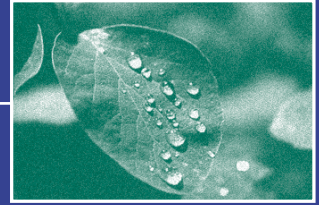


Environmental Health

The Journal of the Australian Institute of Environmental Health



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Environmental Health

Call for Papers

Sustainability in Environmental Health

Papers are sought for the **Special Issue, Sustainability in Environmental Health, *Environmental Health*, Volume Three, Number One**, to be released in March/April 2003. Final date for submission of papers for the special issue is Tuesday 14 January 2003.

Details of the journal, and Guidelines for Authors, including the aims and sections under which articles can be published are in this issue, can be seen at www.aieh.org.au, and are available from the Editor, Associate Professor Heather Gardner.

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Papers, reports, commentaries, and reviews on all aspects of environmental health, national and international, are always welcome.

Call for Papers

The Journal is seeking papers for publication.

Environmental Health is a quarterly, international, peer-reviewed journal designed to publish articles on a range of issues influencing environmental health. The Journal aims to provide a link between the science and practice of environmental health, with a particular emphasis on Australia and the Asia-Pacific Region.

The Journal publishes articles on research and theory, policy reports and analyses, case studies of professional practice initiatives, changes in legislation and regulations and their implications, global influences in environmental health, and book reviews. Special Issues of Conference Proceedings or on themes of particular interest, and review articles will also be published.

The Journal recognises the diversity of issues addressed in the environmental health field, and seeks to provide a forum for scientists and practitioners from a range of disciplines. *Environmental Health* covers the interaction between the natural, built and social environment and human health, including ecosystem health and sustainable development, the identification, assessment and control of occupational hazards, communicable disease control and prevention, and the general risk assessment and management of environmental health hazards.

Aims

- To provide a link between the science and practice of environmental health, with a particular emphasis on Australia and the Asia-Pacific Region
- To promote the standing and visibility of environmental health
- To provide a forum for discussion and information exchange
- To support and inform critical discussion on environmental health in relation to Australia's diverse society
- To support and inform critical discussion on environmental health in relation to Australia's Aboriginal and Torres Strait Islander communities
- To promote quality improvement and best practice in all areas of environmental health
- To facilitate the continuing professional development of environmental health practitioners
- To encourage contributions from students

Papers can be published under any of the following content areas:

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Articles and reports should be approximately 3000 words in length and can include articles and reports on successful practice interventions, discussion of practice initiatives and applications, and case studies; changes in policy, analyses, and implications; changes in laws and regulations and their implications, and global influences in environmental health. Up to six key words should be included. Name/s and affiliation/s of author/s should be included at start of paper and contact details including email address at the end.

REPORTS AND REVIEWS

Short reports of topical interest should be approximately 1500 words. Book reviews should be approximately 700 words and Review Articles should not exceed 3000 words in length.

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Environmental health officers (EHOs) are an important and necessary resource within the local community. The typical EHO is a source of local knowledge and is an expert in applying this knowledge and environmental health principles in assisting community security and wellbeing.

Although there has been acknowledgment of the need for this expertise by many local government authorities, the preliminary results of the Environmental Health Workforce Survey indicate that there has been a decline in the number of qualified local government EHOs. In fact there has been a decline in excess of 27% of this workforce over the last decade and, as most practitioners know, there has been an increased workload associated with the administration of legislation in addition to increasing expectations from the community. The survey data also indicate that future employment numbers will fall short of filling current vacancies in Victoria.

One of the surprising issues arising from the survey is the local government expenditure on the administration of the public health legislation or statutory environmental health services. Victorian local government spends \$5.48 per head of population on these services or \$26.4m annually. In comparison, local government spends \$7.73 per capita on public halls and civic centres, or \$37.5m annually. This is an important statistic and points to the relatively low priority of environmental health legislation and related services. The

low priority might also impact on the workforce generally. Does the falling number of EHOs stem from a falling number of new graduates entering the field, or is it a question of retaining EHOs? Is there a sufficient career path for experienced EHOs in local government? In addition, according to other local government peak bodies, there seems to be a general lack of attractiveness for local government employment. It is time that these issues were tackled and the priority of environmental health enhanced.

The imminent review of the *Health Act* (Vic) might just provide the vehicle and opportunity to promote the cause of environmental health, both in terms of statutory services and broad environmental health strategic planning. In Victoria, there is a requirement for Municipal Public Health Plans, however, the threats posed by and to the physical environment neither seem to be acknowledged, nor given a higher priority. There need to be Local Environmental Health Strategies that specifically examine and address current issues pertaining to water quality and conservation, land protection, and reversing the neglect of the environment? These strategies should then be integrated into the National Environmental Health Strategy? Where is the Victorian State Environmental Health Strategy?

The broad policy issues pertaining to environmental health and environmental health resources are important and require some intense action on the part of the Australian Institute of Environmental

Health and its partners; however, each EHO must also contribute. Each EHO must have a belief in him or herself, in the profession, and in the important contribution that they make to their respective communities. EHOs must never lose sight of how important they are to their communities - far more important than perhaps even policy makers are. When members of the community need assistance, EHOs are there - local, responsive and professional. Much of the public and environmental health service

effort is delivered by EHOs, but the community does not see much of what is done. The profession is called upon in times of crisis both locally and internationally, and is recognised for this by both the World Health Organization and the International Red Cross.

There is huge diversity, interest, and scope in the work that individual EHOs might undertake in their commitment to the profession, their community, and their employer.

James C. Smith

Outgoing State President

Australian Institute of Environmental Health (Victorian Division)

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Editor's Note

The guest editorial is based on the Closing Address given to the 71st Annual State Conference, Australian Institute of Environmental Health (Victorian Division), 5-6 September, Mansfield, Victoria.

Production of Mosquitoes in Rainwater Tanks and Wells on Yorke Island, Torres Strait: Preliminary Study

Scott Ritchie, Brian Montgomery and Ian Walsh

Tropical Public Health Unit, Queensland Health

The Torres Strait in northernmost Queensland, Australia, is subject to periodic outbreaks of dengue. A large outbreak of dengue 2 in 1996-97 affected five islands, resulting in 200 confirmed cases. On most of the affected islands, rainwater tanks were a common breeding site for vector mosquitoes. Rainwater tanks, wells and household containers filled with water are the most common breeding sites for dengue mosquitoes (*Aedes aegypti*), the primary vector of dengue in Queensland. We report on surveys conducted in February 2002 to measure the productivity of rainwater tanks and wells on Yorke Is. (Torres Strait), the first time the productivity of rainwater tanks has been measured in Australia. Of 60 rainwater tanks sampled, 10 had broken screens. Using a sticky emergence trap, 179 adult mosquitoes were collected, consisting of 63 *Aedes scutellaris* and 116 *Culex quinquefasciatus*. One unscreened tank produced 177 (99%) of the adults. A plankton net was used to sample 16 wells; 12 positive wells yielded 111 immature (larvae and pupae) mosquitoes, consisting of 57% and 43% *Ae. scutellaris* and *Cx. quinquefasciatus*, respectively. The apparent displacement of *Ae. aegypti* by *Ae. scutellaris* is discussed. Measures to reduce the likelihood of future dengue outbreaks are recommended.

Key Words: Dengue; *Aedes aegypti*; Torres Strait; Rainwater Tank

Dengue is a leading cause of morbidity and mortality in the tropics (Guzman & Kouri 2001). Australia has experienced several outbreaks of dengue fever in north Queensland since 1990 (Hanna et al. 1998; Hanna et al. 2001; Ritchie et al. 2001). The Torres Strait (TS) recorded large outbreaks of dengue 1 in 1981 (Kay et al. 1984) and dengue 2 in 1996-97 (Hanna et al. 1998). Because reticulated water is not present on most TS islands, water storage containers such as drums and rainwater tanks are common. These in turn are a common source of *Aedes aegypti*, the primary vector of dengue. Rainwater tanks represented over 50% of the containers holding *Ae. aegypti* larvae during an outbreak of dengue in 1996 (Hanna et al. 1998). Previously on Darnley Island (TS), containers >200 L capacity (including rainwater tanks) produced 97% and 99% of the larvae sampled in wet and dry seasons, respectively (Brown et al. 1992).

However, no studies measuring the production of adult mosquitoes from rainwater tanks have been conducted in Australia.

The risk of dengue transmission in a particular area is traditionally determined by comprehensive yard-to-yard surveys of all containers that are bearing water. The Breteau Index (BI) is the number of containers positive for *Ae. aegypti* larvae per 100 premises. A BI of 5 is the theoretical threshold for dengue transmission whereas a BI in excess of 50 indicates that the risk of transmission is high (Hanna et al. 1998). Campaigns that reduce the number of water-bearing containers in yards are traditionally used to reduce the risk of dengue transmission (Kay 1987).

Covert breeding sites are often not included in the BI as they are either inapparent or logistically difficult to sample. Subterranean sites can constitute a major

breeding site for *Ae. aegypti* and include wells, mines, telecommunication pits and sump pits (Russell & Kay 1999; Kay et al. 2000b; Russell et al. 2001; Russell et al. 2002). Blocked roof gutters can also be key containers (Montgomery & Ritchie, in press). Additionally, deep sites such as wells and mineshafts require specialist sampling equipment to collect larvae. The funnel trap (Russell & Kay 1999) was designed to sample mosquito larvae along with other arthropods, such as copepods, that can be ecologically relevant as predators of early instar mosquito larvae.

Yorke Island (Masig) (1996 population 296) is a flat coral cay island located in the eastern TS. During the 1996-97 dengue 2 outbreak, 58 cases of dengue were confirmed on Yorke Is. (Hanna et al. 1998). Yorke Is. offers an excellent opportunity to determine the productivity of rainwater tanks and wells in the TS. Most premises (ca. 90) have rainwater tanks and the island has ca. 60 traditional shallow wells, now used to water gardens. We report on a wet season survey of yards, wells and rainwater tanks, with particular reference to the productivity of wells and rainwater tanks. Yard surveys for ground containers were also undertaken on Darnley and Murray Islands (TS).

Methods

Yard Survey: Yorke, Darnley and Murray Islands

Yards were visually inspected (1-6 February 2002) and, using a pipette or turkey baster to remove water, all potential containers were sampled for mosquito larvae. A sample of up to 10 larvae was retained for identification.

Well Survey: Yorke Island

All wells detected during the yard survey were sampled with a 20 cm diameter plankton net. The net was allowed to sink to the bottom, settle for 2 minutes to allow disturbed larvae to come to the surface, then briskly pulled up to sample the water column. Five replicate samples were

collected per well and mosquito larvae and pupae were tallied, a representative larval sample was pipetted into jars for identification under a compound microscope, and the presence of copepods noted.

Rainwater tank survey: Yorke Island

Rainwater tanks were visually inspected for faulty or missing screens, including those on inlet and overflow pipes. Tanks with inadequate screening were sampled for adult mosquitoes using a sticky emergence trap, similar in principle to the method used to sample service pits (Kay et al. 2000a). The tank emergence trap consisted of a black plastic sheet that was placed over the inlet screen. A 1-2 m length of 10 cm diameter plastic tubing was filled with sand and placed around the perimeter of the screen to secure the plastic covering, carefully securing the plastic around the inlet pipe using tape. A clear plastic jar (1 L) was coated on the inside with an isobutylene adhesive (Bangs et al. 2001) then secured to the plastic cover by screwing the jar lid over the edge of a hole cut in the plastic. Mosquitoes emerging through the faulty screen were attracted to the light transmitted through the jar and trapped by the adhesive inside the jar. In three calibration trials where a total of 29 *Ae. aegypti* pupae were placed inside the plastic cover, all the 27 adults that successfully emerged were trapped in the jar adhesive after 24 hours. For unscreened or faulty overflow pipes, the sticky jar was simply taped over the opening of the pipe. The emergence traps were run for 48 hours, the time necessary for any pupae within the tank to emerge in summer.

Results

Yard survey

A total of 195 yards were inspected on Darnley, Murray and Yorke Islands, yielding 120 surface containers positive for seven species of mosquito (Table 1). Yard surveys on Yorke and Darnley Is. were

Table 1: Survey of surface containers in yards at Yorke, Murray and Darnley Islands from 1-4, 5 and 6 February 2002, respectively.

	Yorke Is.	Murray Is.	Darnley Is.
Premises inspected	90	20	85
+ve containers	63	30	27
<i>Ae. aegypti</i>	0	22	5
<i>Ae. scutellaris</i>	46	19	16
<i>Cx. halifaxii</i>	0	0	4
<i>Cx. quinquefasciatus</i>	11	6	13
<i>Oc. notoscriptus</i>	14	0	0
<i>Oc. tremulus</i>	2	0	0
<i>Ve. carmentis</i>	1	0	0
Combined Breteau Index*	51	205	25

*Includes *Ae. aegypti* and *Ae. scutellaris* as both are proven dengue vectors.

comprehensive (approximately 95% and 90% of all yards surveyed, respectively). Surface containers positive for mosquito breeding were characteristic of the area (Hanna et al. 1998), consisting of tyres, shells, buckets, boats, garden and household utensils, and pot plant bases. A hole atop a wooden post contained larvae of *Verrallina carmentis*, a species typically associated with brackish swamps (Lee et al. 1989). *Aedes scutellaris* was the dominant mosquito, found in 81 (67.5%) containers that had larvae. *Aedes aegypti* was also abundant, especially on Murray Is. where 20 yards yielded 22 positive surface containers. The most startling observation was the lack of *Ae. aegypti* on Yorke Is. All three islands, especially Murray Is., had a high BI, which indicates that the risk of dengue transmission is still high.

Well survey

Wells proved to be an important source of mosquitoes on Yorke Is. (Table 2). Of 16 wells sampled 75% were positive for mosquito immatures, yielding 89 larvae and 22 pupae. Of these, 57% and 43% were *Ae. scutellaris* and *Culex quinquefasciatus*, respectively. Similar to surface containers in the yard survey, no *Ae. aegypti* were sampled in wells and no copepods were sampled in the plankton net.

Table 2: Mosquito immatures collected from 16 wells on Yorke Is., 1-4 Feb. 2002, using a 20 cm diameter plankton net (5 samples per well).

Parameter	<i>Ae. scutellaris</i>		<i>Cx. quinquefasciatus</i>	
	Larvae	Pupae	Larvae	Pupae
% +ve	44%	19%	37%	6%
Range	0 - 28	0 - 7	0 - 12	0 - 11
Mean \pm SD	3.3 \pm 7.2	0.7 \pm 1.9	2.3 \pm 4.0	0.7 \pm 2.7

Rainwater tank survey

Fifty of the 60 rainwater tanks inspected on Yorke Is. were securely screened (inlet and overflow pipes tightly sealed with stainless steel screen of < 1 mm mesh) with no apparent mosquito larvae or pupae. Ten tanks had the following faults: inlet opening (35 cm diameter) unscreened (6); outlet pipe unscreened or with hole (3), bolt hole on side of tank (1).

