pesticide Monitoring Program employed by DPIW has not sought to determine the concentrations of chemical degradation products or metabolites. It is known that many pesticides undergo change when exposed to biological and natural systems. For example some pesticides degrade into similar chemicals during exposure to sunlight (caused by UV), while others may be converted into allied compounds as a result of biological action. Many of these ‘degradation products’ may still have biological activity. Consequently, knowledge of their concentration and behaviour is vitally important in any risk assessment.

Endocrine disruption

The literature describes endocrine disrupters as follows,

“Disruption of the endocrine system can occur in various ways. Some chemicals mimic a natural hormone, fooling the body into over-responding to the stimulus, or responding at inappropriate times. Other endocrine disruptors block the effects of a hormone from certain receptors by blocking the receptor site on a cell. Still others directly stimulate or inhibit the endocrine system and cause overproduction or underproduction of hormones. Medical interventions commonly manipulate the endocrine system for the betterment of a patient, and side effects of such therapy can be interpreted as due to endocrine disruption. Substances in question are also known as Endocrine Disrupting Chemicals (EDCs) or Hormone Disrupting Chemicals (HDCs), and belong to the group of

xenobiotics, foreign chemicals that affect a biological system”

<http://encyclopedia.thefreedictionary.com/Endocrine+disruptor>.

It turns out that many pesticides and other chemical substances can, in minute concentrations, behave as endocrine disruptors. Interest in the role of pesticides in endocrine disruption continues to be an area of active research.

The pesticide atrazine, which is permitted to be applied in Tasmanian water catchments, has been found to be an endocrine disruptor and shown to chemically castrate and feminise male amphibians at extremely low (0.1 to 1 ppb⁶⁴) levels (Hayes et al 2002), and has been linked to prostate and breast cancers (Birnbaum and Fenton 2003)⁶⁵. Atrazine is persistent and is one of the most significant water pollutants in rain, surface, marine, and ground water⁶⁶. Because of its associated risk it has already been banned in several European countries. The allowable health value for atrazine was doubled in 2004 to 40 ppb (Australian Pesticides & Veterinary Medicines Authority 2004) despite these concerns.

It is unclear how endocrine disruptors that induce different effects will act when in combination (EDEN 2005). Non-linear (non-monotonic) dose response curves are normal for endocrine disruption Myers (n.d.). This means that in some cases low doses may actually cause greater impact than high doses for a specific response. The amount of chemical(s) required to cause various effects is often impossible to predict even with very exact scientific experiments. It is no longer possible to express toxicity as “the dose is the poison”, i.e. the higher the dose of chemical, the more toxic the effects. In 2005 over 100 research scientists actively involved in research on endocrine disruption issued a joint statement raising concerns about endocrine disruption:

“In view of the magnitude of the potential risks associated with endocrine disruptors, we strongly believe that scientific uncertainty should not delay precautionary action on reducing the exposures to and the risks from endocrine disruptors.”

(The Prague Declaration on Endocrine Disruption, EDEN 2005)

⁶⁴ ppb means parts per billion. It is a unit of concentration. When used on a w/w basis it refers to 1 microgram (which is one millionth of a gram) in one litre (in this case of water).

⁶⁵ Recent research has shown linkages between atrazine and cancers in human, see ‘Atrazine-Induced Aromatase Expression is SF-1-Dependent: Implications for Endocrine Disruption in Wildlife and Reproductive Cancers in Humans’ (*Environmental Health Perspectives*) <http://dx.doi.org>.

⁶⁶ See www.pan-uk.org/pestnews/Actives/atrazine.htm.

Questions have been raised as to how to regulate the use of endocrine disrupters. While it is clear that some pesticides are capable of endocrine disruption, no “official” list of these chemicals has yet been compiled in the United States. In 1996, testing to identify endocrine disruptors was mandated by the Federal Food Quality Protection Act; however, delays and lack of funding continue to set back the schedule for implementation.

Despite all of the above, current regulations do not require comprehensive evaluation by APVMA for the above effects (immunotoxicity, endocrine disruption and epigenetic changes) prior to the release of pesticides (active constituents, excipients and products) for general use.

Issues Requiring Further Investigation

- There is no Water Management Plan for the George River or most of the other rivers in the BOD Municipality. There is currently no information being gathered on the flow pattern of the George River, as the river flow gauge has not been operational since 1990. Tree plantations have been shown to increase water uptake when compared with agricultural land or natural forest (Leaman 2005). However, water uptake by plantations (interception) has not been determined or allocated in water management planning to date in Tasmania, and will not be required to be considered until 2011. This could be seen to be advantageous to plantation owners at the expense of other water users and the ecosystem, both which may be disadvantaged if there is a decrease in water flow. Climatic changes leading to decreased rainfall in the catchment will exacerbate this problem. Water quantity and quality are closely inter-related, such that a decrease in water quantity may lead to an increase in the concentration of water pollutants, thereby exacerbating water pollution problems.
- Break O’Day Council has failed to implement a number of actions recommended by the Group. For instance, the Incident Communication Protocol (ICP) for BODC has not been modified with respect to the types of incidents it is designed to address. This is in spite of the fact that the ICP was not activated by the helicopter crash and subsequent chemical spill in December 2003. Furthermore, the crash site has not, to date, been remediated, despite its close proximity to the South George River, which constitutes the source of St Helens water supply.

- Labelling of pesticide products by APVMA does not include all additives and the Material Safety Data Sheets do not always list the same ingredients as the label. Updating labels for pesticides is currently dependent on review of the pesticide or when a new product is reviewed prior to entering the market. Current information regarding the toxicity of a pesticide or product is therefore not automatically incorporated into a label as the information becomes available.
- Although APVMA regulates access to, and use of, pesticides prior to the point of retail sale, there are currently no national competency standards for pesticide applicators, aerial or otherwise.
- Labels do not explicitly state which chemicals can be mixed together and in what proportions. Labels only stipulate what the product cannot be mixed with, i.e. ‘do not mix’. There are no Safety Data Sheets for pesticide and/or product combinations⁶⁷.
- An Adverse Incident Report (AIR), authored by Dr M. Scammell, Dr A. Bleaney, Dr M. Aizen (President, Tasmanian branch of Australian Medical Association) and the St Helens Marine Farmers, was lodged with APVMA at the end of 2004. The report detailed the impact produced by the flood in February 2004 and the events surrounding it. It called for further investigations, conclusions, and restorative treatment. The APVMA replied that the above group’s investigations had not established a “cause and effect” and therefore no action would be taken. It did not detail any further investigative work it had carried out, either directly or indirectly. AIR is an ad hoc reporting system and reporting is at the individual’s discretion. Mandatory reporting is solely by chemical companies after an adverse event has been reported to them.
- To the author’s knowledge, the DHHS does not collect comprehensive epidemiological data in the North East of Tasmania. See also the Tasmanian “State of Public Health Report” 2003 (Department of Human Health Services 2003) which states the need for further epidemiological studies to be undertaken in Tasmania.

⁶⁷ There are no MSDS sheets for mixtures of products used in pesticide application operations e.g. when operators mix and use combinations of products including chemicals such as glyphosate, metsulfuron-methyl, sulfometuron-methyl, simazine, and detergent.

- Pesticide Use in Australia 2002 (Radcliffe 2002) documents that beyond the point of retail sale the use of agricultural and veterinary chemicals (pesticides) is governed by the individual and regulatory arrangements of each State and Territory. The regulatory and institutional arrangements vary widely between States and Territories. There seems to have been no previous attempt to summarise all the regulatory arrangements relating to the use of agricultural chemicals for every State and Territory. This is perhaps not surprising given that there are currently over 60 Acts and Regulations relating to pesticide supply and use throughout Commonwealth, States and Territories legislation.

Conclusions

It is clear from this inquiry that no guarantee can be given that the water of the George River is safe, clean and non toxic. This statement may also apply to the other rivers in the BOD municipality and Northeast Tasmania.