Table 3. Adult mosquitoes produced by rainwater tanks* on Yorke Is., 2-4 Feb. 2002 using a sticky emergence trap set for 48 hours.

Parameter	<i>Ae. scutellaris</i>		<i>Cx. quinquefasciatus</i>	
	Male	Female	Male	Female
% +ve*	10%	30%	10%	10%
Total	8	55	36	80
Range	0 - 8	0 - 55	0 - 36	0 - 80
Mean \pm SD	0.8 \pm 2.	5.5 \pm 16.7	3.6 \pm 11.4	8.0 \pm 25.3

*based upon tanks with no or faulty screens (n = 10); 50 other tanks were properly screened.

The sticky emergence trap collected 179 adult mosquitoes from the 10 faulty rainwater tanks, with *Ae. scutellaris* and *Cx. quinquefasciatus* respectively representing 35% and 65% (Table 3). Three tanks produced adult mosquitoes and seven body imprints (adhered scales) of mosquitoes were found on two other traps, indicating that five (50%) of the improperly screened tanks were positive for mosquito breeding. The imprints consisted of black scales, suggesting they were from *Ae. scutellaris*. The majority of the production (Figure 2) (177/179

mosquitoes; 99%) was in a tank beside an abandoned building that had no screen on the inlet opening (diameter ca. 35 cm). However, four other tanks were similarly unscreened, two of which had mosquito imprints. Most other faulty tanks had an exposed outflow pipe (diameter 5 cm) or a bolthole in the side.

Discussion

We provide the first report of adult mosquitoes emerging from rainwater tanks in Australia. On Darnley Is. in 1990 there were 37 water tanks accessible to mosquitoes, and the vast majority of larvae (97% and 99% in two surveys) were from containers > 200 L including water tanks (Brown et al. 1992). Our data indicate that rainwater tanks have the potential to produce large numbers of mosquitoes; the collection of 55 female *Ae. scutellaris* in 48 hours (27.5 adults per day) is an extremely high number. For example, dengue simulations models indicate that the number of *Ae. aegypti* pupae that would be required to initiate dengue transmission under TS conditions range between 0.53 and 0.13 pupae per person (Focks et al. 2000). *Aedes scutellaris* has also been shown to be a capable vector of dengue (Mackerras 1946) but transmission thresholds have not been evaluated. The presence of *Cx. quinquefasciatus* does not pose a human disease risk but indicates a pest problem to nearby residents.

The apparent displacement of *Ae. aegypti* from Yorke Is. is noteworthy. Possible explanations could be the initial inadvertent eradication of *Ae. aegypti* during previous dengue control operations or extended dry conditions. In 1996 the BI on Yorke Is. was 96 and included 56% of rainwater tanks holding *Ae. aegypti* (Hanna et al. 1998). Because Yorke Is. is very small; the application of residual insecticide in domestic surface containers or lack of rain would confine potential breeding sites to rainwater tanks and wells. Rainwater tank screening on the island in recent years has

been comprehensive with the exception of a few tanks, thereby restricting potential *Ae. aegypti* breeding sites to the traditional system of wells and untreated surface containers.

Wells provided a significant habitat for *Ae. scutellaris* and *Cx. quinquefasciatus* on Yorke Is. The absence of *Ae. aegypti* in these wells may be a function of water salinity or quality. *Aedes scutellaris* has a wider tolerance to salinity and water quality (Lee et al. 1987).

Discussion with residents revealed that water from wells nearest the beaches tasted brackish. The wells are relatively shallow and water levels fluctuate with the tides. Additionally, the traditional use of these wells for drinking water has been discontinued due to concerns of contamination with nearby septic systems. The absence of predatory copepods (*Mesocyclops* species) in these wells may similarly be due to water salinity or quality. Indigenous undescribed species of *Mesocyclops* were collected from two wells on Darnley Is. (Brown et al. 1992). However, *Mesocyclops* species are found in freshwater lakes, reservoirs, streams and ponds (Brown et al. 1991). Disused wells should be identified and rendered mosquito-proof, that is either filled in, capped, provided with predators (e.g., fish) or insect screened.

Container-breeding *Aedes* continue to place TS islanders at risk of dengue. The high BI, especially on Murray Is., suggests that importation of dengue could emulate the 1996 Murray Is. outbreak that subsequently spread to four other TS islands and then Cairns. However, the data suggest that programs to reduce the number of potential mosquito breeding sites can reduce the risk. On Darnley Is., our survey (5-6 February 2002) coincided with a clean-up campaign organised by the council due to the impending visit by a federal government minister the following day. The result was a BI of 25 on Darnley Is., versus 205 on Murray Is. (5 February 2002) where no such

campaign was conducted. Previous surveys on Darnley Is. have generally recorded much higher BIs. For example, the mean BI between 1986 and 1990 (7 surveys) for *Ae. aegypti* was 167 (Brown et al. 1992) and in 1996 was 73 (Hanna et al. 1998).

Surveillance by councils should target tanks without adequate screens. Rainwater tanks screens should be checked annually. Rainwater tanks with inadequate screening should be repaired whereas disused tanks should be removed or rendered free-draining. Community awareness campaigns and a commitment by councils to routine surveillance and control of container-breeding mosquito species should significantly reduce the receptivity of TS islands to the re-introduction of dengue.

Postscript

The Tropical Public Health Unit was notified of a suspected case of dengue on Murray Is. on 20 June 2002. The cases' only reported travel history was from Cairns. Two

members of the Dengue Action Response Team were deployed to the island 24-28 June 2002 to conduct comprehensive source reduction measures around yards, treat unscreened rainwater tanks (with S-methoprene briquets) and apply residual spray (lambda-cyhalothrin) to the interior, and external living areas, of as many premises as possible.

High levels of container-mosquito breeding sites were reported throughout the 90 premises inspected in the community, with a BI of 72. Species composition was similar to that recorded on Murray Is. in February (see Table 1) with *Ae. aegypti* and *Ae. scutellaris* present in 40.5% and 24.3% of containers, respectively. Approximately 77 rainwater tanks were not screened effectively. Evidence from the productivity of unscreened rainwater tanks on Yorke Is. suggests that screening of tanks and the removal of disused tanks on Murray Is. should be given top priority as a means to reduce the risk of dengue transmission.

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An Evaluation of Heavy Metals in Sediment and Fish in the Swan River and the Health Risks Associated with Fish Consumption: A Pilot Study

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The objectives of this pilot study were to determine levels of certain heavy metals (cadmium, lead and mercury) in river sediment and fish and to quantify the associated health risks for recreational anglers who regularly consume fish from the river. World Health Organization (WHO) guidelines were used to evaluate levels of heavy metals in fish and US Environmental Protection Agency (EPA) prescribed reference doses were used to calculate risks associated with fish consumption. It was determined that adults can safely consume one fish meal per day. Children should consume no more than one fish meal every three - four days and pregnant women should limit their consumption to one meal per month. Hair samples obtained from a group of regular fishermen were within the WHO guidelines but were elevated when compared to a control group. Future acidification and pollution of the Swan River catchment area could negatively impact upon the health of the ecosystem and the people who use the river resources. It is recommended that further studies be conducted in order to identify a profile of pollution and heavy metal distribution throughout the river ecosystem. A sentinel population of regular fish consumers needs to be identified and monitored. Seasonal fish consumption guidelines need to be developed for various species of fish in different parts of the river. A baseline level of heavy metals in hair samples for the Perth population needs to be established and the public need to be informed of risks associated with fish consumption.

Key Words: *Heavy Metals; Cadmium; Lead; Mercury; Fish; Health Risks*

The Swan River

The Swan River is a continuation of the Avon River. The coastal plain catchment supports 72.5% of Western Australia's population and a diversity of rural activities, including horticulture, vineyards, livestock as well as urban and industrial developments. For as long as people have lived in the Perth region, the river has been the focus of their activities and thus subjected to pollution from various sources. It was thus anticipated that the river sediment and fish would contain elevated levels of heavy metals. Prior to conducting

this study no recent data were available for levels of heavy metals in the Swan River (Swan River Trust 2002).

Heavy Metals

The negative health impacts associated with heavy metals such as lead, methyl mercury and cadmium have been well documented (WHO 2001). There are various factors such as the dose, chemical form of the toxicant and host factors that affect the toxicity of heavy metals. The nervous system is a common target organ for some toxic metals and both methyl mercury and

lead have been identified as neurotoxins, which are particularly toxic to the developing foetus (US EPA 2002).

The combined effect of exposure to both lead and methyl mercury has not been fully established but since both metals have an effect on the same target organ such exposures are of particular concern and could be considered as additive or synergistic (Lu 1996; US EPA, 2002).

The kidney is the main excretory organ in the body and is thus also a common target organ for some heavy metals such as ingested cadmium (Lu 1996). Cadmium affects the renal proximal tubular cells, causing urinary excretion of small-molecule proteins, amino acids and glucose (Lu 1996). Lead also induces lesions in the proximal tubules of the renal cortex therefore the possible additive effect of combined exposures on the kidney also need to be considered (US EPA 2002).

Exposure Guidelines

Reference dose

The oral reference dose (RfD) of the US EPA is based on the assumption that a threshold exists for toxic effects such as cellular necrosis and is expressed as mg of the toxic substance consumed per kg of body weight per day. The RfD is thus an estimate of a daily exposure even to sensitive subgroups, which is likely to be without appreciable risk over a lifetime of exposure (US EPA 2002). Hazard Quotients are used to quantify heavy metal exposures. The total daily intake of mercury is calculated and divided by the RfD. When the resultant hazard quotient value is less than 1, no harm is expected, if greater than 1 the threshold has been exceeded and toxicity is likely to occur (Fan & Chang 1996).

Methyl-mercury exposure guidelines

The WHO guideline levels for methyl-mercury in fish have been set at 0.5 mg/kg for non-predatory fish (WHO 2001). The US EPA employed a benchmark dose

approach to determine the mercury level in hair, which is associated with no adverse effects. The benchmark dose is the intake of methyl-mercury associated with the lower bound limit of the 95% confidence interval around the dose producing a 10% prevalence of adverse effects.

The adverse neurological effects used for benchmarking included delayed walking, talking and abnormal neurological scores among children. A dose-conversion of daily intake, including an uncertainty factor of 10, produced a reference dose of 0.0001 mg methyl-mercury/kg body weight/day. This dose will maintain a blood methyl-mercury concentration of approximately 44 (g/l in blood or 11 (g/g in hair (US EPA 2002).

Cadmium exposure guidelines

WHO guidelines for fish have not been finalised, however, the European Community has established that a level of 0.05 mg/kg is appropriate for fish (WHO 2002). The US EPA RfD for cadmium is 0.001 mg cadmium/kg body weight/day. No significant proteinuria was used as the benchmark for establishing the RfD.

In determining the oral (food ingested) RfD consideration was given to the fact that cadmium would also be ingested with drinking water. Based on a no adverse effect level (NOAEL) of 0.005 mg/kg/day and an uncertainty factor of 10, an oral (food) RfD of 0.001 mg/kg/day was determined for cadmium exposure (US EPA 2002).

Lead exposure guidelines

The WHO has not established guidelines for fish lead levels, although this is being investigated and a level of 0.2 mg/kg has been proposed (WHO 2001). The US EPA decided not to publish a RfD for lead as they deem it to be inappropriate. It has been found that some effects, particularly changes in blood enzymes and certain aspects of children's neurobehavioural development may occur at such low blood lead levels that they essentially have no safe threshold (US EPA 2002).

Methods

Design

A cross sectional risk assessment was conducted during the period October 2001 to June 2002. River sediment, fish and hair samples were collected to quantify levels of mercury pollution in various media and to evaluate the risk the community may be exposed to.

The Swan River Trust granted permission for this study to be undertaken. Permission to take hair samples from regular fishermen and a control group was obtained from the Ethics Committee of the Faculty of Communications Health and Science of Edith Cowan University as well as from all study participants.

Areas frequented by recreational anglers were identified mainly through discussions with Swan River anglers and observation. Furthermore the westangler chat board on the inter-net (www.westangler.com.au) was used in an attempt to canvas study participants. The study area was divided into two main regions namely the Upper Swan from Guildford to Burswood and the Lower Swan, from Burswood to the sea. Topographical maps of the Swan Valley were used to identify sampling positions.

Sampling methodology

Sediment, fish and human hair samples were collected during the period 30 October 2001 to 31 January 2002. Sampling personnel wore clean cotton clothing and gumboots during sample collection and handling.

All samples, immediately after collection, were placed in styrofoam insulation boxes, which were packed with ice in order to reduce the temperature as rapidly as possible. The samples were dispatched to the School of Natural Sciences at Edith Cowan University (Joondalup Campus) for analysis, on the day of sampling.

i) Sediment samples:

17 single sediment samples (top 10 cm) were collected with the aid of a

clean teflon coated scoop and were placed in clean sampling bags. The samples were inspected visually in an attempt to ensure that the bulk of the sample consisted of finely graded matter and high organic content. Samples were collected at approximately two kilometre intervals throughout the study area. Depositional zones, representative of upstream influences and various flow regimes, were selected as sample points, in order to ensure that samples were representative of the depositional patterns of the river. The sample areas were approached from downstream in order to reduce disturbance of the sediment bed and to prevent contamination of the sample (Porter et al. 1993).

ii) Fish

23 adult fish of various species were obtained from regular anglers who were recruited to participate in the study. The species of fish sampled varied; the criteria for inclusion was that the fish should be edible and of legal size.

iii) Hair

While collecting fish samples, the anglers and their families were requested to provide a sample of their scalp hair. Hair was cut with stainless steel scissors and samples were placed into clearly marked envelopes (Porter et al. 1993). Due to poor participation rates, only 10 human hair samples were collected.

Laboratory analysis of samples

The US Environmental Protection Agency (1999) recommends that due to cost and other considerations fish samples should be analysed for total mercury content as it can be assumed that between 90 and 100% thereof will be in the form of methyl-

mercury. All samples were transported to the School of Natural Sciences analytical laboratory of Edith Cowan University, where they were analysed for mercury, cadmium and lead concentration.

Fillets of the fish (skin and scales removed) and the soil were air dried at 30°C for approximately 48 hours. The hair was used as received. Approximately 1 g (in duplicate) of each of the dried soil samples and 0.5g of each of the dried fish samples was weighed and transferred to separate 50 mL digestion tubes (which had been acid washed) and in duplicate. The sample mass of hair ranged between 0.01-0.25g depending on the sample size. The hair samples were not done in duplicate due to lack of sample.

Standards in the range 0.2-5.0 ppb Hg were prepared. Standards in the range 5-50 ppb Cd and Pb were prepared in 5% nitric acid.