Many complex and far reaching issues have emerged during the course of this two year Community Based Audit.

Through the Group's investigations it is clear that communication between the general public, Local Council, and Government Departments is often non-productive and the outcomes unclear. For this reason it has been difficult for the Group to assemble the information contained in this audit and to progress community involvement in water catchment planning and management issues. The governing systems (Local Council, State and Federal) do not allow for communities to become easily involved in the investigation and resolution of problems relating to those human activities that have the potential to cause water pollution in the catchment.

The Group has found no evidence of any change in the State's approach to pesticide use and has concluded that pesticide use in the catchments continues unabated. Finding solutions to the problems associated with the regulatory control of pesticide use in Tasmania is a daunting prospect. DPIW control the use of pesticides and takes the lead role in the inter-agency approach to water management. These could be seen as conflicting roles. As stated previously, there is no routine monitoring of spray events. If a pesticide spray activity does adversely affect human health, agricultural stock, produce, or the environment, the onus of proof lies with the person affected. This is an onerous task and the Department itself admits that this is probably why there have been no prosecutions regarding

aerial spraying for the last 10 years. The Review of Code of Practice of Aerial Spraying undertaken in May 2005 by DPIW has failed as yet to provide definitive conclusions and recommendations.

The Public Health Act states that a water authority has a legal obligation to provide a supply of pure and wholesome water (free from toxic substances) sufficient for the domestic use of all the inhabitants of the water district. Despite this, there remains no mandatory requirement by the Department of Public Health for water authorities to provide comprehensive catchment risk assessments and chemical monitoring if seen to be relevant.

The ADWG state clearly that pesticides are not to be present in drinking water. Yet on many occasions pesticides have been found in river waters despite protestations from the Government that “best practices” are being followed. The Group, following the ANZECC Guidelines, recorded evidence of water toxicity, by way of a positive bio-assay test. DPIW has failed to repeat this line of testing and produce a thorough Toxin Identification and Evaluation (TIE).

It is now well recognised that the relationships between key ecological processes and their components are complex and variable (probabilistic) and cannot be determined precisely. The ANZECC and ADWG guidelines attempt to take these factors into consideration. The guidelines have not been fully adopted in Tasmania, but are being used selectively, with the possibility of serious and deleterious impacts to ecosystems. A significant length of time (nearly three years) has elapsed since the oyster kill with no comprehensive investigation yet in place. No effective catchment risk assessments are in sight. The focus continues to be on random quarterly river water monitoring for individual soluble pesticides (unrelated to pesticide use or rainfall events), and the AUSRIVAS program.

It is the Group’s opinion that the “Pesticide Monitoring in Water Catchments” program and the “State of the River Reporting”⁶⁸ are inadequate to provide proof that river water is uncontaminated. The Group is at a loss to understand why catchment risk assessments in conjunction with baseline monitoring programmes, as per the ANZECC Guidelines, have not been instigated.

⁶⁸ now known as Waterways Monitoring Reports – see <http://www.dpiw.tas.gov.au/inter.nsf/WebPages/JMUUY-5C76P7?open>.

The Group has determined that relevant Federal Departments have also failed to take into account all of the key aspects in relation to pesticide safety. For example, the APVMA in association with the Department of Health and Ageing, and the Department of Environment and Heritage, register agricultural and veterinary chemicals for use but they do not comprehensively test for immunotoxicity, endocrine disruption, or epigenetic changes. They also allow for pesticides and other chemicals to be used in catchments in spite of the fact that both State and Federal departments acknowledge through their reporting systems that spraying pesticides will produce spray drift onto non-target areas.

While not absolutely proven, evidence points strongly in the direction of environmental interference with gene behaviour contributing to the causation of many diseases. History shows us that it took 40 years to prove with certainty that smoking causes lung cancer. Communities and ecosystems cannot afford to wait for certainty to prove the links between cause and effect of more complicated diseases.

Science's lack of knowledge in the area of environmental toxicology has led to a degree of uncertainty, and perhaps ignorance, in our decision making. Our quest for certainty has, to some extent, taken us away from one of the prime tools for effective management, namely the Precautionary Principle. Through this principle it is possible to deal with uncertainty, thus leaving science to fulfil its mission of the quest for knowledge. In this sense then, certainty and knowledge are two different things.

It is no longer possible to rely on classical toxicology alone where chemicals are tested individually (Colborn 2006; Hayes et al 2006; Howard 1997). Ecosystems are exposed to multiple mixtures of compounds with additive, synergistic, antagonistic, or neutral effects. Testing for multiple exposures, often pulsed, and measuring direct and indirect impacts requires new testing methods (Colborn 2006; Feron et al 2002; Porter et al 1999; Myers (nd)) and much more reliance on an epidemiological approach. APVMA states clearly that it does not allow genotoxic chemicals to be registered for general use. Chemicals, including those that can produce endocrine disruption (which can induce epigenetic changes) that cause diseases and cancers to develop in the next generations, should be treated like genotoxic chemicals and regulated for accordingly.

The growing body of knowledge which links diseases and illnesses to environmental toxicants confers at least an ethical responsibility and duty

to make decisions that promote and maintain human and environmental health (Montague 2005).

There is no national regulatory framework to determine pesticide control and use, no national registration scheme certifying competency of pesticide applicators, no national holistic monitoring program for environmental or human health, and no comprehensive, integrated national chemical adverse incident reporting system. Federal, State, and Territories legislation contains what appear to be significant loopholes that permit inadequate protection of ecosystems sustained by water catchments.

In its final objective, the State Policy on Water states, “*apply the Precautionary Principle to achieve water quality objectives*”. As human activities in the catchment, including pesticide use, are not being considered in risk assessments, how can this objective be achieved? Ecosystem health is not being adequately monitored in the short or long-term. Cost benefit analyses are not being undertaken and the cost of ill-health of communities, including that of social dislocation, is not being taken into consideration.

The Group has determined that these critical aspects of potential impacts on environmental and human health are not being effectively addressed by the Government Departments responsible for these issues.

If harm is caused to human health and ecosystems when catchments are managed in the manner described above, it could be construed as a failure of duty of care. However, determining harm is difficult, as there are no relevant data-monitoring systems in place. Absence of evidence of harm is not evidence of absence of harm. In current circumstances, severe direct and immediate impacts have to eventuate before authorities are alerted and instigate appropriate investigations or actions. By then, only remedial action may be possible and it is too late to prevent harm.

Despite the authorities stating that there are no water quality problems in the George River catchment, several consultants were engaged over the past four years by DPIW to investigate oyster ill health⁶⁹. The last, in

⁶⁹ 1. Report by Dr Marcus Scammell, ‘Tributyl Tin Contamination of Shellfish Growing Areas Field Investigation: 25th to 28th March 2002’, Stemus Pty Ltd, P.O. Box 335, Concord, NSW 2137, Australia.

2. Report by Professor Barry Noller, 2000, concerning tributyltin and possible impacts on oyster leases at Georges Bay and other Tasmanian locations, EnTox, 39 Kessels Road, Coopers Plains, Brisbane, Qld 4108, Australia.

2004, was the investigation by Percival (Percival 2004), whose report came out after the large oyster kill. Few of his recommendations have been implemented, including those relating to determining diffuse and point source inputs into Georges Bay, and the instigation of full risk assessment of the catchment, including pesticide usage.

The Group has determined that water management is not being effectively regulated by the Public Health Act, EMPCA, the State Policy on Water Quality Management (which has adopted the NWQMS) or the Water Management Act, and the regulations do not appear to allow achievement of the objectives of the State Policy on Water Quality Management.

It is the opinion of the Group that the Break O’Day Council (BODC) and the State and Federal Governments are not meeting their statutory obligations and undertaking their duty of care to water users and ecosystems supported by the catchments. With no evidence of effective collaboration or clear lines of responsibility, the current seemingly haphazard approach appears to provide little protection to the catchments and their ecosystems, and in fact could expose them to as yet unquantifiable risk.

The Group has concluded that the Tasmanian and Federal Governments do not see the development of a coherent, integrated, enforceable framework for the implementation of water management, with ecosystem protection, as a priority.

It also seems clear to the Group that the authorities have not placed value on community consultation regarding catchment issues raised in this paper. Communities need to be encouraged to engage effectively in decision-making processes that affect them. Transparent and accountable decision-making by governments and public authorities would allow this to happen, resulting in effective community governance. In reality, public servants and elected officials work for and on behalf of their communities. Effective consultation involving participation and shared decision-making can provide a powerful and effective means of promoting and achieving meaningful change.

3. Review by Dr Munro Mortimer, (Senior Principal Scientist, Environmental Sciences Division, Queensland Environmental Protection Agency) of ‘Critical review of the environmental fate TBT and its toxicological fate on the Pacific oyster *Crassostrea gigas* including at Georges Bay and other Tasmanian locations’, by Barry N. Noller, ENTox.

Sixteen years after the Senate Select Committee Report on Agricultural and Veterinary Chemicals and four years since the recommendations made by Pesticide Use in Australia, we remain well behind in wide spread adoption of the key recommendations for improved management, use and control of pesticides.

Knowledge is available to make rational decisions with regard to exposure to harmful chemicals. The challenge for our decision-makers is to act on that information. The current system of evaluating the safety of pesticides is clearly dysfunctional. We know that a precautionary approach is a responsible and rational direction for risk assessment. It is the author's view that the authorities need to embrace innovative approaches to risk assessment such as those offered by post-normal science (Harding 1998; Gallopin et al 2001; Tattersall 2003(b)). But our challenge is much more than that. The emergence of the "*new community way forward*" will see the community as a generator of new and valid knowledge. This is in contrast to the current view, held by many institutions that communities are only capable of dealing with "feedback" and "input" well after courses of action have been decided elsewhere (Dakin 2003). All too often has community knowledge been dismissed almost out of hand (Carson 2001).

Having access to safe, clean water will become increasingly important. Tasmanian communities must continue to work to protect their water catchments. Healthy ecosystems depend on healthy catchments.

To quote the concluding remarks of the Tasmanian State of Public Health Report 2003:

"Tasmania's most precious resources are the health of its people and its environment. These cannot be separated from each other and their continued protection is the key to our future."

Recommendations

1. All pesticide application in water catchments should be reviewed and the aerial application of pesticides in Tasmania's upper and mid-water catchments should cease.
2. The recommendations from the Review of Code of Practice of Aerial Spraying (Tasmania) should be implemented to allow for the protection of ecosystems. Details of all chemicals used in catchments should be in the public domain. These should detail the chemicals used in each application, along with details of amounts used, the method of application, where it was applied and when.

3. Identifying markers should be added to pesticide products by a) the manufacturer, b) the company/person ordering the application and c) the applicator. In this way any off-site movement of pesticide can be traced directly to its source. Performance monitoring, especially of spray events, is otherwise impossible to track.
4. Water authorities need to support catchment communities with integrated, comprehensive approaches to risk assessment, ensuring water is treated as a single entity, including quantity and quality. A full assessment of a catchment's natural status and the impact of all previously known human activities should be undertaken before primary, or any, industry is allowed to operate in it.
5. Licensing and policing roles for chemical usage should be undertaken by separate government departments to allow for appropriate independent regulation and auditing of these activities.
6. Water and environment acts and regulations should be administered from a government department separate to that of industry, removing potential conflicts of interest.
7. EMPCA should be amended to allow for review of existing activities. Forestry activities should be fully subject to EMPCA so that their practices adhere to appropriate environmental practices and can be monitored effectively.
8. Communities should be able to audit, review, and have input into what is taking place in the catchments from which their potable and non-potable water is drawn. The results of the State's performance monitoring should be made readily available. This should include independent water monitoring programs, where appropriate. Accordingly, a register of catchment activities should be maintained by local authorities and publicly audited on a regular basis.
9. Health Impact Assessments, including review of risk management strategies, need to be undertaken when operational systems are modified or new scientific and toxicological information is obtained. DPIWE, DHHS and DIER need to operate under an integrated and co-ordinated system, which promotes consistency, reliability and accountability and includes open consultation with all water users.
10. APVMA should undertake comprehensive evaluation and testing of all chemicals - pesticides, excipients (footnote 13) and products - under their

control which can impact on ecosystems, including humans. This should include rigorous testing for immunotoxicity, endocrine disruption, and epigenetic changes.

11. APVMA should clearly state on each pesticide product label its exact composition. The label should be clear and easily read and understood by all users. Product labelling should be automatically updated as new information about each chemical and product comes to light.

12. APVMA should adequately test all pesticide and products including mixtures. These mixtures should be evaluated with regard to their full range of toxicity. Material Safety Data Sheets should be issued for each product and mixture that is to be used.

13. A single national reporting system with a centralised database should be devised for all chemical adverse events and used by all bodies so that environmental impacts and influences can be assessed in a more holistic manner.

14. National standards for the competency of and licensing of pesticide applicators should be implemented.

15. A national pesticide and chemical register should be implemented. The Federal Government, States and Territories should reach a consensus as to what chemicals can be used, where and when, and by what method. This should include off-label use. This information should be easily accessed in the public domain.

16. Nationally integrated long-term monitoring programs for health and ecosystems need to be undertaken immediately. These should have an epidemiological focus.

17. Regulatory bodies should act in a way to safeguard those that they are entrusted to protect. This includes adhering to the Precautionary Principle in fulfilling their statutory obligations. These bodies should work collaboratively, effectively and in a time-sensitive manner. Environmental and public health bodies - Federal, States and Territories - need to work in an integrated way, sharing knowledge and resources. Their performance should be subject to independent audit.

18. The Federal Government needs to provide a national regulatory framework, consistent across all States and Territories, which ensures ecosystem and human health protection. This should include reforming the regulatory bodies that have responsibility in this area. The Precautionary

Principle is fundamental to this approach as defined under the Intergovernmental Agreement on the Environment (Ecologically Sustainable Development Steering Committee 1992) to which Tasmania is a signatory.

Acknowledgements

The author wishes to thank the following individuals for their contribution to this paper: Dr. Marcus Scammell; Beris Hansberry, Roger Harlow, members of BODCRG; Jim Harris; Ian Coatsworth and Mike Bleaney.

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Appendices

Our Ref: S04/1178 017\012\002

Enquiries Tony Walker



from the **mountains** to the **sea**

28 May 2004

Dr. A. Bleaney
PO Box 294
ST HELENS TAS 7216

Dear Alison

Results of Samples Helicopter Crash

Please find attached copy of report prepared by David Parsley, Spray Information and Referral Unit of DPIWE. This report is provided for your information and not public distribution. As Council is not the author of the report we can not authorize its distribution.

The report and sample results would confirm that the spill was extremely unlikely to have resulted in any contamination of the water supply. The report raises concerns that I share in respect to notification, let us hope that the authorities concerned will ensure a similar incident is reported to all affected parties.

Although the report has not answered all the specific questions in your letter of 24th May I believe it has provided sufficient details to resolve the issue.

If you have any queries regarding the above please contact me on 63 767 900.

Yours sincerely,

Tony Walker
Manager – Development Services

Break O'Day Council
ABN 96 017 131 248

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24 MAY 2004

Report on the site inspection of the helicopter crash at Pyengana on 15 December 2003

Following speculation that a chemical spill of insecticide from a crashed helicopter was responsible for the deaths of various marine fauna in the Georges Bay intertidal zone, the Spray Information and Referral Unit inspected the crash site to see what assessment could be made of the risks due to the spillage.

Background

On 15 December, 2003, a helicopter operating for the company Tasmanian Helicopters came down while spraying a eucalypt nitens plantation with the insecticide Astound Duo.

The Tasmanian Fire Service and the Tasmanian Police were notified of the accident.