The samples and the Hg standards were treated in the same way following the method adapted by Sadiq (Sadiq, Zaidi & Al-Mohana 1991). Briefly, concentrated sulfuric acid (4 mL) and concentrated nitric acid (4 mL) were added to the tubes containing the standards and the samples. The tubes were heated at 120°C for 3 hours. After cooling excess hydrogen peroxide (30%) was added and the samples reheated for 30 minutes at 80°C or until the solutions turned clear. On cooling, 12% hydroxylamine hydrochloride (5 mL) was added and the solutions made up to volume (25.0 mL).

Mercury in the samples was determined by the method of hydride generation using a Varian AA20 fitted with a vapour generator, (VGA76 module). Stannous chloride (10%) was used as the reductant. Cadmium and lead in the samples was determined using a Varian Vista ICP-OES (Inductively coupled plasma optical emission spectrometer).

Statistical analysis of data

- i) Sediment and fish samples were classified into groups according to sample type and sample location. Descriptive statistics were used to compare sediment and fish mercury levels from various areas. These data were statistically analysed with the aid of independent t-tests. The level of significance was expressed at $p < 0.05$.
- ii) Mean fish mercury levels measured in the various sampling locations were used to estimate the potential daily heavy metal methyl-mercury intake of adult males and females as well as children. The potential dose was expressed in μg mercury per kg body weight.

These data were compared to international norms and hazard quotients were calculated in order to estimate the risk to which people could potentially be subjected.

- iii) Hair samples of regular fishermen and controls were analysed to determine if there was a statistically significant difference in heavy metal exposures between these two groups and to identify people who may have required further counselling.
- iv) The SPSS (version 10.0) statistical computer software package was used for data entry and analysis.

Results

Table 1 is a summary of results obtained from the analysis of sediment samples obtained from the study area. The results were grouped into two categories, namely the upper and lower Swan River and mean levels of mercury, cadmium and lead were

Table 1: Sediment samples collected from the Swan River during the period 18 January - 14 February 2002

Area collected	Hg (µg/g)	Cd (µg/g)	Pb(µg/g)
Upper swan			
Guildford	<0.025	0.041	3.28
Guildford	<0.025	<0.015	<0.3
Sandy Beach reserve	<0.025	<0.015	<0.3
Redcliffe	<0.025	0.018	0.69
Ascot	<0.025	0.028	0.66
Grove Farm Reserve	<0.025	<0.015	<0.3
Burswood	<0.025	<0.015	1.09
St Annes Hospital	<0.025	0.028	0.32
East Perth	0.29	0.090	0.69
Heirisson Island	<0.025	0.032	0.52
Mill Point	<0.025	0.021	0.355
Mean	not calculated	0.029	0.78
Standard deviation	not calculated	0.02	0.87
Lower Swan			
Mosman Bay	<0.025	0.019	<0.3
Chidley Point	<0.025	0.024	<0.3
Blackwall Reach	<0.025	0.023	0.334
Gourley Park (Freemantle)	0.033	0.034	<0.3
Point Walter	<0.025	0.015	<0.3
Mean	not calculated	0.023	0.32
Standard deviation	not calculated	0.007	0.015
Canning River			
Canning Rowing Club	<0.025	0.020	4.939

Notes: Where below level of detection, lowest value was used to calculate means

Mercury: (not calculated)

t-test to determine difference in levels between Upper and Lower Swan:

Cadmium: $p = 0.44$, CI -9.94 - 2.18

Lead: $p = 0.11$, CI -0.12 - 1.04

calculated for each region. A t-test was performed to measure the difference between the mean levels of cadmium and lead in the upper and lower Swan River. The sample obtained from the Canning River was excluded from the analysis as only one sample from this tributary was obtained.

Table 2 is a summary of results obtained from fish samples taken in both the upper Swan and lower Swan River. A t-test was performed to measure the mean difference between upper and lower river fish levels of cadmium. Mercury and lead levels were generally found to be below the level of detection.

Table 2 Fish samples collected from the Swan River during the period 18 January - 14 February 2002

Fish Species	Area collected	Hg (µg/g)	Cd (µg/g)	Pb (µg/g)
Fish	Upper Swan	0.05*	0.05*	0.2*
Bream	Guildford	0.026	<0.03	0.53*
Flathead	Guildford	<0.025	0.04	<0.5
Bream	Guildford	<0.025	0.04	<0.5
Flathead	Guildford	<0.025	0.04	<0.5
Bream	Guildford	<0.025	0.27*	3.09*
Bream	Guildford	<0.025	0.04	<0.5
Flathead	Guildford	<0.025	0.03	<0.5
Bream	Guildford	<0.025	0.06*	<0.5
Bream	Guildford	0.025	<0.03	<0.5
Flathead	Redcliffe	<0.025	0.18*	<0.5
Bream	Redcliffe	<0.025	<0.03	<0.5
Bream	Redcliffe	0.029	<0.03	<0.5
Bream	Redcliffe	<0.025	<0.03	<0.5
Bream	Redcliffe	<0.025	<0.03	<0.5
Bream	Redcliffe	<0.025	0.04	<0.5
Flathead	Redcliffe	<0.025	0.04	<0.5
Bream	Redcliffe	0.056*	0.04	<0.5
Bream	Redcliffe	0.063*	0.03	<0.5
Bream	Redcliffe	<0.025	<0.03	<0.5
Bream	Redcliffe	<0.025	0.03	<0.5
Yellowtail	Redcliffe	<0.025	0.05*	<0.5
Mean		not calculated	0.05	not calculated
Std deviation		not calculated	0.06	not calculated
Lower Swan				
Trumpeter	Matilda bay	<0.025	<0.03	<0.5
Flathead	Matilda bay	<0.025	0.04	<0.5
Mean		not calculated	0.035	not calculated
Std deviation		not calculated	0.007	not calculated

Notes:

WHO permissible level in fish tissue *

Where below level of detection, lowest value was used to calculate means

t-test to determine difference in levels between Upper and Lower Swan:

Mercury/lead not calculated

Cadmium $p = 0.18$ CI -0.009 - 0.048

Table 3 is a summary of heavy metal levels in hair samples obtained from a "high-risk" purposive sample group of regular Swan River anglers and a control group of people who do not eat fish from the river. A t-test was performed to measure the difference between mean levels of mercury, and cadmium of regular fishermen and a control group.

Table 3: Hair samples collected from Swan River fishermen and controls during the period 18 January - 14 February 2002

Group	Hg (ppm)	Cd (ppm)	Pb (ppm)
Exposed group			
	0.27	1.07	2.74
	0.07	0.82	<1.0
	0.53	0.38	<1.0
	0.36	0.21	<1.0
Mean	0.31	0.62	not calculated
Standard deviation	0.19	0.4	not calculated
Control group			
	0.05	<0.1	1.0
	0.08	0.29	1.0
	0.3	0.58	1.0
	0.12	0.38	1.0
	0.17	0.29	1.0
	0.43	0.18	1.0
Mean	0.19	0.3	not calculated
Standard deviation	0.15	0.17	not calculated

Notes:

Where below level of detection, lowest value was used to calculate means

Mercury: $p = 0.35$ CI -0.17 - 0.4Cadmium: $p = 0.209$ CI - 0.28 - 0.91

Lead: not calculated

Table 4: Mercury risk prediction for daily fish consumption (Upper Swan) based upon US EPA criteria, 2001

Body weight	Estimated daily dose mg/kg based on a fish meal of 200gr/day and a mean fish mercury level of 0.029 µg/g.	Hazard quotient based on an RfD of 0.0001 mg/kg/day (should be below 1)
Adult male (75kg)	0.00008 mg/kg	0.8
Adult female (60kg)	0.0001 mg/kg	1
Child (19 kg)	0.0003	3.1

Table 5: Cadmium risk prediction for daily fish consumption (Upper Swan) based upon US EPA criteria, 2002

Body weight	Estimated daily dose mg/kg based on a fish meal of 200gr/day and a mean fish cadmium level of 0.05 µg/g.	Hazard quotient based on an RfD of 0.0001 mg/kg/day
Adult male (75kg)	0.00013 mg/kg	0.13
Adult female (60kg)	0.00017 mg/kg	0.17
Child (19 kg)	0.00053 mg/kg	0.53

Discussion

Limitations

The following limitations were identified:

- The study covered a large geographical area and it was not possible to establish a comprehensive profile of heavy metal distribution, sources or uptake but rather to determine whether further investigations are necessary. In essence this was a pilot study.
- Seasonal and species variations of heavy metal uptake in fish were not established.
- Obtaining a suitable human sampling group proved to be difficult and subsequently the human hair sample group was small ($n=10$, including 6 controls).

As can be seen in Table 1, the mean levels of mercury could not be determined as most of the results obtained were below the level of sensitivity of the laboratory method. A t-test was done to compare mean levels of cadmium and lead in the upper and lower Swan River.

The levels of both cadmium and lead were higher in the Upper Swan (upstream from Burswood) as compared to the lower reaches of the river. These findings were however not statistically significant. Cd ($p = 0.44$, CI -9.94-2.18) and Pb ($p = 0.11$, CI -0.12-1.04).

The trend noted in the sediment samples was replicated in fish tissue samples (Table 2) with fish caught in the upper Swan River having (non-significantly) higher levels of cadmium ($p=0.18$, CI -0.009-0.048).

Although the mean levels of all heavy metals measured were well within WHO published guidelines, 10% of mercury, 19% of cadmium samples and 10% of lead samples exceeded the prescribed limits and could therefore have posed a risk to consumers (Table 2).

Except for methyl-mercury, there are no published critical limit values for trace elements in human hair. However, for both

cadmium and lead, hair samples can be used as a screening method (Wilhelm & Idel 1996). The prescribed limit of 11 ppm for mercury in hair (WHO 2001) was not exceeded in any of the hair samples collected (Table 3). It was, however, noted that hair samples of regular fishermen contained higher levels of all heavy metals measured. A t-test confirmed that these findings were not statistically significant, yet the trend is well worthy of further exploration, Hg ($p=0.35$, CI -0.17-0.4), Cd ($p=0.21$, CI -0.28-0.91).

Anecdotal reports suggest that there may be some families living along the upper reaches of the Swan River that rely quite heavily upon fish caught from the river as a source of food. Although such a population would not be classified as subsistence fishermen it was deemed prudent to do a risk estimate for people should they consume fish from the river on a daily basis. The US EPA RfDs for both mercury and cadmium were used as the basis for the risk calculation and a fish meal was estimated as being 200g in weight (US EPA 1997). Body weight of adult males and females and children were estimated using tables published by the WHO for the Australian population (US EPA 2002; WHO 2001).

Table 4 is a summary of the mercury risk estimation for a population if one fish is consumed per day. For the purposes of this calculation a mercury value of 0.025 ppm was used where levels were below the level of detection, this would therefore represent a worst case scenario. The hazard quotients in Table 4 indicate that the predicted dose for all age groups except adult males would be exceeded. Adult females could however safely consume one fish meal per day and children one fish meal every three to four days. Pregnant women should not consume more than one fish meal per month.

Table 5 is a summary of the cadmium risk estimation for a population, if one fish is consumed per day. The hazard quotients in Table 5 indicate that the predicted dose for all age groups were within acceptable limits

and daily consumption of fish would not present an increased risk of cadmium poisoning.

In determining these exposure guidelines no consideration was given to the fact that the two toxins impact upon the same target organ and that the effect therefore could be additive or synergistic in some way. This increased potential risk requires further investigation. Furthermore, the relative contribution of heavy metal pollution from other food sources, smoking and occupational exposures was not considered.

Recommendations

1. To conduct a more comprehensive study of heavy metals and to map their distribution throughout the Swan and Canning River systems as an ongoing routine activity.
2. Research needs to be conducted to identify factors that impact on the mobility of heavy metals and their uptake in the ecosystem.
3. Levels of heavy metals in various species of fish and at different seasons and zones in the river need to be monitored and consumption guidelines should be published when appropriate. In order to obtain fish samples in an environmentally responsible manner it would be prudent to enlist the help of regular anglers. They could be trained to excise a sample of fish tissue and document details regarding size, weight, species, time and place of capture. Although difficult to control, this would avoid the unnecessary collection of fish samples.
4. Fish consumption guidelines should be published and reviewed annually. As an interim measure, the following consumption guidelines

- could be used: Adults should consume no more than one fish meal per day. Children no more than one fish meal every three or four days. Pregnant women not more than one fish meal per month.
5. A sentinel population of regular fish consumers needs to be identified and monitored so as to detect any increases in heavy metal levels of consumers.
 6. The possible additive effect of combined exposures to lead, mercury and cadmium needs to be considered.
 7. Hair samples from various areas throughout the Perth metropolitan area need to be collected in order to establish a baseline for heavy metal levels in the Perth population. These data may be useful for future studies of heavy metal exposures.

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The Legislative Benefits Dependency Chain: The Identification of a Missing Link

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Environmental health officers are regulatory officers and as such have significant responsibilities for protecting and promoting public health. As illustrated by the legislative benefits dependency chain, the enjoyment of environmental health legislative benefits is dependent on compliance with the law by environmental health officers, as regulators and, through their efforts, in ensuring the compliance of the regulatees. This article assesses aspects of the legislative benefits dependency chain model through an examination of research by Oberdorfer and Wiggers and the findings of the South Australian Coronial inquiry into the death of Nikki Dearne Robinson, and finds that there is a missing link in the model. This is the need for appropriate education and training of environmental health officers as regulators. Without due consideration of this element, the benefits of public health legislation can be and, it is argued, have been lost. Both at a practical and theoretical level therefore it is vital that the missing link is incorporated into Australian environmental health.

Key Words: *Legislative Benefits; Dependency Chain; Regulator; Regulatee*

Oberdorfer and Wiggers (2002a, p. 55) have argued that the mere existence of legislation is not sufficient to ensure compliance with the legislation. This article underscores the validity of this observation by exploring some under-regarded aspects of the process of securing the benefits of legislative compliance. Two particular sets of findings are used to advance this argument. One is Oberdorfer and Wiggers' research relating to infection control in skin penetration establishments. The second dataset derives from the findings of a South Australian Coroner into the death of a child due to food-borne illness. Both "inquiries" produced evidence of regulatory failures that resulted in, or had the potential to result in, serious public health consequences.

The framework for this exploration is that of the legislative benefits dependency chain. The legislative benefits dependency chain is an administrative model that helps to explain how the transition from the existence of legislation to compliance is effected. However, it becomes clear as the

analysis progresses that the dependency chain is incomplete, with its four links or elements, namely:

1. the law
2. regulator compliance with the law
3. regulatee compliance with the law, and
4. the legislative benefits delivered and enjoyed as a result of compliance.

There is a critical element missing from this chain. The missing link is that of appropriate education and training of environmental health officers as regulators. The value in identifying the missing link is twofold. Its insertion into the dependency chain makes a contribution to regulatory theory by making the model more complete. Perhaps more immediately important, improving the regulatory compliance process will contribute to ensuring the public receives the legislative benefits

intended by the parliament. A more effective delivery of legislative benefits addresses issues that have a bearing on public/environmental health, which are concerned with people's lives and safety.

The analysis undertaken in this article produces evidence that challenges the current trend towards the marginalisation of the traditional role of environmental health officers as regulators. The *National Environmental Health Strategy*, itself, appears to be a contributing factor in this marginalisation. It stated that:

Traditionally, the role of environmental health has been strongly centred around the enforcement and monitoring of legislative requirements. However, new focuses, methodologies and technology are altering the way issues are managed. Approaches that have proved effective in the past are not necessarily the way of the future. With change comes opportunity, in particular the opportunity to question and evaluate current approaches and adopt new ones (enHealth 1999, p. ii).

And clearly, undergraduate training courses now are responding to the enHealth focus. For example, the proposed new Bachelor of Applied Science (Environmental Health) course at the University of Western Sydney has asserted, "The direction of the new program, which has emphasis on change management and change agency, is directly in line with the Australian National Environmental Health [S]trategy" (University of Western Sydney 2002, p. 14).

The *National Environmental Health Strategy* quite rightly has argued that, "Decisions and deliberations must be based on a careful analysis of available scientific evidence about potential environmental risks to human health" (enHealth 1999, p. 9). This argument, nevertheless, must be extended to risks other than just those pertaining to the environment. Regulatory failures also give rise to risks that can affect health. This article provides some explicit evidence of regulatory failures that have caused, or have the potential to cause, much

harm to human health. The exposure of these risks necessitates interested parties such as the enHealth Council, the Australian Institute of Environmental Health, environmental health undergraduate course providers, and environmental health officers themselves, to take appropriate urgent action to redress the deficiencies and thus reduce the likelihood of future failures.

Before proceeding with the main argument, it is desirable to clarify the meaning of "legislative benefit". Legislative benefits generally are not specified in the legislation. They have to be "discovered" by analysing the law, itself. For example, some of the general benefits relating to food hygiene law include a reduced likelihood of contracting a food-borne illness; a reduced likelihood of sustaining a food-borne injury; a reduced likelihood of suffering a financial disadvantage through premature food spoilage; and a general economic benefit to the community because less money needs to be spent on treating preventable food-borne illnesses and injuries, thus freeing up the money which may then be redirected to other health care needs. Legislative benefits are consistent with, but extend beyond, many of the entitlements that have been specified in the Australian Charter for Environmental Health for individuals, communities, business and industry (enHealth 1999, pp. 10-11). For example, when there is compliance with the law there is less likelihood that public monies have to be spent on legal processes, such as coronial inquiries, or as already mentioned, less money needs to be spent on the treatment of preventable disease.

Environmental Health Legislative Benefits Dependency Chain

Oberdorfer and Wiggers stated that, "The effectiveness of legislation and regulation is dependent upon the adequacy of its enforcement, monitoring and promotion" (2002a, p. 50). This statement sits comfortably with the notion of a legislative

benefits dependency chain, the renamed “law enforcement sequential dependency chain” (Richards 1999, pp. 23 & 25). Legislative benefits, that is to say the direct and indirect benefits that parliament intended to be enjoyed by various classes or groups of people within the community when it enacted the legislation, can only be enjoyed if the benefits are delivered through compliance with the law.

The enjoyment of environmental health legislative benefits is dependent on compliance with the law by environmental health officers, as regulators, and regulatees. There is a co-responsibility. However, it is reasonable to argue that regulatees are more likely to comply if regulators comply with their own legal obligations and responsibilities. Thus, the role of the regulator precedes that of regulatees in the legislative benefits dependency chain as follows:

- A law is passed to provide for public health protection requiring
- regulators to comply with their legal obligations and responsibilities so that
- regulatee compliance with legal obligations and responsibilities follows and thus
- the intended legislative benefits are delivered and enjoyed by the community.

The legal obligations and responsibilities of environmental health officers vary according to legislation. For example, there may be a duty to inspect premises before registration to ensure that there is compliance with the law and to inspect premises after registration to ensure that compliance is being maintained. There is also a responsibility to take appropriate action when there is non-compliance. This action will depend on the remedies that the law has provided and the appropriate

enforcement strategy vis a vis the nature of the non-compliance. Even though the legislation may make some remedial provisions discretionary, it does not mean that an officer has no duty to activate a discretionary provision. As Pearce and Geddes (2001, p. 273) have observed:

If the court is satisfied that the aim of the Act would be defeated if a task were not carried out by a person or body, it will rule that the provision is obligatory and the possessor of the power has no discretion to refuse to exercise it.

Thus, it becomes clear that it is not only a matter of a regulator ensuring the regulatees comply with the law but also that the regulators, themselves, must comply with the law as well.

Many might expect that environmental health officers' compliance would be assured, yet there is no guarantee that officers will meet their own obligations. The New Zealand Controller and Auditor-General carried out an efficiency audit of territorial local authority health inspection services and found:

Not all food premises are inspected every year, despite the statutory requirement that this be done. In the files we examined in the course of the audit, 32 percent of premises had no obvious documented record of inspection in some years. There were some premises, which had not been inspected for two or more years (Tyler 1988, p. 14).

Clearly, when this situation occurs, many regulatees will not be too concerned about meeting their responsibilities either. However, even when inspections are undertaken there may be another obstacle to the delivery of legislative benefits. Tyler also observed:

[F]iles reviewed indicated little apparent recognition by health inspectors of the powers vested in local authorities either to revoke registrations of unsatisfactory premises or to summon difficult proprietors to provide good reason for not revoking registration. These powers are contained in the Health (Registration of Premises) Regulations 1966 (1988, p. 26).

It is not unusual for regulatory officers to have little knowledge of the law with which they are required to work. Frank and Lombness said of food inspectors with the Wisconsin Department of Agriculture, Trade and Consumer Protection, "In general, inspectors had a limited knowledge of both the regulations they enforce and the finer points of legal procedure" (1988, p. 86). Frank and Lombness also noted that inspectors lacked the technical knowledge of matters falling within their jurisdiction thus disempowering the officers (1988, pp. 76-79).

In response to these matters, Richards said:

Obviously, if inspectors do not have the technical knowledge to identify violations for example or to know how violations can be remedied there is not much to be gained from carrying out inspections. When officials lack knowledge about powers, procedures, technical matters and, indeed, the regulations per se their expert base of power is very weak and thus their power to exert influence over regulatees is likely to be very weak also (1999, p. 27).

Therefore, to put the environmental health officer before the regulatee in the legislative benefits dependency chain is realistic with regard to cause and effect. And, looking at the dependency chain as a whole, it is also reasonable to conclude that, unless the environmental health officer link is strong, the chances of the legislative benefits being delivered and enjoyed in the end are seriously compromised.

Exploring the Australian Environmental Health Officer Link

The relevance to Australia of the New Zealand Auditor-General's report and the Frank and Lombness' article might be questioned because neither referred to Australian officers. Moreover, they addressed matters that are now at least 14 years old. While both criticisms might have some validity, their utility in this article is in helping to explain the legislative benefits dependency chain as a model. The specific

experience of the Australian environmental health officer is explored in this article by looking at two other inquiries. These are the research of Oberdorfer and Wiggers (2002b) into the knowledge and attitudes of environmental health officers regarding infection control in skin penetration establishments and the findings of the South Australian Coroner into the death of Nikki Dearne Robinson (Chivell 1995).

The Oberdorfer and Wiggers' Research

Infection control in skin penetration establishments is important because there is the potential for the transmission of blood-borne diseases such as HIV/AIDS, hepatitis B and hepatitis C. Indeed, skin penetration activities may be classed as public health risk activities under some legislation, for example, *Public Health Act 1997* (Tas). As with much of environmental health law, the law pertaining to skin penetration activities, undoubtedly, is based on good science and, consequently, both the prescriptive and proscriptive legislative provisions can be regarded as valid.

Oberdorfer and Wiggers conducted a large scale study; they sampled 245 local council environmental health officers in New South Wales and 30 officers from the public health units in that State. The scale of this study is important as it provides those parties such as the enHealth Council, the Australian Institute of Environmental Health and environmental health course providers with an indication of the magnitude of the problem revealed by the research, at least as it applies to New South Wales. Whilst scale is not critical when developing regulatory theory, one officer demonstrating regulatory deficiencies would be sufficient to make a contribution to theory knowledge, the scale adds some considerable weight to the theory modification.

For the purposes of this article, Oberdorfer and Wiggers' research can best be summarised by citing an extract from the research abstract:

... More than half of [officers] from local councils and one fourth from public health units reported that they did not know the meaning of the "standard precaution approach". Almost half of both groups did not know the correct disinfection procedures. Only one third of local councils and half of public health units received training in inspections, and approximately 50 to 70% of them believed they needed more skills to effectively encourage compliance among operators. There is a need to improve the knowledge and skills of environmental health officers involved in skin penetration inspections (2002b, p. 35).

These findings signal serious regulatory knowledge failures from both the health and legal perspectives. It is not known whether any harm has been caused to the public as a result of the failures. However, the potential for harm is evident. These regulatory failures warrant further exploration by going beyond the original research parameters. This exploration can be commenced by looking at the terms that caused difficulty for many of Oberdorfer and Wiggers' respondents - standard precautions and disinfection procedures.

- Standard Precautions

The term "standard precautions" is defined in section 2 of the New South Wales Health Department's *Skin Penetration Guidelines* (1999). Section 4 is headed "Standard Precautions" and deals with the several aspects of standard precautions. There is a statement in section 4 that "standard precautions" assume all blood and body substances to be potential sources of infection. From this statement alone, it should be possible for an officer to work out what precautions need to be taken to prevent contamination and disease transmission. However, throughout the *Guidelines*, information is provided regarding the safe work practices and protective barriers that must be

employed to reduce the risk of contamination and disease transmission.

The *Skin Penetration Guidelines* document is written in plain English and it is difficult to understand why so many respondents did not know what the term meant. Indeed, some of the precautions, such as those pertaining to hand washing, operator hygiene, clothing, smoking, eating and drinking apply equally to the protection of food from contamination as set out in the *Food Safety Standards* (Australia New Zealand Food Authority, 2001) and *Safe Food Australia: a Guide to the Food Safety Standards* (Australia New Zealand Food Authority 2001) so it is not as though the concept of a standard precautions approach regarding the prevention of contamination is entirely new. One wonders whether the precautions to protect against the transmission of communicable diseases are taught in undergraduate training. Further, it might be questioned also whether students are taught that after graduation they will need to refer constantly to standard communicable disease reference works such as the *Control of Communicable Diseases Manual* (Chin 2000).

- Disinfection procedures

The word "disinfection" is defined in section 2 of the *Guidelines* and is further dealt with in section 6. The recommended method for disinfection of equipment is stated quite plainly. Oberdorfer and Wiggers say that perhaps it is not surprising that comparatively few council officers could correctly identify disinfection procedures because many officers had not received training in the implementation of the *Guidelines* (2002b, p. 41). One could reasonably expect that basic public health terms such as "cleaning", "sanitising", "disinfection" and "sterilisation" and the associated methods are dealt with in the undergraduate courses.

Knowledge pertaining to standard precautions to prevent disease transmission and methods of disinfection is of crucial importance to an environmental health officer. So also is knowledge regarding inspections, compliance strategies and enforcement strategies.

Environmental health officers are regulatory officers. Training in inspection and in enforcement and compliance strategies should be central to the education and training of environmental health officers. Once the basic principles and rules of inspection have been taught, they can be applied, with appropriate modifications, to specific situations. There should be no need for special training. However, there is a need to read, understand and be familiar with the relevant law before embarking on a newly introduced inspection area. In the case of skin penetration establishment inspections, there is also a need to consult a standard reference work that deals with blood-borne diseases. Very useful information can be extracted from this preparatory activity that facilitates the inspection process and the education of skin penetration operators; information such as the fact that the hepatitis B virus is stable on environmental surfaces for at least seven days and, therefore, indirect inoculation of the virus can occur via inanimate objects (Chin 2000, p. 246).

Despite the central importance of regulatory technology in the work of environmental health officers, a review of the units listed for study in the various environmental health degree courses that are regarded as being suitable for employment as environmental health officers reveals that no university includes regulatory technology or regulatory theory as units in the courses they offer. One university does not even list law as a unit for study. Officers should not attempt to inspect premises unless they know the statutory and common law requirements relevant to their work. It is not only a matter of officers knowing the specific legislative provisions, such as those pertaining to skin penetration,

for example, but also of understanding the provisions relating to obstruction, hindrance, assault, power of entry and so forth. Officers must be given some guidance also as to what actions the courts have regarded as obstruction and hindrance and, conversely, what actions have not been regarded as such. It is possible, of course, that aspects of regulatory technology and regulatory theory, and law where it is not listed as a unit, might be dealt with in other units, but they certainly do not appear to be given the status of a course unit in their own right.

It is quite clear from Oberdorfer and Wiggers' research that universities cannot, and should not, rely on their students receiving appropriate advice, training and experience when they undertake their industry-based experience to compensate for gaps or deficiencies in their courses. Students can only benefit from their work experience when those with whom they are placed are competent in the areas for which the student is seeking experience.

Professional education and training through a bachelor degree is different from the technical training associated with lower level qualifications. According to the *Australian Qualifications Framework: Implementation Handbook* (AQF Advisory Board 2002), the characteristics of the learning outcomes of a bachelor degree are:

- *the acquisition of a systematic and coherent body of knowledge, the underlying principles and concepts, and the associated communication and problem-solving skills;*
- *development of the academic skills and attributes necessary to undertake research, comprehend and evaluate new information, concepts and evidence from a range of sources;*
- *development of the ability to review, consolidate, extend and apply the knowledge and techniques learnt, including in a professional context;*
- *a foundation for self-directed and lifelong learning; and*

- *interpersonal and teamwork skills appropriate to employment and/or further study* (p. 49).

Oberdorfer and Wiggers' research findings suggest that many graduates may not have attained some of these learning outcomes. Even if students had not been taught concepts and meanings of terms such as "standard precautions approach" or "disinfection procedures" or their inspectorial training had not covered skin penetration establishments, graduates should have been able to come to grips with such matters through self-directed learning and should have the skills to subsume new knowledge into their regulatory practice. Because legal requirements are constantly changing, it is essential that officers should have developed the skills in their basic education to enable them to modify their regulatory practice as needs arise. If environmental health officers have to undergo training when new requirements are introduced, they are moving away from being a profession back towards an occupation that is more technical in nature.