On 5 April, 2004, about 16 weeks after the crash, the Spray Information and Referral Unit went up to Pyengana and took three soil samples from the crash site for analysis. One sample was taken from the depression in the ground where the helicopter was had come to rest. A second sample was taken about 9 metres away from that spot. That point was chosen because there was a natural decline along a contour, from the first site to a low point where liquid could possibly pool. A third sample was taken about 2 metres directly down hill from the first site. Also, a water sample was taken from the South George River at what is known as the Intake Bridge. All samples were tested for alpha-cypermethrin.

The tree plantation stands about 6m. tall. There is some ground cover, with a significant infestation of blackberry. The soil is a dark brown to black clay loam. The distance from the crash site to the South George River is about 250 metres down hill. The land is contour-ploughed, meaning the natural fall of the ground is impeded by a soil barrier every metre or so.

The helicopter had about 60L of made-up chemical in its tank when it came down. It is reported that only 20L spilled out, but for the purpose of this exercise, it will be assumed that the whole 60L was spilled. The product Astound Duo contains 100g/L alpha-cypermethrin. 4 litres of product (400g of cypermethrin) was mixed in a 400L tank; In other words, a one to a hundred dilution. 60L of this mix would contain 60grams of alpha-cypermethrin.

Cypermethrin is not soluble in water. It adheres strongly to soil particles, and has a half life of somewhere between 4 days and 8 weeks in aerobic conditions. It is subject to microbial degradation under these conditions.

In the Pyengana area, 26.4 ml of rain fell in November; the driest month on record. From December 1 to 15, 12.4 ml was recorded. At the time of the helicopter crash, the soil was therefore as dry as it has probably ever been at that time of the year.

At the end of January, 2004, on the 29th, 30th and 31st, 250 ml of rain fell per day, causing a vast amount of water to flow down to Georges Bay, apparently, a one-in-a-hundred year event.

Interpretation

6 weeks had elapsed between the helicopter crash and the large rainfall event at the end of January. In that time, the cypermethrin would have firstly, seeped into the dry soil where it would absorb onto the soil particles. There, soil microbes would have degraded the chemical to some unknown extent. Cypermethrin remaining on the surface would have been degraded by the sunlight. Any amounts of remaining chemical would have been fixed onto the soil particles and not susceptible to leaching. 250 metres is quite a distance for a chemical that is not prone to leaching.

The contour ploughing would have controlled the movement of water down the slope such that torrential flows down hill were unlikely. At the crash site, there was no sign of the contours being breached.

Tests on samples taken on 5 April 2003 have shown a cypermethrin concentration of 218 parts per million at the very spot at which the helicopter came to rest. (identified by Mr. Rob Sutton, manager at Seaview farm) At two other points 2 metres and 9 metres away, the cypermethrin concentration was 1.0 and 0.2 respectively. This demonstrates that cypermethrin will persist in the soil, (in a forest situation at least) and that it does not leach appreciably as shown by the rapid decline in cypermethrin levels over a short distance from the site locus. Further tests on samples taken on May 23 support this conclusion. See attached test results.

Other pesticides 'showed up' in the analysis, namely Simazine, atrazine, terbacil and small amounts of others. The conclusion to be drawn from that was that the spray tank was not thoroughly rinsed between jobs. These pesticides showed a distribution similar to the cypermethrin found in the immediate environment of the crash site.

The spray operator has been informed of the laboratory results. He is expected to take appropriate steps to see that a more thorough rinsing is given the tanks between operations.

Conclusion

I would say that the spillage of 60L of Astound Duo in that environment, at that time, is most unlikely to have caused the environmental problem that some people have attributed to it. In the very unlikely event that some cypermethrin should have reached the South George River, the dilution factor would soon have made it of little consequence.

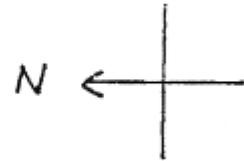
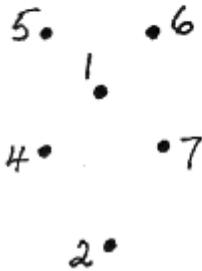
Of some concern, is the protocol for an incident of this kind, which in hindsight has proved to be inadequate. The Code of Practice for Aerial Spraying requires major spills to be reported to the Tasmanian Fire Service, and incidents that may cause environmental harm to be reported to the Director of Environmental Management, as soon as possible.

The incident was correctly identified as being of minor environmental significance. However, in view of the subsequent claims that the spill caused the marine deaths in Georges Bay and serious health concerns among the human population in that area, it would seem that an investigation of the crash, at the time, would have been useful.

David Parsley
Spray Information and Referral Unit

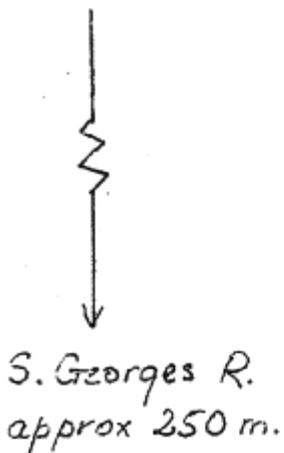
21 May 2004

Soil Sample Sites shown to scale



SITE	DESCRIPTION	CYPERMETHRIN	DATE
1	Wreck depression	218 mg/Kg	5/4/04
2	2m W. of wreck	1 mg/Kg	5/4/04
3	9m S of wreck	0.21 mg/Kg	5/4/04
4	1m NW of wreck	0.60 mg/Kg	23/5/04
5	1m NE of wreck	14.8 mg/Kg	23/5/04
6	1m SE of wreck	55.4 mg/Kg	23/5/04
7	1m SW of wreck	16.9 mg/Kg	23/5/04
8	13m W of wreck	< 0.10 mg/Kg	23/5/04

• 8





ANALYTICAL SERVICES TASMANIA
Sandy Bay Laboratory
 c/- Chemistry Department University of Tasmania
 Sandy Bay Tasmania 7005



Report No: 22119

Report Date: 20-Apr-2004 13:25

		Lab.No.:	57304	57305	57306	57307
		Sample Id.:	Crash Site 2M West of Crash	9M South of Crash	S Georger@Old In	
1501-Water	Alphamethrin	µg/L				<0.1
2501-Soil	Alphamethrin*	mg/kgDMB	218	1.00	0.21	
	Atrazine	mg/kgDMB	75.0	<0.05	0.05	
	Chlorothalonil*	mg/kgDMB	1.25	<0.10	<0.10	
	Simazine	mg/kgDMB	254	0.05	0.15	
2507-Soil	Terbacil	mg/kgDMB	12.0	<0.10	<0.10	



ANALYTICAL SERVICES TASMANIA

Sandy Bay Laboratory

c/- Chemistry Department University of Tasmania

Sandy Bay Tasmania 7005

Telephone: (03) 6226 7175 Fax: (03) 6226 7825

Email: ast.sandybay@dpiwe.tas.gov.au



NATA Accreditation
Number: 5589

Laboratory Report

Report No: 22238 Issue No: 1 Final Report
 Submitted By: D. Parsley (E&P Division - Overspray)
 Client: E&P Division - Overspray
 Site Description: Seaview Pyengana
 Received: 28-Apr-04 Client Order No:
 Report Date: 17-May-2004 9:53
 Report To: D. Parsley
 Address: PO Box 46 Kings Meadows TAS 7249

Test Method(s) :

Test Date

Chemical Testing

2501-Soil: Semivolatile Organics in Soil by GCMS - OC OP Pesticides 10-May-2004
 2507-Soil: Pesticides in Soil by GCMS * 10-May-2004

Samples exhibited poor homogeneity for Atrazine. Results for Atrazine are considered approximately only.

Lab.No.	Sample Id.	Sampled On	Method: Analyte: Alphanethrin* mg/kgDMB	2501-Soil Atrazine mg/kgDMB	2501-Soil Simazine mg/kgDMB	2507-Soil Terbacil mg/kgDMB
57821	Crash Site 1	23-04-2004 12:00	0.60	0.16	0.36	<0.10
57822	Crash Site 2	23-04-2004 12:00	14.8	0.59	3.32	0.26
57823	Crash Site 3	23-04-2004 12:00	55.4	0.16	0.67	<0.10
57824	Crash Site 4	23-04-2004 12:00	16.9	0.81	1.35	<0.10
57825	Crash Site 5	23-04-2004 12:00	<0.10	<0.05	<0.05	<0.10



Tasmania

MINISTER for
PRIMARY INDUSTRIES and WATER

Mr George Walker
22 Bevan Heights
Binalong Bay
Tas 7216

- 9 NOV 2004

Dear Mr Walker

Thank you for your letter dated 4 October 2004 to the Hon. Judy Jackson MHA concerning the St Helens water supply. Most of your concerns relate to matters which I have responsibility for and therefore I am providing you with this response.

I appreciate your concerns about the contamination of the St Helens water supply, however the Department of Primary Industries, Water and Environment is unaware of the water supply being polluted. If you could provide further evidence of pollution or contamination I would be happy for my department to investigate your claims.

In your letter, you refer to a recent helicopter crash. A helicopter crashed on 15 December 2003. It was spraying a *Eucalyptus nitens* plantation in the Pyengana area, with the insecticide Astound Duo (active constituent, alpha-cypermethrin).

Whilst at full capacity, the helicopter could carry 400 litres of spray mix, (which equates to 1 kg of the active ingredient, alpha-cypermethrin), at the time of the crash the helicopter was estimated to have about 60 litres of spray mix remaining on board. Reports from people attending the crash site suggest that about 20 litres of the spray mix spilled onto the ground, well away from any watercourses.

The spray mix comprised 0.25% alpha-cypermethrin, equating to about 50 grams of active chemical. It does not represent a significant chemical spill and alpha-cypermethrin is rapidly and strongly absorbed to soil particulates and is essentially immobile in the soil.

You also raise more general concerns about atrazine and other chemicals being sprayed into areas that constitute the St Helens water catchment. The Government takes your claims seriously as it is committed to making Tasmania a clean and healthy place to live. As water quality is a very important part of this it is vital that the use of herbicides is strictly regulated and they are managed carefully to minimise the risk of them making their way into our waterways.

64 Wilson Street
Burnie Tasmania 7320
Tel: (03) 6434 6307
Fax: (03) 6434 6221

Postal Address:
GPO Box 44
Hobart Tasmania 7001

Level 5, Marine Board Building
1 Franklin Wharf
Hobart Tasmania 7000
Tel: (03) 6233 8807
Fax: (03) 6233 8013

I believe Tasmania has some very good legislation in place to regulate which chemicals can be used and how they are used, so that our health, environment and trade are not compromised. There is also very good evidence to show that Tasmania's forest plantation managers and spraying contractors are competent and responsible in their approach to managing herbicides and other pesticides. The responsible use of forest herbicides in accordance with the current legislation presents little risk to contamination of our waterways.

In addition, the Australian Pesticide and Veterinary Medicines Association (APVMA) found there was sufficient information available from a number of water monitoring programs around Australia to conclude its recent review of atrazine. This included data from a nationwide series of trials to evaluate the effects of atrazine, applied at the nominated rates, on water quality in forestry use situations.

The 2002 report of the review found that *"it is unlikely that atrazine use in accordance with the label recommendations, paying particular attention to environmental restrictions, will contaminate waterways to any extent likely to present hazard to the environment or to human beings through the consumption of contaminated drinking water"*.

The Agricultural, Silvicultural and Veterinary Chemicals (ASCHEM) Council is considering how Tasmania's water monitoring programs might be coordinated and improved to give a frequency and quality of monitoring that ensures any risks to water quality from chemical spraying in agriculture and forestry are appropriately identified, assessed and controlled. Whilst you propose an alternative course of action, I am confident the ASCHEM Council is quickly working towards the development of an enhanced program for pesticide monitoring involving sample collection, interpretation and investigation.

I believe this to be an appropriate way forward to assure public confidence in all Tasmania's water catchments, including the St Helens water catchment. Whilst there is no scientific evidence to support the damaging assertions of water contamination, a rigorous monitoring program and a range of other actions will maintain community confidence in the quality of Tasmania's water supplies.

Yours sincerely



Steven Kons LLB MHA
MINISTER

Environmental Defenders Office (Tas.) Inc.

**131 Macquarie Street
Hobart TAS 7000**

**tel: (03) 6223 2770
fax: (03) 6223 2074
email: edotas@edo.org.au**

10 January 2005

**Dr Alison Bleaney
4 Bayview Avenue
Binalong Bay TAS 7216**

Dear Dr. Bleaney,

Drinking Water Quality

Thank you for contacting us about your concerns regarding the quality of the domestic water supply drawn from the Georges River. As discussed, this letter briefly outlines the laws regulating domestic water quality in Tasmania. In summary:

- Water quality (including chemical levels) will be assessed against the Australian Drinking Water Guidelines, published by the National Health and Medical Research Council (*NHMRC*).
- Council and the Department of Health and Human Services are responsible for ensuring that water quality in reticulated supplies does not pose a threat to public health.

Break O'Day Council has released the results of monthly tests conducted by Analytic Services Tasmania regarding chemical residues in the St Helens water supply. These results are available on their website at www.bodc.tas.gov.au. As you have noted, samples are taken above the intake on George River and a sample of treated water from within the township. There is no information regarding groundwater.

- Mineral Resources Tasmania is responsible for ensuring that water quality in groundwater supplies does not pose a threat to public health.
We have written to MRT asking that testing be carried out for groundwater supplies in the St Helens area.
- Untreated surface water is not "managed" by any agency, and is therefore not effectively regulated by the Public Health Act 1997 (though the Director can order a health evaluation if he is concerned). However, contamination of these water supplies may constitute "environmental harm". If there is evidence to identify the party responsible for the contamination, it may be possible to take action in the Tribunal to require ongoing monitoring.

Public Health Act 1997

Part 6 of the *Public Health Act 1997* deals with water quality issues for all potable, ground and reticulated water supplies. Relevant obligations include:

- Councils and controlling agencies must manage water under their control in a manner that does not pose a threat to public health.

- All health evaluations are to be conducted by qualified persons approved by the Director;
- The scope of the health evaluation must be determined in consultation with the Director;
- A copy of the final report shall be presented to the Director and the controlling authority; and
- The Director will advise the controlling authority about any action that must be taken in response to the health evaluation.

If they are satisfied that the water quality is a concern, the Director or the agency / council may make a number of orders. Possible orders include:

- that the water supply to be closed;
- restricting access to the water supply;
- preventing the use of food products in which the water has been used;
- that water be brought up to an approved standard; and
- that the responsible authority provide a temporary alternative water supply.

Groundwater supplies

Documents published by Mineral Resources Tasmania (*MRT*) indicate an emphasis on landowners' personal responsibility for ensuring that water is safe for drinking. For example, *MRT* state:

For an individual household supply, the emphasis should be on selecting the best quality source water available, and on protecting its quality by the use of barrier systems and maintenance programs. Whatever the source (ground, surface or rain water tanks), householders should assure themselves that the water is safe to drink. Information on the quality of surface and ground water may be available from state or local governments who may monitor the particular source water as part of a state or local water monitoring program. Alternatively, the individual should consider having the water tested for any key health characteristics identified as being of local concern. Where the raw water quality does not meet these guidelines, a point of use device (eg. filters) may be useful.

If testing does reveal contamination of groundwater supplies, it may be possible to take action under the *Water Management Act 1999*. Section 129 prohibits a person to introduce into a well any matter likely to cause pollution of groundwater. However, this relies on being able to identify the party responsible for the contamination.