It is reasonable to suggest from Oberdorfer and Wiggers' research that there is likely to be a significant degree of non-compliance amongst skin penetration operators (regulatees) in New South Wales with their legal obligations and responsibilities, because many officers, themselves, appear not to understand critical aspects of the *Guidelines*. Indeed, in a previous study, Oberdorfer et al. (cited in Oberdorfer & Wiggers 2002a, p. 55) indicated that 72% of skin penetration operators reported that environmental health officers lacked specific skills and knowledge relating to skin penetration matters. This is a very dangerous situation from both the health and legal perspectives. The *Skin Penetration Guidelines* contains a statement that advises:

For further information on this Guideline, please contact an Environmental Health Officer at your local authority or Public Health Unit (p. ii).

Clearly, this government document is telling skin penetration operators that appropriate advice can be obtained from environmental health officers. In *Shaddock (L) and Associates Pty. Ltd v Parramatta City Council* ((1981) 36 ALR at 385) it was held that:

A person comes under a duty of care in relation to the provision of advice or information if he carries on a business or profession and in the course of it provides advice or information of a kind which calls for skill and competence or he otherwise professes to possess skill and competence and he provides advice or information when he knows or ought to know that the recipient intends to act or rely on it.

It is reasonable to assume that skin penetration operators who seek advice and information from environmental health officers will be relying on the advice and information given. When one applies this legal principle to the research findings of Oberdorfer and Wiggers, the risk of law suits for negligent misstatement is evident. There is also a risk that other legal processes may be activated if a skin penetration client contracts a blood-borne disease as a result of a skin penetration procedure. Legal processes such as inquests are thorough and expose regulatory deficiencies.

The Findings into the Death of Nikki Dearne Robinson

The South Australian Coroner inquired into the death of four year old Nikki Dearne Robinson (Chivell, 1995) who died in 1995 as a result of eating contaminated garlic mettwurst produced by Garibaldi. A total of 23 children, including Nikki, were diagnosed as suffering from haemolytic uraemic syndrome after consuming the contaminated product. The Coroner said:

Apart from the tragic death of Nikki, at least five of the other children suffered lasting symptoms which have been attributed to the condition and, although it is difficult to predict with certainty, several of them may well suffer permanent and significant disabilities as a result (ch. 1).

This quotation referred to those who had developed haemolytic uraemic syndrome as a consequence of eating the contaminated food. However, the outbreak does not appear to have been limited to 23 because the Coroner noted that “approximately 150 other people contracted illness of varying degrees of severity and many of those illnesses were suspected of being associated with the epidemic” (ch. 1).

As part of his inquiry, the Coroner examined a number of previous food-borne illness outbreaks where food similar to that which caused Nikki’s death was involved in order to identify what information was available to the South Australian Health Commission (SAHC), at the time when the mettwurst incident occurred, and which could have influenced the actions of the Commission in relation to the outbreak. With respect to what has been called the Gallichio wedding outbreak in 1991 the Coroner said:

There was no prosecution of either the company or any of the directors in relation to this outbreak, either in relation to the presence of salmonella in its food product, or in relation to the lack of appropriate labelling from which it might have been possible to have identified the particular date of manufacture. What is particularly remarkable about this incident, is that the SAHC officials were fully aware of the fact that Garibaldi could not trace the raw materials that went into the contaminated salami at that stage, and yet no mention appears to have been made by anyone concerned of the need for them to attend to this.

Even if they had not been prosecuted, one might have thought that the Health Commission would have advised or warned Garibaldi that they were in breach of the code by their inability to identify the date of production.

Had they done so, and Garibaldi complied, the date of production of the contaminated mettwurst in 1995 might have been ascertained, the particular source meat which caused the contamination could then have been traced, and the investigation would have been made easier and more effective.

Further, the Health Commission seems to have accepted the assurances of Mr Mead and Mr Marchi [Garibaldi officials] that they intended to address issues of quality control and upgrading of their processes. No-one from the Health Commission attended at the Garibaldi factory after this outbreak in 1991 to ensure that these undertakings were being carried out (ch. 6).

Notwithstanding the failure to prosecute, the Coroner clearly found basic regulatory deficiencies namely the failure to provide appropriate advice, the failure to issue warnings and the failure to undertake follow up inspections. Advice, warnings and follow up inspections are located at the very bottom of the “enforcement pyramid” (Richards 1999, p. 25). If health officials do not apply even basic regulatory responses to serious aspects of non-compliance, one cannot expect regulatees to take the law very seriously. And, it seems, Garibaldi did not.

Some sixteen months later in 1992, there was another incident involving Garibaldi known as the Pisani outbreak. Salami submitted by a member of the public was handed to a local council environmental health officer. The sample was then submitted to the Institute of Medical and Veterinary Science and subsequently forwarded to Adelaide for analysis. It was found to be heavily contaminated with salmonella. The contaminated meat was established as being a Garibaldi product, although it appears that there was still a labelling problem. Officials from Garibaldi said that it was difficult to identify the product as theirs. Consideration was given to launching a prosecution but the Crown Solicitor’s Office advised that it should not be attempted because the salami had passed through so many hands that it was impossible to prove a chain of evidence sufficient for a prosecution. The Coroner said:

Again, it seems extraordinary that no follow-up took place with Garibaldi, particularly in relation to the labelling issue, which has proved most unfortunate in view of the

difficulties involved in the investigation of the 1995 outbreak.

...

It is just as extraordinary that there were no further visits by SAHC in which they sought to verify that the company had fulfilled their promises in the ensuing three years (ch. 6).

The Pisani incident demonstrates similar basic regulatory deficiencies that had been found in the Gallichio wedding incident. From the report of the incident, it is not entirely clear as to what extent the environmental health officer contributed to the problem associated with the prosecution difficulty. However, because an officer does not know where an investigation will eventually lead, all proper procedures must be activated immediately an officer receives a complaint. It is not possible to go back and correct regulatory deficiencies in relation to evidence of the type in the Pisani incident once an investigation has started. Protecting potential evidence and maintaining an evidence chain is as critical in regulatory work as ensuring that correct sampling techniques have been employed in microbiological or toxicological research, for instance.

It appears that environmental health officers may not see themselves as regulators; a matter to which the Coroner referred when dealing with the 1995 fatal outbreak. In response to an environmental health officer referring to the occupiers of the Garibaldi factory where the mettwurst was produced as "customers" the coroner said:

I must say that I have some difficulty with the concept of a regulatory authority describing the occupier of premises to be inspected as a "customer". I realise that the expression has a certain currency in management jargon at the moment, but it implies a relationship of service which is inappropriate. It is not the function of an EHO to please those whom he or she is required to inspect, although I do not suggest that unnecessary rudeness and officiousness should be resorted to. However, there will be times when the "customer" will be displeased by an EHO's actions, and, in

my view, the public has a right to expect that an EHO will not be daunted by that.

Firmness, objectivity and professionalism should govern the activities of a regulator, particularly where, as here, the health and safety of the general public are at stake. I do not consider that the concept of customer service has a role in this context (ch. 12).

The coroner makes very clear his view of the role environmental health officers should play in protecting public health when he said:

In the event that some manufacturers do not embrace these modern developments [referring to HACCP for example] and find themselves in breach of the legislated requirements, they should be left in no doubt that they will be prosecuted energetically. The requirements of public health are too urgent, as this case has tragically demonstrated, for half-measures in enforcement of food legislation (ch. 12).

Successful prosecutions depend on officers possessing highly developed skills in regulatory practice. Amongst the recommendations made by the Coroner was one that is highly relevant to the dependency chain argument being offered in this article:

That the SAHC reconsiders its policies and procedures in relation to the powers held by authorised officers pursuant to the Food Act, and implement training and development programmes which equip its officers to take a more pro-active and rigorous [sic] approach to the enforcement of the food legislation (ch. 13 Recommendation 11).

Drawing on the *Leviathan*, the work of Thomas Hobbes, a 17th Century English political philosopher, Siegel (2001, p. 359) said, "Life in a world without public health laws would surely be shorter and nastier, even if not more brutish". In view of the extracts quoted from the South Australian Coroner's report, one should modify Siegel's statement to, "without the enforcement of public health laws, life can be shorter, nastier and brutish". The Garibaldi saga involved four years of regulatory failure. Legislative benefits were not delivered to, and enjoyed by, a number of consumers of

the Garibaldi products. Only costs were incurred.

Assessment of Some Implications for a Missing Link

The research of Oberdorfer and Wiggers and the extracts from the South Australian Coroner's report suggest that the environmental health officer link in the legislative benefits dependency chain is nowhere near as strong as it must be if legislative benefits are to be delivered and enjoyed. The weakness appears to be in the knowledge and skills of officers and a possible reluctance by officers to perform a regulatory role. By extension, this suggests there is a serious problem with the education and training of environmental health officers. The problem may extend beyond the matters raised in this article. Attention is drawn to one obvious matter.

The difficulty that many respondents had with answering questions relating to the requirements of the Skin Penetration Guidelines raises an important question for consideration. How will officers, who were obviously struggling to understand basic terms, cope if they are required as witnesses in a court or tribunal? The examination-in-chief may not be too demanding. Cross-examination, however, is a very different matter. Mental agility is certainly required, as unexpected questions are likely to be asked. One needs to be able to apply principles to questions or draw on sound knowledge whilst under pressure. Lack of confidence in officers will certainly act as an impediment to commencing litigation. This immediately reduces available enforcement options and may contribute to further regulatory failure.

Thus, the exploration undertaken in this article places a question mark over a statement made in the National Environmental Health Strategy that:

*The undergraduate training of
environmental health officers (EHO)*

*provides a broad scientific base and equips
them well to perform in areas of
environmental health practice (enHealth
1999, p. 29).*

The evidence presented in this article does not support this statement. The undergraduate training of environmental health officers appears to be deficient in a number of crucial areas. Education and training providers must accept some responsibility for sending graduates out into the community with certain skill and knowledge deficits. Such deficits may account, in part, for the reluctance of some officers to adopt a regulatory role.

Further evidence of officers not wishing, or lacking the confidence, to assume a regulatory role can be found in the National Environmental Health Strategy. The Strategy claims that there is a tendency for environmental health practitioners to reduce the amount of "hands-on" work and to increase the amount of time spent in the direct or indirect management of issues (enHealth 1999, p. 29). This raises the question of who, then, is doing the "hands-on" regulatory work? It has to be done.

Reliance on tools such as food safety plans, is unacceptable. As is the case with legislation, the mere existence of a food safety plan, for example, does not mean that it is implemented or that associated records are not being falsified. Everyone who drives a motor vehicle is required to hold some form of driving licence. Holders of the full licence have passed a test so one can say that they have been educated and trained to the required level. Does this mean that everyone obeys the traffic laws and, therefore, we do not need police officers to undertake their regulatory work? Regulatory work certainly is not less skilled than the work of managers or scientists. Indeed, it has been shown that environmental health regulatory work demands considerable skill (Richards 2001, 2002). Nor is regulatory work less important than that of scientists or managers. Indeed,

it can be argued that unless officers undertake their regulatory responsibilities, the goals of the Australian Charter for Environmental Health will not be achieved.

Inserting a New Link

The evidence presented in this article has shown that it is wrong to assume automatically that the regulator link in the dependency chain can be relied on to ensure that the regulatees fulfil their obligations and responsibilities. The reasons identified in this study are the lack of specific knowledge and skills on the part of regulators and their reluctance, or failure, to undertake regulatory work. Perhaps, this reluctance is also indicative of a lack of understanding that regulators too must comply with the law.

These identified deficiencies can be overcome, in part, by providers of environmental health undergraduate courses ensuring that graduates are equipped with appropriate regulatory practice skills. The importance of these skills in protecting the public, and in the contribution they make towards the attainment of the goals of national and global environmental health agendas, must be stressed.

Whether there will be a change in relation to the training of environmental health officers is a question with which others must deal. One interesting observation is that the National Environmental Health Strategy was published several years after the release of the coronial findings. The authors of the strategy document were clearly aware of the coronial findings as the contaminated mettawurst incident is the focus of a case study (enHealth 1999, p. 18). No mention is made, however, of the major regulatory failures, merely a mention that the incident raised, amongst other matters, the issue of the adequacy and effectiveness of enforcement of relevant legislation and regulations. Lessons from this tragic incident do not seem to have been learned for there is no "push" in the Strategy for regulatory

work to be strengthened. Indeed, the contrary view is taken in that the effectiveness of the traditional regulatory role is questioned. Now, however, the Oberdorfer and Wiggers' research must cause interested parties to at least re-evaluate their stance on the role of the environmental health officer.

Independently of whether there is an actual change to the education and training of officers, a small but critical change can be made to regulatory theory by adding this new link to the legislative benefits dependency chain. The link is that of appropriate regulatory education and training of student environmental health officers. That it should be added to the existing administrative model is clear and where it should be added is equally clear. The new link must precede the regulator link. It makes little sense to undertake this training after graduates have become regulators.

A summary of an extended environmental health legislative benefits dependency chain, with its five sequential links, thus would look like this:

- The written law: comprising statutes, ordinances, regulations, by-laws and enforceable guidelines. The law imposes a co-responsibility on regulators, such as environmental health officers and their agencies, and those whose behaviour is regulated in order to protect the public.
- Regulatory education and training: students must be equipped with skills and knowledge so they are able to fulfil their role, as parliament intended. Common law education must be included, as it is not possible to work with legislation without an awareness, or use, of common law such as statutory interpretation, the ultra vires doctrine, trespass and the duty of care. Courses must be tailored to meet the demands of the law.

- Regulator compliance: regulators must apply their knowledge and training to comply with their legal obligations and responsibilities. This includes, but is not limited to, ensuring that those tools, for example, inspections, registrations, licences and remedial or sanction provisions, that are provided in the legislation which are directed towards securing regulatee compliance are used as parliament intended.
- Regulatee compliance: regulatees must comply with their legal obligations and responsibilities that are prescribed by law. They are more likely to comply with the law when regulators comply with the law also.
- Legislative benefits: compliance with the law by regulators and regulatees alike will ensure that the benefits that parliament intended to be enjoyed by members of the community will be delivered and enjoyed.

Conclusion

The core argument of this article is based on the need for environmental health regulators, whom parliament has tasked with a vital role to play in ensuring that legislated public health protection is delivered, to be adequately equipped to undertake this role. This is not to minimise the value of other contributions to this regulatory process. Much of environmental health law is based on good science and environmental health regulatory practice is based on the law. Thus, the law links science to practice. Because the law is based on this firm foundation, it is logical to argue that non-compliance with the law will be at a cost. The price paid by Nikki Robinson for consuming contaminated garlic mettwurst was her life. Non-compliance with the law relating to skin penetration establishments has the potential to end in tragedy also as blood-borne diseases such as HIV/AIDS, hepatitis B and hepatitis C can prove fatal.