Environmental Harm

It is an offence against the *Environmental Management and Pollution Control Act 1994 (EMPCA)* to cause **environmental harm**, defined as any adverse effect on the environment (of whatever degree or duration). Key concepts include:

- **Serious environmental harm** – environmental harm that involves high impact or wide spread health consequences, serious adverse environmental impacts or property damage exceeding \$50,000;
- **Material environmental harm** – environmental harm that involves a health risk or environmental impact that is not negligible, property damage exceeding \$5,000 or a widescale environmental nuisance;
- **Environmental nuisance** – the emission of a pollutant (*which is widely defined*) that unreasonably interferes with your enjoyment of the environment.

Contamination may constitute “environmental nuisance” (if the contamination is unsightly or causes an odour) and could amount to material environmental harm if there is evidence that the contamination presents a significant health risk.

There are a number of options for regulating activities that cause environmental harm, including:

- Environmental Infringement Notices
- Environment Protection Notices
- Civil Enforcement

Environmental Infringement Notice

If DPIWE is satisfied that contamination has caused environmental harm, and can identify the person responsible, an authorised officer may serve the offender with an environmental infringement notice in respect of the offence (section 67).

An environmental infringement notice imposes a penalty (usually less than \$1,000) for the offence. However, an environmental infringement notice does not impose any obligations to remedy the environmental harm.

Environment Protection Notice

Pursuant to section 44(2), where DPIWE is satisfied that the contamination has caused environmental harm, an officer may issue an environment protection notice (EPN) on the person responsible for the activity. For example, the EPN could require the offender to:

- remediate any damage to the water supply;
- cease the use of particular types of chemicals;
- carry out detailed water quality monitoring; or
- reimburse landowners for any medical expenses, cost of buying water etc.

It is an offence not to comply with an EPN.

Civil Enforcement

Under s.48 of EMPCA, DPIWE, council or a person with a “proper interest” (which would include affected landowners) may apply to the Resource Management and Planning Appeal Tribunal (the *Tribunal*) for an enforcement order in respect of environmental harm.

The Tribunal has wide powers to make orders. For example, the Tribunal may require the offender to

- refrain, temporarily or permanently, from using a particular chemical;
- comply with an environmental agreement imposing restrictions on chemical application regarding issues such as timing, release height, notification etc;
- take actions to remediate the contaminated waterway;
- pay compensation for injury, loss or damage suffered as a result of the contamination (such as loss of stock, medical fees, anything done to remediate or protect the water supply);
- take action to repair any environmental damage or to prevent or mitigate further environmental harm;

For reticulated water supplies, this is the responsibility of Council and the Department of Health. Section 18 of the *Waterworks Clauses Act* also imposes an obligation on Council regarding reticulated water. Council must provide “a supply of pure and wholesome water sufficient for the domestic use of all the inhabitants of the water district...” “Pure and wholesome” is defined as “*clean, free from obvious suspended matter, and free from toxic substances and pathogenic organisms in amounts harmful to humans*”.

For groundwater, the responsible agency is Mineral Resources Tasmania.

- Councils and controlling agencies must notify the Director of Public Health if they believe that water quality could pose a threat to public health (s.128(1)). The Guidelines for Water Quality (the *Guidelines*) set out the following procedure for notifying the Director:
 - An immediate phone call must be made to the Director advising of the circumstances of the event and the subsequent action being undertaken to combat the threat to public health.
 - Written confirmation by letter or facsimile must be sent by the controlling authority within twenty four (24) hours after the initial phone call, formally advising the Director of the circumstances of the event and action being undertaken to combat the threat to public health.
 - It is recommended that controlling authorities should develop a protocol for advising the users of water under their control on water quality issues.
- If an environmental health officer reports to council that water quality is likely to become a threat to public health, the council must take any “necessary and practicable” action to prevent the threat, such as restricting the use of water or warning the public to boil water (s.128(3)). The Guidelines require the Council to
 - send a copy of the report to the Director within one working day;
 - seek advice from the Director on the contents of any public announcement and as to the appropriate precautions to be taken to protect the public.
 - in correcting problems with potable water supplies, consult the Australian Drinking Water Guidelines (*ADWG*). The ADWG provide guidance on acceptable standards for drinking water (including maximum chemical levels and appropriate chemicals to clarify drinking water). You can download the ADWG at www.nhmrc.gov.au.
- Councils must monitor the quality of water within their municipal area (s.130)
Councils must monitor water quality in accordance with the ADWG (regarding sampling frequency and types of chemicals to test for). Each supplier of water provide a report detailing the results of sampling to the Director each year.
An annual water quality report for Tasmania is published by the Department of Health and Human Services
For groundwater, the Director *may* order MRT to monitor water quality.
- The Director may require any agency to carry out a health evaluation of any water under its control (s.132). Pursuant to the Guidelines, health evaluations must be conducted as follows:

- carry out a specified project for the restoration or enhancement of the environment in a public place or for the public benefit (the project does not have to be related to the damaged property);
- publish details of the contravention and its environmental and health consequences.

Please be aware that the **action must be commenced within 3 years** of the date of the contamination.

Local Government Obligations

Councils are not specifically required to take action to address water contamination. However, councils are subject to a number of obligations in respect of pollution in council areas. In particular:

- Section 20A(2) of the *Environmental Management and Pollution Control Act 1994 (EMPCA)* requires a Council to “*use its best endeavours to prevent or control acts or omissions which cause or are capable of causing pollution.*”
- If Council is satisfied that a nuisance (including anything that is a risk to public health or gives rise to unreasonable levels of pollution) exists, they must issue an **abatement notice** pursuant to s.200 of the *Local Government Act 1993*. The abatement notice must state the actions to be taken by the polluter and the period in which the action must be taken. The polluter must comply with the abatement notice, or be fined up to \$2,000.

If the polluter does not take action to address the pollution, the Council can take necessary action and recover the costs from the polluter. Council may also get a court order requiring the polluter to comply with the abatement notice.

Given that their tests indicate that there is no contamination, Break O’Day Council is unlikely to take any action. However, if MRT or any independent tests reveal contamination, you should request that Council take action to address the issue.

Water testing

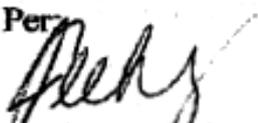
You asked us to provide information regarding any independent water testing facilities in Tasmania. We recommend that you contact Dr Terry Walker of Water Eco Science on (03) 6233 2143. We understand that the testing facility is located in Melbourne, but Dr Walker will be able to give you more details. Please be aware that water testing can be expensive and is often inconclusive.

Please do not hesitate to contact us if you require any further information about this matter.

Yours sincerely,

Environmental Defenders Office (Tas) Inc

Per


Jessica Feehely
Principal Lawyer

St Helens Issues

Following the re-commencement of aerial spraying in the Georges River catchment yesterday I felt it was important to raise some additional points.

Firstly, in regards to what is being used in the catchment it is clear to me that no one knows what is going on. Consider the following table;

Table 1: Chemicals Disclosed within Forestry Operations (Georges Bay Catchment)

	2003	2004			Notification 1	Notification 2
	Council	DPIWE	Health	DPIWE	Helicopter	Helicopter
Chemical	Disclosed	Crash Inv.	Disclosed	Audit	Yesterday	Yesterday
Glyphosate	Yes		Yes	Yes		Yes
Metrulfuron-methyl	Yes		Yes			Yes
Sulfometuron Methyl	Yes		Yes	Yes		Yes
Clopyralid triisopropanolamine	Yes		Not in Use		Yes	
Alphacypermethrin		Yes	Yes	Yes		
Atrazine		Yes	Not in Use			
Simazine		Yes	Not in Use			Yes
Terbacil (Paclobutrazol)		Yes	Yes	Yes		
Chlorothalonil		Yes	Other Crops			
1080						
Haloxypop R-methyl ester					Yes	
Diethylene glycol monoethyl ether					Yes	
Dispersant/Detergents						Yes

Further, despite Public Health's (and Councils) assurances that appropriate monitoring would be conducted it appears that Council was not notified and was unaware that the spraying was occurring.

Given the discrepancies in the table above and given the disregard for the local water authority, how can Public Health be expected to fulfill its' charter, to protect the public from harm?

Secondly, there appears to be some uncertainty over what risks water contamination may pose to the human community. There are anomalies with respect to human health in Tasmania and within the region. From Dr Bleaney's cases at least 3.7% of the local population have symptoms that might be caused by biocide exposure. According to the media the Northwest region has higher than expected premature labours, 19% higher than the national average (11.9% compared to the national average of 10%). Premature labour and infant mortality have both been associated with atrazine and simazine. There are anomalies too in the Tasmanian Health Report for 2003. A quick summary of statistically significant differences follows.

Table 2: Summary of Age Adjusted Mortality Statistics for Tasmania

Compared to Australian Average	Females	Males
Cancer		
Colon	0.05% ↑	ns
Rectal	0.01% ↑	0.05% ↑
Pancreatic	ns	ns
Lung	0.05% ↑	0.01% ↑
Melanoma	ns	ns
Breast (F) / Prostate (M)	ns	0.01% ↑
Brain	ns	ns
Lymphomas	ns	ns
Leukaemias	ns	ns
Disease Other than Cancer		
Diabetes mellitus	ns	ns
Hypertensive diseases	ns	ns
Ischaemic Heart Disease	ns	0.05% ↑
Cerebrovascular Disease	ns	0.01% ↑
Arteries etc disease	0.01% ↑	0.01% ↑
Influenza, pneumonia	0.05% ↑	ns
Lower respiratory	0.01% ↑	0.01% ↑
Renal failure	ns	ns
Other Causes		
Injury & poisoning	ns	ns
Road vehicle accidents	ns	ns
Suicide	ns	ns

Where “ns” means not significantly different to Australian average, “0.05% ↑” means significantly higher at a probability of 0.05 and “0.01 ↑” means significantly higher at a probability of 0.01.

Anomalies in population statistics are not unusual, however, if they were random we would expect as many significantly lower statistics compared to the number of significantly higher findings. Note all significant differences are higher.

Other indicators of catchment issues have also been misrepresented. DPIWE have known about oyster mortality following rainfall for many years and the suggestion that this is a flood-based anomaly is nonsense. Consider the following history.

Table 3: History of Reports regarding Oyster Problems

Date	Author	Comments
Mar-02	Scammell for DPIWE	Tributyl Tin (TBT) is not the only issue facing the Georges Bay area and other catchment issues should be investigated. Two monitoring programs were recommended.
Jun-02	Noeler for DPIWE	Agreed with Scammell's finding and offered hypotheses for investigation.
Jun-02	Mortemer for DPIWE	Agreed with Scammell's findings and recommended further investigation.
Aug-02	DPIWE Correspondance	We have tested St Helens shellfish for heavy metals,.....St Helens shellfish test fine for all metals tested (Cd, Pb, Zn, Cu, Se).
Nov-02	Animal Health Laboratory, DPIWE	It was reported that over the last 3-4 years, there have been increased mortality that coincided with the season of increased rainfall
Feb-03	Animal Health Laboratory, DPIWE	Oysters have poor shell shape and with excessive growth of flutes. No mortality at this stage but suspect they would be very sensitive to rain.
Feb-03	Animal Health Laboratory, DPIWE	Before Christmas there was a 30% loss of stock (handled within 3 weeks prior to rains) at the time of rains. These did have TBT of 5.6ng (moderate levels).
Jun-03	Animal Health Laboratory, DPIWE	Pacific oysters (<i>Crassostrea gigas</i>) were submitted after lease holders report of excessive, irregular shell growth following a period of rain 3 weeks previous
Apr-04	Pycroft, DPIWE	Investigated mortality following 2004 flood event. Inconclusive.
Jul-04	Percival for DPIWE	Cannot identify cause of mortality following 2004 flood event. Recommends investigation of catchment activities including chemical usage.
Jul-04	Scammell, Blaeney and St Helens Marine Farmers	Identifies Aerial Spraying as a hazard worthy of immediate investigation and recommends Precautionary Principle.

Similarly, the facial tumors and mortality of Tasmanian Devils equally suggest that there are serious catchment issues that require investigation.

Having worked on chemical contamination issues in the past I am confident that a causal relationship will be established now that we have a clear hypothesis to test. Of all the methods of applying chemicals only aerial spraying (particularly when using helicopters) results in routine and extensive contamination of non-target areas.

To my mind there is clear evidence of a problem. The question becomes, what is the best course of action? If nothing is done then at some stage the legal profession will become involved with serious financial implications for private and public companies involved in plantations. If we allow the helicopters to keep flying and then test, then evidence will be collected which will be useful from a legal point of view. If the helicopters stop flying now then ecological and public health will be protected while at the same time removing the possibility of further measurement.

Application of the precautionary principle will allow the quickest and cleanest resolution of the issue.

10/3/04

Dr Alison Bleaney OBE
MB ChB FACRRM

AS

**4 Bayview Avenue,
Binalong Bay, Tas 7216
Tas 7216**

**PO Box 294
St Helens**

*Email: sthelensmedc@vision.net.au
Tel: (03) 6376 8351 Fax: (03) 6376 1888 MB 0417 302 549*

The Premier
Mr Paul Lennon
Parliament House
Hobart
Tasmania.

8 September 2006

Dear Premier,

There is some disturbing information in the DPIW "Pesticide Monitoring and Water Catchments" website. As my concerns include the environment, water, industry, and public health I have decided to write to you in the hope that you will deal with the situation by taking urgent measures to ensure that there is no further pesticide contamination of drinking water and water used for aquaculture.

I have listed my concerns below and would be grateful if you provide answers to my highlighted questions.

My concerns include that:

- pesticides have been detected in the random grab samples of four river catchments in the July testing. The Duck River showed MCPA; the Rubicon River simazine and 2,4-D; the Brid River simazine; and the Jordan River atrazine. The tests were taken well downstream, close to the tidal limits, with no tangible relationship to pesticide use or rain events in the catchments.
 - the samples were taken and tested in July 2006 and the water users had still not been notified of these results in early September.
 - the results, I believe, were not put on the public record until early September 2006.
 - the levels of 2,4-D in the Rubicon – 25/7/2006 – were 6 times the guideline value (GV) for drinking water. The simazine levels were 0.18 micrograms/L (below GV). The levels of MCPA in the Duck River – 10/7/2006 – were at detectable limits. There are no GV or health value (HV) for MCPA as it is not recommended that MCPA be found in drinking water. The Brid River's level of simazine was 0.13 micrograms/L (below GV). The Jordan River's level of atrazine was 0.14 micrograms/L, above the GV of 0.1.
- What action has been taken in the intervening seven weeks or so since this testing and what process is being followed?**
- the flood monitoring program results were somewhat puzzling. The Duck River's last recorded read reading was the 20/4/2006 and the Esperance River 5/5/2006. However the George River and Little Swanport River had no readings after December 2005 despite the oyster farms being closed several times due to decreased salinity from rain events several times this year.
- Can you please provide an explanation for this?**
- it has been confirmed that glyphosate is being tested for at AST in Hobart using filtered samples, i.e. the pesticide that is adhered to fine particulate matter has been disregarded. The total pesticide load is therefore not being measured. The current

testing procedure would therefore seem to be inappropriate for measuring glyphosate levels in drinking water testing programs.

- all the pesticides listed above are toxic to humans and ecosystems. Please refer to the submission I have sent to the RPDC re the proposed pulp mill, regarding the toxicity of chemicals including pesticides.
- The 2,4-D detection limit is 0.2 micrograms/L and the GV is 0.1 micrograms/L. **What does this mean with regard to the safety of the water testing program as per the ADWG and the ability of DPIW to prevent water contamination?**

The DPIW "Monitoring Water Quality" website re-states that there are community concerns about the level of chemical usage and of the impact of chemical pollution on industry, human health, and the environment. It also states that Tasmania's disease-free status and reputation for clean air and water underpin a marketing advantage that is invaluable for the State's agricultural industries.