Compliance with the law is a co-responsibility of environmental health officers, as regulators, and regulatees. However, there is a dependency factor. Regulatees are more likely to comply with the law when regulators fulfil their legal obligations and responsibilities. Thus a commitment to public health by environmental health officers, demonstrated through the fulfilment of their own regulatory obligations and responsibilities, will do much to ensure that the likelihood of harm to members of the public is substantially reduced, as the law intends. However, no matter how deep the commitment of officers may be, they need to possess appropriate regulatory skills and knowledge. Thus it is logical to argue that environmental health course providers should make their contribution to protecting public health by ensuring that their graduates are suitably equipped for the role which the law, at least, expects them to undertake. The traditional role of officers may be marginalised by many but in the final analysis, it is what the law requires of officers that counts. And, it is officers and their regulatory agencies, rather than course providers, the enHealth Council or the Australian Institute of Environmental Health, who have to explain their actions or non-actions to officials such as coroners, magistrates, judges, juries, health complaints commissioners and ombudsmen.

The evidence presented in this article challenges the view of the enHealth Council that the undergraduate training of environmental health officers provides a broad scientific base and equips them adequately to perform in areas of environmental health practice. The evidence also poses a specific challenge to those who currently believe that the traditional role of environmental health officers has gone past its "use by date". It is to be hoped that they will re-evaluate their stance. Whether the Oberdorfer and Wiggers research and the re-visiting of the coronial findings will alter their perceptions remains to be seen, but few could reasonably argue that their findings and those presented in this article are not disturbing.

Finally, notwithstanding the question of whether there will be any changes made to

the education and training of student environmental health officers, this article has proposed a small but important change to regulatory theory. A new link pertaining to the appropriate regulatory education and training of students should be inserted into

the legislative benefits chain. This is required to recognise that appropriate training is necessary to ensure that the regulators are properly prepared to make their vital contribution to protecting public health.

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PRACTICE, POLICY AND LAW

Setting the Health of the Future¹

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There is enormous worth and value in sustainable development as a goal towards which all can move forward for mutual benefit. There is, however, a danger that pursuit of sustainable development as an entity in its own right will result in losing sight of the primary objectives for humankind and the desirable endpoints in maintaining health. Sustainable development is a concept of ideal interactions, involving multiple components, for the conjoint management of earth and society, a tool for thinking about interdependencies, from which sustainable solutions for meeting our needs can be found. The transition to sustainability involves an appreciation of the enormity of the issues and sense of urgency required, but with a concentration on a positive vision for the future for all. To make the transition, we have to be prepared to change, to adopt a new philosophy, and to be much more prepared to think about total systems management.

Key Words: *Sustainable Development; Environmental Management; Health Outcomes*

The Future

I want to challenge everyone involved in all aspects of environmental and public health and health promotion to develop a more effective and positive vision for the development of health, through being part of the construction of our healthy futures. We have to look to the broader strategies from the sustainable development philosophy to achieve satisfactory outcomes that will be dependent on the management of multiple factors. The programs arising from the three planks of sustainable development managed in community-industry partnerships, and with good governance, can give us greater faith in our health future.

In this context, the traditional reactive focus in environmental management for human health must move to the proactive view. We might lose sight of the potential for promoting health through environmental management in the focus on reactive responses in damage control mode, if that attention excludes proactive and anticipative strategic policies directed at forward planning in the pursuit of long-term

resolutions. Sustainable development for health makes no sense unless we can be forward thinking.

Through our work in the Environmental Health Section of the Population Health Division we are engaged in developing strategies for progressing national environmental health services in Australia. The capacity of those services in meeting the challenges of the future, must be founded on concepts of building health. Whether in developing the built environment, or supply of essential services, or developing any activity, including health services themselves, the desirable health outcomes must dictate the specifications.

The environment forms our natural life-support systems, and its management should not be left to chance. McMichael bases his book *Human Frontiers, Environments and Disease* (2001) on the view that we have arisen from, and are continuing to change in, an ecological framework, challenging us to using our evolved brains to participate constructively in the ongoing evolution of humankind. There is a huge challenge in asking us to apply our intellect to the issues for construction of our healthy future.

In building health, plans for the construction are required. In making logical and sequential decisions for health, predictions of health outcomes, and predictions of health status arising from such plans are essential. Predictions for the future require assessment of the current situation, prediction models from data collections, and an understanding of the assumptions made. The term “sustainable development” requires some explanation.

Sustainable Development

The concept of sustainable development arose out of the view that rational economic development and preservation of our environment for human needs, in the broadest sense, were in some way in potential conflict with one another. In accommodating this apparent conflict, the notion of sustainable development sought to emphasise and promote those aspects of both, which were synergistic and mutually supportive.

In the promotion of sustainable health solutions, the success of the approach is predicated on the integrated advancement of the three basic planks: social, economic and environmental considerations. These planks form the Triple Bottom Line for accountability in sustainable development. All three agendas have to be pursued but in an integrated manner. The process of integration needs to ensure that health is maintained at the forefront of consideration as the ultimate motivation in ensuring a sustainable environment.

There is enormous worth and value in sustainable development as a goal towards which all players can move forward for mutual benefit. There is, however, a danger that pursuit of sustainable development as an entity in its own right will result in losing sight of the primary objectives for mankind and the desirable endpoints in maintaining health. Sustainable development is a concept of ideal interactions, involving multiple components, for the conjoint management of earth and society, a tool for

thinking about interdependencies, from which sustainable solutions for meeting our needs can be found.

The sustainable development way of thinking is useful in challenging health promotion for the future because it reinforces our commitment to inter-generational action and the need for leadership from health in appropriate intersectoral collaboration.

Building Health in Our Created Future: Health Impact Assessment

In building health into our created future we must at first ask ourselves several questions:

- what are the optimal characteristics for an appropriate environment to derive maximal health gains?
- what are the necessary prerequisites?
- what factors need to be taken into account in the design of our health into the future?
- to what degree is it indeed possible for us to be prescriptive in the development of strategies?
- how for that matter are we to accommodate inevitable risk and undertake risk assessment in such programs?

Health Impact Assessment (enHealth 2001) as a formal procedure can take us a long way in preparing our building plans. The multiple determinants of health, or causes of change in health status, include any number of evolving environmental and socio-economic factors, community capacity, human behaviour, and personal genetically based biology. A complete health impact assessment of any population activity is therefore a complex process, which also needs to accommodate the risk of wild card behaviour. The promotion of Health Impact Assessment implies imperatives of risk sharing and equity in

benefits. It can, in the process of undertaking the necessary community consultation, facilitate interaction between developers and the community, with the side benefits of building social contracts and ownership of solutions.

Health Impact Assessment is not a precise process, but requires a significant degree of flexibility to meet individual circumstances and chance occurrence. It cannot rely on the science of epidemiology to give precise levels of confidence in associations, let alone quantification of such association of factors and effects. There are many questions still to ask about Health Impact Assessment in managing for sustainable development if we are to avoid being formulaic and prescriptive in a complex and haphazard interdependent world.

People Focus

Attention to the goal of sustainable development should place the wellbeing and health of people centre stage as a paramount consideration in the advancement of its basic rationale. It therefore follows that basic measurement of human wellbeing and health should serve as objective indicators of progress in achieving sustainable development. Indicator development in this area is a priority.

Healthy and productive people serve as a most valued and productive resource in the advancement of sustainable development, both in terms of economic progress and environmental enhancement. Nurturing their health is an investment for the future, but we need actions that have a savings and investment component.

Health care and services also consume resources and attract costs. Health needs to be promoted in the context of investment for sustainable development. Programs must be designed such that overall what is someone's gain is not someone else's loss, and risks are not externalised. Policies must take account of social, economic, and environmental predictions.

Settings Management

In environmental health practice, there is a need to react to pressures working against health, the risks in our surroundings and conditions. Taking the view that we can control our health determinants, and optimise our surrounding and conditions for living, also implies that we can gain better control of risks. The engineering view is that risks are best controlled at source where possible. Down-stream consequences of risk, particularly if gaining momentum over steep terrain, are harder to manage. This approach will also internalise risks as opposed to externalise, creating costs in the form of health losses, and financial losses for others.

Hazard Analysis Critical Control Point (HACCP) principles, based on engineering principles, have been adapted for other public health processes such as food safety and could be further applied to planning for future health. HACCP asks those in charge of risks to be responsible for controlling them at the point of highest effectiveness. HACCP is consistent with the quality management approach where it is important to obtain the most desirable outcomes. What is more important than achieving optimal health for all?

Working towards sustainable development involves adopting a sustainable development philosophy with its attendant change of culture. All levels of society, individuals, communities, organisations and governments, are called upon to adopt the sustainable development approach. The culture is characterised by systems thinking, regarding equality as a priority, a collaborative approach and a future orientation, as well as being aware of the current interdependencies. This cultivated approach to decision making on time and place axes fits nicely into preparation for quality management to deliver on our health needs. In this way we can begin a path to good governance.

If we can identify the optimal characteristics of a healthy environment, then we can also be proactive in building for

health, not merely reacting to emerging hazards. Quality management processes mark the desirable traits and set them as the points of particular attention for control, so that important parameters do not enter the danger zone. How do we know what leeway at these risky points is acceptable before we have an unsustainable situation?

Reporting on Progress

How can we change what we cannot measure? In controlling points of potential risk to health and engineering for quality outcomes, we have to be able to measure what is happening. We require performance measurement in each of the social, environmental and economic spheres. We need indicators of sustainable development that are theoretically sound, based on empirical data that are practical to collect and can act as useful signals for decision making.

There are attempts to develop measures of sustainable development, such as the Ecological Footprint (McMichael 2001) and the Genuine Progress Indicator (Moffat, Hanley & Wilson, 2001). The Ecological Footprint is a measure of the land required to supply the food, energy and building materials needed to sustain a person's way of life. The Genuine Progress Indicator is an estimate of the net production of services, be they human, capital or natural.

All indicators have limitations and several indicators have to be used to try to give a better picture for policy decisions. Different indicators are necessary for different purposes. At the very least, an indicator in each of the domains of environment, economy and social development is required. In *Measuring and Modelling Sustainable Development 2001* (Moffatt, Hanley & Wilson 2001), the authors present data for seven indicators of sustainable development for Scotland. The results are mixed, but overall the impression is that Scotland is not sustainable. The time scale of its demise is not predicted.

The Global Reporting Initiative is an

international process to develop sustainability reporting guidelines encompassing economic, environmental and social aspects of performance. The Initiative seeks harmonisation of disclosure to maximise the value of reporting for an organisation or program and other users of the reported information. There is a thirst for credible ways to describe the consequences of development.

Funding

Are we going to be able to pay? In making decisions about spending to improve health, we have to consider whether the benefit outweighs the costs, and if the benefits do exceed costs, that the benefits can be enjoyed in the most equitable fashion.

Valuing costs and benefits is not always straightforward and might not be expressed quantitatively at all. Benefits might accrue to different parties. Costs are not always borne by users. Costs and benefits might occur at different points in time. When considering the economic implications for sustainable development, future costs as well as future benefits have to be taken into account with an evaluation for present time decisions. Economic evaluation might discount future costs and benefits too much or inappropriately. Further research into the most appropriate discount rate is required.

The sustainable development approach is consistent with a preventive approach to disease from which future costs might arise. Externalities of development arising from inattention today to potential health impacts might introduce costs to parts of the health system to be experienced in the future. What is society willing to pay, what benefits to forego, in order to save on, or limit, the consequences of poor health in the future?

Savings gained from preventing the decline of resources, natural and man-made stock, is a fundamental requirement in the maintenance of future welfare. We are not saving, but borrowing against the future, unless we can develop the technology to

overcome the resource decline. Have resources been adequately transferred into knowledge and creative potential?

Other western societies and Australia have made remarkable improvements in health, as indicated by life expectancy and years of wellness. At what cost and to what benefit, to others and to ourselves on the globe? Have we asked ourselves this question in relation to planning health care and health services? Have we taken stock of the contradiction we seem to have upheld as we manage the earth, that while we have increased life expectancies across the globe, simultaneously we have degraded our ecosystems and thus created uncertainties as never before? The unprecedented gains in health of the last 50 years have been at the expense of the environmental capital of future generations (McMichael 2001), Can we repay even the interest on this loan?

Change

Despite the problems presenting as awesome and complex, changes are required. We do not have to accept the present situation, but can decide to use our intelligence and wills to adjust our thinking on management of society and treatment of our living planet.

I suggest we need a shift from traditional health promotion in terms of targeted behaviour change related to specific identified determinants, to health promotion through managed collaboration across the different sectors, working towards the sustainable development philosophy. We need to be thinking and acting in an integrated fashion, based on appreciation of the interdependencies of health determinants. Programs currently residing in traditional corridors of single field management would shift to be truly intersectoral with triple accountability, and eventual outcomes as measures by sustainability indicators.

Patterns of resource consumption, population growth and the responsible use of technology are not traditional subjects in public and environmental health training.

Perhaps we should give thought to the kinds of policy making for creation of health promoting surrounding and conditions, to be lead by those in environmental health and health promotion. And if we foresee this kind of problem solving, what training can we foresee?

Community involvement will continue to be important. Appreciation of the imperatives and roles to be played will come from such strategies as mutual or social learning, and reward incentives to support changes in behaviours.

Roles

Industry is already taking the lead, thinking in terms of reputation as essential for remaining in business. Not only has there been a change to social responsibility in business as a way of maintaining the competitive edge, but also industry is emphasising the need for partnerships between industry and other stakeholders, such as government and community groups.

One of the core functions of environmental and public health practitioners is to promote, develop, support and initiate actions which ensure safe and healthy environments, an emerging component of which is recognised by the National Public Health Partnership as promoting ecologically sustainable development. All environmental and public health practitioners need to think in these terms.

Spreading the philosophy of sustainable development among a broad range of practitioners is imperative, and a real adoption of the philosophy necessitates a novel, integrated way of working, with health professionals taking the lead, if only because health is the ultimate objective.

Industry and government will respond to society's expectations. Through partnerships we can maintain the dialogue, develop concepts and prepare to respond.

Broad based community action, with all the meaning behind participation, empowerment, and capacity building, is an

obvious process to be employed to bring sustainable development into reality.

Conclusion

Healthy people are a resource, the objective and the rationale for sustainable development. The concepts of sustainable development help us to see the way forward for health promotion and disease prevention in a changing world, but putting them into practice involves some complex thinking and cooperation from many quarters of society. Health practitioners can lead the way, by calling for collaboration essential for human health and integrating the fields of economics and environmental management into social measures.

The transition to sustainability involves an appreciation of the enormity of the issues

and the sense of urgency required, but with a concentration on a positive vision for the future for all. To make the transition, we have to be prepared to change, to adopt a new philosophy and to be much more prepared to think about total systems management.

We must be positive about the future health prospects within our intelligent grasp but also recognise that there is no zero risk and that we do not know how to precisely prescribe all parameters for optimal results. We need the courage to change where we can foresee poor health consequences, the maturity to prepare in spite of our haphazard world, and the wisdom to discriminate in order to put our energy into the possible.

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Endnote

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Immigrant and Refugee Health¹

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There are more than 20 million people “of concern” to the United Nations High Commissioner for Refugees (UNHCR). Australia receives approximately 12 000 refugees each year through its Humanitarian Program. There are also a number of people who enter Australia under the mainstream family migration program that share “refugee-like” backgrounds and experiences. It is estimated that around one in eight people entering the family program in 1999-2000 originate from countries from which Australia currently accepts refugees. The paper considers why we should focus on immigrant health special issues when thinking about immigrant health and resources available to help manage immigrant health effectively and appropriately. Delivery of services needs to be culturally sensitive without stereotyping different groups. Providers need to have awareness that their practices might not conform to practices that clients are familiar with and usual explanations might be inadequate. There is a range of health problems that are specific to different populations within the refugee group, for example, immunisation, food and nutrition, or parasitic infections. Women often lack knowledge of and access to screening services. Children and adolescents often experience behavioural problems, and men might have problems related to changes in self-esteem, employment status and drug and alcohol consumption. Immunisation is a problem that affects all.

Key Words: *Refugee; Immigrant; Health; Service Delivery; Resources*

Worldwide the number of refugees is increasing. Currently, there are more than 20 million people “of concern” to the United Nations High Commissioner for Refugees (UNHCR) (UNHCR 2002). In this setting Australia receives approximately 12 000 refugees each year through its Humanitarian Program. There are also a number of people who enter Australia under the mainstream family migration program that share “refugee-like” backgrounds and experiences. It is estimated that around one in eight people entering the family program in 1999-2000 originate from countries from which Australia currently accepts refugees (Department of Immigration Multicultural and Indigenous Affairs 2002).

The paper considers why we should focus on immigrant health special issues when thinking about immigrant health and

resources available to help manage immigrant health effectively and appropriately. Although the focus of this paper is on health, the issues described are likely to be common to all types of service delivery to this group and should therefore be considered in settings other than direct health care provision, such as local government authorities.

Why Focus on Refugee Health?

It has been shown that refugees are particularly vulnerable to poor health in Australia (Lehn 1997). They commonly experience disruptions in health services in their country of origin, which mean basic health care, including preventive care and chronic disease management, have been inadequate. Time spent in refugee camps or travelling from their country of origin might

also have prevented adequate access to health care services. Further, poor health status might be exacerbated by both physical and mental trauma pre-migration and/or in transit. Finally, they might also experience difficulties accessing health services on arrival due to language and financial difficulties, or lack of awareness of availability and access to services.

Special Issues Needing Raised Awareness

There are several special issues to consider when dealing with refugee clients. These issues are relatively easily defined if you consider what your own experiences might be like if you were on holiday, or working overseas, and trying to access services in an unfamiliar country when you do not speak the language and have little access to funds. The five key issues include:

- barriers to accessing (health) services
- use of interpreters
- linking families with available services
- effects of trauma on interactions with refugees
- time.

Barriers to accessing services

Ideally, refugee patients prefer health professionals who are able to speak their own language. Lack of English speaking skills is common, as is illiteracy. Recent studies of Horn of Africa immigrants at the Royal Children's Hospital, Melbourne found that 45% of the parents interviewed spoke no English. Australian Migrant English Program (AMEP) data suggest that over 70% of entrants with the Humanitarian program and almost 60% of entrants in the family migration program have little or no English skills on arrival in Australia (Australian

Migration English Program 2002). As such, access to interpreters is vital for communication, as written information might also be inadequate. Delivery of services also needs to be culturally sensitive without stereotyping different groups. Providers need to have awareness that their practices might not conform to practices that their clients are familiar with and usual explanations might be inadequate. Like other people in the community who experience financial hardship, transport to and from services might also provide difficulties for refugees. Finally, an awareness of how the health system works and how to use the system appropriately might also be lacking. Australian health systems might differ significantly from services offered in the country of origin, and it can be difficult to know how to use the system effectively and appropriately.

Some of these problems can be overcome through the provision of multilingual information. Using a trained interpreter also facilitates communication with refugees. When using an interpreter there are several other issues to consider, including how much extra time might be needed, preferred language, and whether the interpreter should be a male or female. Clear communication is aided by checking that instructions are understood, asking interpreters to write down instructions, using visual aids and encouraging questions.

Explanation of appointment systems, practices like bulk billing, the use of prescriptions, hospital services, screening, availability of interpreters, immunisation, and the right to choose your own doctor are all important initial information. Educating people about services where they can discuss mental and physical health issues is also important.

Linking families with services

Linking families with services is also important. Families often lack a primary health provider and might be unaware of ethnic support networks or facilities such as Migration Resource Centres. Keeping a list

of local services for easy access can facilitate this information process. The Victorian Foundation for the Survivors of Torture and trauma (VFST) has produced an extensive list of referral services in its handbook: *A Handbook for Doctors and Health Practitioners Caring for People from Refugee Backgrounds* (Victorian Foundation for the Survivors of Torture and Trauma 2001). A similar list is also available in the desktop guide of the handbook, available on the Royal Australian College of General Practitioners website (<http://www.racgp.org.au/downloads/20000831refugeevic.pdf>).

Effects of mental and physical trauma

Almost 70% of refugees in Victoria have experienced trauma of some kind (Victorian Foundation for the Survivors of Torture 1998). Because of prior experiences with system discrimination or persecution, health carers and officials might be a source of anxiety or distrust. Further, fear of repatriation or prevention of family immigration might mean that refugees are hesitant to seek help as needed. Refugees with a history of mental or physical trauma might need counselling or psychological support. Establishing trust is the key to ensuring refugees feel able and happy to access services offered and to use the support services available to help them.

Time

Extra time is often needed when dealing with refugees. This might be due to the need for more explanation or because of working through interpreters. Multiple appointments might also be required if there is a lot of material to be covered. Ensuring adequate time so that appointments are not rushed and appropriate information can be delivered is vital.

Some Specific Health Concerns

As health services in the country of origin are often inadequate and because health disease patterns in that country might be different from that experienced here, there

are several special considerations when caring for refugee health. These are outlined briefly below.

Mental health

In general, this is the largest health issue facing refugees. Mental health problems can present in a variety of ways including withdrawal, fear, aggression, bed-wetting or soiling, and school performance or behaviour problems. Mental health problems should be considered and where appropriate referrals made.

Dental status

Dental problems are also common. Up to 70% of refugees have dental difficulties, (Victorian Foundation for the Survivors of Torture and Trauma 2001), often due to long standing problems or trauma. Early referral to public waiting lists is important.

Immunisation

Due to the nature of fleeing a country of persecution and transit, records for immunisation are often unavailable. Self-reported immunisation has often been shown to be unreliable. Further, vaccination coverage is often low due to the unavailability of vaccines or different vaccination schedules in the country of origin. Catch-up vaccination is often forgotten by health providers and should be undertaken at every health contact.

Nutrition

Unfamiliarity with local foods, lack of availability of traditional foods and problems with high fat and sugar intake in new diets are common in this group. Limited finances also impact on health choices (New South Wales Refugee Health Service 2001).

Occupational health and safety

Workplace related injuries have also been identified in refugees employed in repetitive and manual labour industries (New South

Wales Refugee Health Service 2001). Occupational health and safety (OHS) issues might arise from lack of training in tasks and lack of knowledge of OHS matters. New employees might also fear reprisal if they take time off due to, or report, injuries (New South Wales Refugee Health Service 2001).

Parasitic disease

Asymptomatic infection is common in some groups. While this rarely offers a threat to the public, early diagnosis and treatment is important for the client.

Vitamin D

Vitamin D deficiency has been shown to be common in refugees who have darkly pigmented skin, have been resident in Australia for more than 12 months, wear covered clothing and have less than 4 hours sun exposure/day. It is often unrecognised and routine screening for those with these risk factors is recommended (Nowson & Margerison 2002).

Other issues

Finally, there is a range of other health problems that are more specific to different populations within the refugee group. For example, women often lack knowledge of and access to screening services. They are also often isolated. Children and adolescents often experience behavioural problems. These can relate to prior trauma, cross-generational problems and cultural assimilation. Men might have problems related to changes in self-esteem, employment and drug and alcohol consumption (New South Wales Refugee Health Service 2001).

What Help is Available?

There is a range of resources available for those working with newly arrived refugees. The Victorian Foundation for Survivors of Torture and Trauma ([\[survivorsvic.org.au/\]\(http://survivorsvic.org.au/\)\) conducts professional training and provides excellent resources for professionals working with refugees, for example, *Promoting Refugee Health: A Handbook for Doctors and Other Health Care Providers Caring for People from Refugee Backgrounds* \(Victorian Foundation for the Survivors of Torture and Trauma 2001\). A desktop version of this is available at the Royal Australian College of General Practitioners \(RACGP\) website: \(<http://www.racgp.org.au/downloads/20000831refugeevic.pdf>\). Both versions include lists of national and Victorian services that manage a variety of issues in the refugee and newly arrived immigrant setting. The RACGP website has links to organisations also working with asylum seekers \(<http://www.racgp.org.au/refugeehealth>\).](http://www.</p></div><div data-bbox=)

The VFST has also produced a variety of free multilingual materials about accessing the Australian health care system (<http://www.survivorsvic.org.au/HealthyAccess.htm#HealthyStart>) and food and nutrition issues (<http://www.survivorsvic.org.au/Multilingual.htm>). Another source for translated material about accessing services, multiple health conditions and preventive services is the NSW Multicultural Health Communication Service (<http://www.mhcs.health.nsw.gov.au/>).

The Centre for Ethnicity and Health (<http://www.ceh.org.au/>) similarly has a wealth of on-line resources, links to multilingual information and is involved in training professionals working with immigrants. It also has a comprehensive library. The Ethnic Community Council Victoria has a searchable multicultural services database. This is available at

regional, local government authority, and town levels (<http://www.eccv.org.au/>).

Access to translating services can be organised through the Victorian Translating and Interpreting Services (www.vits.com.au) or the Central Health Interpreting Services (www.chis.org.au). The Commonwealth also provides translating services through Translating and Interpreting Services (TIS) (<http://www.immi.gov.au/tis/tis.htm>).

Charles Kemp keeps an excellent site in the United States that covers many health areas and related refugee issues, as well as having an extremely comprehensive list of electronic links, including country specific links at http://www3.baylor.edu/~Charles_Kemp/refugees.htm.

The Royal Children's Hospital in Melbourne and the Royal Melbourne Hospital have both produced management guidelines for common health conditions in newly arrived immigrants. Both of these

hospitals also have specialised clinics for newly arrived immigrants. Migrant Resource Centres also offer a variety of important services to these groups.

Finally, the Settlement Database on the Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) website (<http://www.immi.gov.au/settle/data/cold.htm>) provides settlement reports at all aggregations of Australian populations, which are useful for planning purposes.

Conclusion

While there are many problems in the health of immigrant Australians, there are also many organisations that provide general or specific services. These services provide information and assistance in culturally sensitive ways for working with immigrants. Knowledge of the particular health issues, whether they are related to food and nutrition or immunisation, or lack of exposure to Vitamin D through sunlight, are all relevant to environmental health practitioners and local government authorities.

Endnote

1. An earlier version of this paper was presented to the 71st Australian Institute of Environmental Health (Victorian Division) Conference in Mansfield, Victoria, 5-6 September 2002.

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Mainstreaming the Agenda: Indigenous Environmental Health at a Crossroads¹

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A first national consultation of stakeholders in Indigenous environmental health was held in Alice Springs in 1997, with the aim of developing an Indigenous response to the then emerging National Environmental Health Strategy. The findings of this round of consultations became part of a developing data bank on Indigenous environmental health, on which the writers of the first draft strategy would draw. However, for improvements in the health and wellbeing of Indigenous populations to be felt in the communities, much less sustained, this kind of policy support needed to deliver multi-layered and integrated action. Rather than leaving this task solely to established Indigenous agencies, the National enHealth Council responded with a strong Implementation Plan, one that has a funding allocation in the Federal Budget to address environmental health justice issues for the first time in history. This paper takes a broad look at the development of an Indigenous environmental health workforce in Australia. It identifies a range of programs and initiatives that, like the National Environmental Health Strategy, have embedded Indigenous environmental health into mainstream policy and practice. On the other hand it highlights some cases where this challenge is yet to be clearly understood and adequately addressed, and it argues for the continuing need for all quarters (local, state, and national government, the profession and educational institutions) to remain focused on the task, or risk leaving its committed practitioner base and advocates to flounder on the margins, prone to the ravages of burnout and marginalisation.

Key Words: *Indigenous Environmental Health; Workforce; Indigenous Policy and Practice*

Only as recently as 1996 there were no Indigenous practitioners in the Australian environmental health workforce with full professional qualifications. There were, however, a growing number of community-based Indigenous environmental health workers, retained under a variety of employment, training and development schemes to battle against “front line” environmental health problems in the communities. However, few mainstream environmental health professionals were even aware of the existence and nature of the work of these Aboriginal and Torres Strait Islander practitioners who tended to work in remote settings, well beyond the urban horizon.

Then as now, community-based practitioners provide key services on the ground and either visit, or live in, the communities they serve. The nature of their work varies from one community to another and within each State and Territory. The type of service delivery is largely dependent on the needs and capabilities of the communities in each jurisdiction, and the nature and extent of support given by state health departments and local authorities. In Western Australia, for example, Aboriginal environmental health workers provide basic maintenance services and/or advice and early identification of repair or maintenance requirements of community infrastructure (Environmental Health Needs

Coordinating Committee [EHNCC] 1998); while in Queensland, the emphasis is more on problem identification, the management of repair teams, and community education (Heggie 1997).

Precise figures on the number of Indigenous practitioners working in communities Australia-wide at any one time are difficult to ascertain. Rough estimates based on a combination of State and Territory health department records and course enrolment figures, brought the national tally in 1996 to somewhere between 150 and 200. A much closer analysis of those training and/or working in community-based environmental health, under any employment scheme, in 2002 totalled more than 320. Repeated reports from national Indigenous environmental health forums point to a long history of trained workers: "giving the job away" soon after completing their training; being "poached" by other programs for better wages and career prospects; or simply having no job to go to once trained. There has also been a history of weak strategic and policy support from both government and community, limited operating budgets, unclear work roles, poorly defined career pathways and undetermined award structures.