In the light of the problems described in this letter and the past history of pesticide problems in river water catchments in Tasmania, how can the community and water user have faith in the present systems to produce clean and safe drinking water, let alone flourishing ecosystems?

There appears to me to be insufficient transparency, accountability and responsible action taken by the relevant government departments.

I await your response.

Yours sincerely

Alison Bleaney

Alison & Mike Bleaney

From: Jennifer.Maltman@dpiw.tas.gov.au
Sent: Tuesday, 7 November 2006 9:46 AM
To: Sthelensmedc@vision.net.au
Subject: correspondence from Minister Llewellyn

Dr Alison Bleaney
4 Bayview Avenue
BINALONG BAY TAS 7216

Sthelensmedc@vision.net.au

Dear Dr Bleaney

Thank you for your letter to the Premier of 8 September 2006 concerning the Department of Primary Industries and Water's water-monitoring program for pesticides.

This program is helping to develop a greater understanding of the broad impact of agricultural and forestry pesticides usage on water quality in Tasmania. Positive detections from the baseline program are followed up with further sampling and investigation, to determine the likely source of contamination, where possible.

Follow-up testing after the July 2006 round of testing found no herbicide residues in the Brid, Jordan or Duck rivers. Residues of simazine continued to be found at a number of locations along the Rubicon River. The latest results to hand show some low-level residues remaining at 14 September 2006. The highest result of 1.1 parts per billion was recorded at a site near Parkham on 28 August 2006. Analytical results from further testing in late September are not yet available.

The investigation of this matter has identified a particular forestry operation as the likely source. However, the ground-based spraying operation at that site appears to have been conducted in accordance with the product label directions, as required by law.

An adverse experience report is being prepared for the Australian Pesticides and Veterinary Medicines Authority to provide feedback to the registration authority on the impact of pesticides usage.

Results from the flood-monitoring program are collated and published in a batch at around the same time as the results from the quarterly baseline monitoring program. I am informed that the latest batch of results was sent for publication on 8 September 2006, so they may not have been published at the time of your writing.

You have some concerns that the total pesticide load is not being measured. That may be true if there is significant off-site movement of soil from sites treated with highly absorbed pesticides. However, the program is not designed to account for the total pesticide load; only that fraction in solution, which is typically available for drinking water.

The laboratory methods for determining the range of pesticides that is determined in this program compromises the detection limit for 2,4-D to some extent. However, the detection limit of 0.2 ppb is still a low figure, considering the health value in the Australian Drinking Water Guidelines and the

World Health Organisation drinking water quality guideline value of 30 ppb, for instance. I don't believe the 2,4-D detection limit has any real impact on the relevance of the program.

Thank you for raising your concerns about the pesticide-monitoring program. However, I believe the broader community can and does have confidence in the transparency of the program and its role in further understanding the nature and extent of the impact of chemical use in primary industries on Tasmanian water quality.

Yours sincerely

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Referencing style used in the Journal

Why Reference? There are two main purposes for referencing during the course of your article. First, references point to the sources you have used to find information. Your references are in effect your supporting evidence. Your reader should be able to verify your evidence or follow up any aspects of special interest. Secondly, a reference list enables you and your readers to position your work within the wider literature relating to your subject and topic. The golden rule is *“if you have used someone else’s ideas then you MUST cite them”*.

Is a reference list the same as a bibliography? Strictly speaking, no. A reference list includes all the sources you have cited in the text of your article, whereas a bibliography is a list of the works you consulted, but did not cite. Examples could include general texts relating to your topic that were consulted for background information. For instance, encyclopedias are examples of such sources. Your article can therefore contain both a reference list and a bibliographic list.

What system does the Journal use? We use the system known as Harvard or the author-date system. The Journal does allow some variations within the system as long as the style used in your article is consistent.

What does a reference list look like? Consulting the latest edition of the Journal is recommended. The table below shows the preferred style and layout of the main reference categories (journals, books and the Internet). Note the use of full stops and commas. There are many more categories, but these are the main ones. In any case, the editors are always on hand to support you, so referencing should not be seen as an onerous task.

Table 1 Example citations

Entry into reference list	How cited in the text	Comments
Ascherio, A., Chen, H., Weisskopf, M.G., O’Reilly, E., McCullough, M.L., Calle, E.E., Schwarzschild, M.A. and Thun, M. J. 2006, ‘Pesticide exposure and risk for Parkinson’s Disease’, <i>Annals of Neurology</i> , vol. 60, no.2, pp. 197-203.	Ascherio et al 2006	A journal paper with more than one author. Note the title of the paper is in ‘...’ quotes, and journal name is <i>italicized</i> . Include page numbers in list.
Carson, L. 2001, ‘Innovative consultation processes and the changing role of activism’, <i>Third Sector Review</i> , vol.7, no.1, pp. 7-22.	Carson 2001	A journal paper with one author. Include page numbers in list.
Pollak, J. 1993, <i>The Toxicity of Chemical Mixtures</i> , The Centre for Human Aspects of Science and Technology and The Public Interest Advocacy Centre, Sydney, Australia, pp. 5-40.	Pollak 1993	A book, one author. Note the title is <i>italicized</i> , followed by publisher details and country of publication. Include page numbers in list.
Tattersall, P.J. 2003 (a) ‘Community based auditing: empowering the community to take charge – pathways to a just and sustainable society’, in <i>Proceedings of the Community Research Network, 6th Annual Conference, powerful Collaborations: Building a Movement for Social Change, October 16-19, 2003</i> , ed. Rick Worthington, Sandstone Minnesota, USA, www.loka.org/conf2003/2003_conference.htm .	Tattersall 2003a	Author cited more than once for the same year. Note the location of the citation is a www. Include page numbers in list.

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Day, R.A. 1989, *How to Write and Publish a Scientific Paper*, 3rd edition, Cambridge University Press, New York, U.S.A.

The University of Sydney – Orange 2000, *Guide to Referencing*, 6th edition, Faculty of Rural Management, The University of Sydney.

Tasmanian Community Resource Auditors Inc.

Our job is about facilitating positive change in others, and at the same time, improve our own effectiveness and professional competence as change agents. One of the major challenges facing our organization relates to finding better ways to help community members become more effective inquirers and ultimately competent facilitators of change. The collective experience of our team amounts to over 80 years of practice in self-development and community change. Careful analysis of our individual approaches has led us to believe that *personal change* sits at the very core of any effort to create a more just and sustainable world.

Why is community change important? Tasmanian Community Resource Auditors (TCRA) was formed in response to ongoing calls from the community for a greater role in decisions made on its behalf. While community groups around Tasmania displayed passion and an enthusiasm for change, our numerous interventions have shown us that many groups, despite all the best intentions, are simply not equipped to deal with the complex issues they face. Be they issues relating to water quality, forestry operation, organic food production, community health or crime we see time and time again community groups struggle in their attempts to facilitate meaningful change. In some cases, this can lead to “burn out” and a sense of frustration and disenchantment on the part of community members. At TCRA, we have established a number of innovative strategies to help community groups overcome these hurdles. The process begins by recognizing the strengths, and weaknesses, in the critical thinking abilities we all use. We work with the group members to define and express their concerns, we then delve deeper to explore root causes. We encourage the development of clear, concise arguments that lead the participants to compare problem situations with desirable or improved situations. The issues generated then become the foci of the change processes.

Over the past four years, we have successfully used an approach known as “co-operative inquiry” to help several community groups on their journey of change. The approach, strongly supported by credible research and a wealth of successful community change stories, is simply a disciplined method of sharing ideas and ways to undertake change. One important power of the inquiry process is that it enables participants to explore their approaches to making sense and problem solving. Each of us has a “learning style”, or way of dealing with problem situations. Knowledge of one’s individual learning style can be an important starting point for further personal change. TCRA is about helping others take that step.

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