Today many of these issues remain unresolved. A Commonwealth sponsored national review of Indigenous environmental health workers currently underway is expected to make clear recommendations on each of these important areas. With the distribution and profile of the Indigenous environmental health workforce throughout mainland and island Australia on the increase, mainstream professionals now work much more closely with community-based practitioners across larger areas of rural and remote Australia. In such locations, there is no questioning the important role local Indigenous practitioners can play in progressing environmental health in community settings. In some states positions have been

established for experienced Indigenous practitioners to coordinate regional activities and support the work of their community-based colleagues. The first two of these positions were created in the mid-1990s in the Pilbara region of Western Australia and in Far North Queensland, servicing the Northern Peninsula Area and the Torres Strait Islands. Both required coordinators to cover vast areas of land (and sea in the case of the latter) in their work.

Also emerging in the late 1990s was a national thrust in professional environmental health training for Indigenous people in state and territory health departments, and, where possible, in communities. In 1997, the NSW Health Department developed a strong professional training program for Indigenous environmental health officers as a key professional area for meeting its 2% Aboriginal employment target (NSW Health Department 1998). In its Aboriginal Health Strategic Plan (NSW Health Department 1999), the Department noted the important role Indigenous officers could play in helping to meet its objective of improving the quality of environmental health for rural and remote Aboriginal communities. While other states and territories have also identified the need for professionally qualified practitioners working within their ranks, none have committed the same level of resourcing to this end of the workforce as the NSW government, most opting to dedicate limited funds to the support of community-based worker programs.

Overview of Training

With the exception of the very fine and comprehensive historical account of the situation in the Northern Territory (Clark 1999) consolidated documents on the early training and involvement of Indigenous Australians in community environmental health, are not readily available. Clark's work points to the first "hygiene school for natives" in the Northern Territory commencing on 26 May 1952 at Bagot Aboriginal Reserve in Darwin (p. 83). In-

community training of that sort apparently continued throughout the Northern Territory during the fifties and sixties before a hygiene worker training program was developed and centralised at the Vocational Training Centre (VTC) at Batchelor, a small town some 120kms south of Darwin (Clark 1999). According to Duke and Sommerlad (1976) a massive 438 hygiene assistants and twenty-seven leading hands were accepted into the Centre's program across the short period between 1972 and 1974. But, as Clark has noted, broad ranging organisational, administrative and policy changes in government, coupled with the enormous diversion of funds and manpower following the devastation of Cyclone Tracy (on Christmas eve 1974) interrupted environmental health work and training for Aboriginal communities for many years.

After a hiatus of a few years, sporadic and informal training programs began again in various forms and in different regions of the Territory in the late 1970s and early 1980s. In the eight years between 1985 and 1993, community-based hygiene workers, under supervision and support of Territory environmental health officers, conducted much of the basic duties in community, including rubbish collection, grass cutting, and the cleaning and maintenance of toilets (Standen 1998). Since 1993, the Batchelor Institute of Indigenous Tertiary Education has remained the dominant provider of formal training in community environmental health in the Territory.

In Western Australia and Queensland the early history is not as clear, however, in more recent times the Health Department of Western Australia combined with the Ministry of Education to establish the first certificate level course for environmental health workers at Pundulmurra College in Port Hedland in 1985. Environmental health worker training then expanded into the Kimberley region in 1987, and then again in 1993 into the Geraldton Mid-West and the Eastern Goldfields health regions (Lewin & Jamrozik 1993). In Far North

Queensland environmental health worker training came even more recently with the Cairns TAFE first offering a certificate in environmental health to Aboriginal and Torres Strait Islander people in mid-1996.

Training levels for community-based practitioner education have steadily increased with training courses in Western Australia, Northern Territory and Queensland each being reviewed and redeveloped during the late 1990s and into this millennium. As the nature and role of the work performed by community-based practitioners differs throughout the country, the emphasis within training programs also varies from state to state and, in the case of Western Australia, from region to region (Stephenson 1999a).

There is no evidence of accredited training programs in place in the remaining States (see National Environmental Health Forum/Australian Institute of Environmental Health [NEHF/AIEH] 1998 and enHealth Council 2000a), however, informal training does occur in communities in South Australia and New South Wales. On the Anangu Pitjantjatjara Lands of South Australia, for example, Aboriginal people have developed strong practical skills through many years of hands-on training (Nganampa Health Council and South Australian Health Commission 1987). Community workers carry out a wide variety of environmental health functions, with housing repairs and maintenance being the primary focus of their work.

Similarly, training of community-based staff to maintain improvements to housing forms part of the New South Wales Health Department's application of the Housing for Health program (see Pholeros, Rainow & Torzillo 1993), although no accredited award yet results from this training. Through additional training and future accreditation, it is possible the role of these key community personnel may be expanded to take on a wider range of environmental health functions (Pholeros 1999). In parallel, NSW Health has cited as one of the priority areas for action in its Aboriginal Health Strategic

Plan (1999) the establishment of an Aboriginal environmental health worker training and employment program for community practitioners. However, at this time the main thrust of NSW Health is the workplace training of Aboriginal environmental health officers who are employed on a full-time basis in Public Health Units around the State at the same time as they study toward an undergraduate degree in environmental health.

A National Direction Emerges

In 1997, just as that first cohort of Indigenous practitioners commenced the professional environmental health education program at the University of Western Sydney, initial consultations were being conducted by the then Commonwealth Department of Health and Family Services (CDHFS) to identify ways to improve the management of national activities in Environmental Health. The Commonwealth Department, in conjunction with the states and territories, considered establishing the country's first national strategy for environmental health; a strategy they hoped would build collaborative efforts between governments, industry, communities, and non-government organisations to improve the response to and the administration of environmental health concerns in Australia.

A National Environmental Health Strategy Steering Committee was established and a series of consultations with interested parties began. Representatives of a range of bodies with specific environmental health responsibilities and expertise were invited to workshops around the country. The consultations aimed to determine whether the directions proposed for the strategy, as outlined in a widely circulated Consultation Document (Woodruff & Guest 1997), were supported by members of the key groups.

Indigenous issues and stakeholder views were not obviously apparent in the original consultations. An opportunity existed to bring Indigenous practitioners, other

professionals, policy makers, program managers and funding agency representatives together to respond to this shortcoming. Staff of the Indigenous Communities' Environmental Health Research and Development Program at the University of Western Sydney were in a strong position to undertake this work and saw it as an opportunity to elevate the status and attention given to environmental health issues impacting Indigenous Australian populations and their community-based practitioners. The University team believed that a truly national strategy could not be possible without the inclusion of issues and strategies supporting the Indigenous Australian population for whom all quality of life indicators remained significantly lower than those of most, if not all, non-Indigenous populations in the country.

In August 1997, the Indigenous Communities' Environmental Health Research and Development Program conducted a national workshop for Indigenous environmental health practitioners in Alice Springs. This workshop brought together 36 participants from three states and the two territories. The findings of this round of consultations (see Brown, Stephenson & Mitchell 1997) became part of a developing data bank on Indigenous environmental health, on which the writers of the first draft strategy would draw (see National Environmental Health Forum/National Public Health Partnership [NEHF/NPHP] 1998). It was abundantly clear, however, that simply inserting these findings into a data bank could not be the extent of policy support, if improvements in Indigenous health and well being were to be made, much less sustained. Rather the task ahead required a much more multi-layered and integrated response, one which aimed to:

- re-dress obviously longstanding employment and workforce development issues;
- fill policy voids and funding shortages;

- meet education and training requirements; and
- address practitioner concerns about the lack of a suitable mechanism for ensuring Indigenous representation in the profession and in government decision-making circles.

As one element to this broader approach, a much larger forum subsequently came together in May 1998 in Cairns to discuss issues of concern for Indigenous environmental health, and to propose collaborative strategies for change and improvement. This “*Inaugural National Indigenous Environmental Health Workshop*” was attended by approximately 120 delegates and was supported by the then Commonwealth Department of Health and Aged Care, the National Environmental Health Forum and the Australian Institute of Environmental Health. A video of the workshop was produced (NEHF/AIEH 1998) and a monograph of workshop presentations and recommendations was compiled (NEHF 1999).

Drawing on feedback from the earlier draft strategy and these two national consultations, the Commonwealth government soon completed and released Australia’s first *National Environmental Health Strategy* (enHealth Council 1999). The next step for the Commonwealth was to support a mechanism for developing programs of action around the issues and needs identified in the Strategy. A third national workshop, this time in Broome, Western Australia, in May 1999, set this process in train. At regional and state levels also, Indigenous practitioners combined with other environmental health professionals, government planners and decision makers at annual Environmental Health Worker Seminars in Western Australia (Prouse 1999) and regular Environmental Health Worker Workshops in the Torres Strait and North Peninsula Area of Far North Queensland (Heggie 2000). Together with those at the National

level, these forums prioritised the needs of an environmental health workforce for Indigenous communities according to the schedule in Table 1.

Table 1: Summary of Indigenous environmental health workforce needs

Need	Alice Springs, 1997	Cairns, 1998	Broome, 1999	Alice Springs, 2000
A dedicated chapter on Indigenous environmental health in the proposed National Environmental Health Strategy	△			
Binding of the Crown to meet local and State government environmental health legislation			△	
Employment strategies and recognised salary structures for environmental health work in community and government		△	△	△
Well resourced regional environmental health units to support resident community practitioners	△		△	
A career structure for Indigenous Environmental Health practitioners in community and government	△		△	△
Nationally consistent competencies and awards for Environmental Health Worker training and continuing professional education	△	△	△	△
Resources and support for the Indigenous workforce to implement the National Environmental Health Strategy	△			
National environmental health standards for Indigenous communities	△	△		
Guidelines for the provision of services to Aboriginal and Torres Strait Islander communities.	△	△		
‘Fixing funds’ incorporated into budgets for environmental health and housing needs surveys.		△		△
Technical solutions to community issues associated with housing, food safety, water use and waste water treatment.		△		△
Nationally consistent housing standards with rigorous inspection and certification procedures for building works.		△	△	
An Indigenous Environmental Health Forum with national representation and a place on the enHealth Council			△	
Promotional material on the roles and functions of Indigenous environmental health practitioners			△	
Resources and support to upgrade community food stores in accordance with the National Food Safety Standards			△	
Funded scholarships and cadetships for Indigenous practitioners at undergraduate and postgraduate levels				△
Expansion of professional education options (engineering, planning etc) after certificate level training				△
A national information data base be developed to provide resources to practitioners, students and agencies				△

Mainstreaming the Agenda

As recent "backbone" documents, the National Environmental Health Strategy (enHealth Council 1999) and its Implementation Plan (enHealth Council 2000a) now provide a platform from which to design and deliver major environmental health development programs for Indigenous communities. Chapter Four of the *National Environmental Health Strategy* titled "Environmental Health Justice" identifies environmental health risks to Indigenous children and environmental health concerns of Indigenous populations more widely. Section Three of the Implementation Plan identifies 11 areas for action in support of Indigenous environmental health and its community practitioners. These actions have been largely generated from the forums discussed above and therefore link strongly to issues identified by field practitioners across the years 1997-2000.

This scale of national policy direction brought with it a profile and set of resources never before accorded to this field of practice. Whereas at the 1999 national workshop Indigenous practitioners pressed for representation on government and environmental health professional decision-making bodies, the Commonwealth government was, in the year 2000, in a position to establish and support a National Indigenous Environmental Health Forum. This Forum currently has Indigenous representation from each State and Territory and provides advice on Indigenous environmental health issues direct to the national enHealth Council (Australia's lead agency in environmental health). Members of the Forum have a vital role in creating and implementing Indigenous environmental health policy, in determining research and practitioner support needs and in setting national direction for workforce development. Indigenous practitioners have a means of voicing their needs at the highest level of health agency. With the chair of the Forum sitting on the national enHealth

Council, Indigenous practitioners have a structure and a mechanism for mainstreaming their issues. The Forum, along with other Indigenous environmental health activities auspiced by the enHealth Council in its Implementation Plan (enHealth Council 2000a), strongly complements a suite of existing programs redressing the historical disparities in environmental health standards between Indigenous and non-Indigenous populations.

As in the realm of Commonwealth government policy and strategy development, positive examples of mainstreaming Indigenous environmental health can be found in: professional education; workplace training; and in state government programs, a few examples of which are briefly presented below.

Professional education

The University of Western Sydney (UWS) has delivered a professional degree program in the field of environmental health since 1979. In the mid-1980s, program staff developed distance learning packages so that environmental health officers with TAFE certificate and diploma level qualifications could articulate to a degree at the same time as remaining in full-time employment. By 1988, the entire degree program was available both on campus and through correspondence, and University of Western Sydney received industry recognition as the national provider of professional environmental health training by distance education.

In 1996, a field study of education, health and environmental services in urban, remote and rural New South Wales, Victoria and Northern Territory identified Indigenous environmental health officers as among the most urgently needed professionals for health in Aboriginal and Torres Strait Islander communities (Brown & Stephenson 1997). The following year eight Indigenous students enrolled in the first year of the program - six from NSW and

one each from Queensland and the Northern Territory. Since that time 44 Indigenous candidates from all states and territories except Victoria have applied to enter the degree, of whom: four have now graduated; a further 20 are in the pipeline; seven did not take up offers; and 13 discontinued due to a complex array of personal, employer support, and/or academic reasons. An external evaluation of this program by an Indigenous education consultant established that:

...the clearest benefit of [the UWS program] is that it provides Indigenous students with a professional qualification that is equal to mainstream students. That is, [it] provides Indigenous students with the same course content as their mainstream counterparts. The key difference for this program is in the delivery and student support mechanisms that were especially identified by the program designers and funders (Druett 2000 p. 3).

Non-Indigenous students involved in mainstream agencies learn a great deal from the interaction with rural and remote setting Indigenous practitioners, and visa versa. The melting pot of social and cultural backgrounds, professional and practical experiences and problem-solving skills and approaches, brought together and shared through structured academic workshop sessions in a residential environment, has made for a rich, professionally broadening, and at times, personally challenging learning experience for many students. Teaching staff too have expanded their understanding of the cultural and professional contexts within which Indigenous practitioners must work and in some cases have adapted learning materials and approaches to better accommodate a broader spectrum of issues and learning needs.

The Batchelor Institute of Indigenous Tertiary Education (BIITE) in the Northern Territory, with its history as an environmental health and hygiene training venue extending decades before any of today's professional education institutions around the country, is currently in the

process of developing a degree for "top end" Aboriginal environmental health practice. The designers of this program are working closely with the Australian Institute of Environmental Health, Territory Health Services, and a range of other technical, training and employer stakeholders to develop a program that both meets national professional accreditation requirements and delivers a course that serves the specific needs of environmental health practitioners for Indigenous community settings.

Workplace training

NSW Health currently offers training positions and employment opportunities for Aboriginal or Torres Strait Islanders in the field of environmental health. Trainees acquire experience and practical skills through work as a cadet environmental health officer at a number of Public Health Units across New South Wales while at the same time studying for the Bachelor of Applied Science (Environmental Health) by distance learning. Benefits for these trainees include annual salary in accordance with a professional award, all course fees and travel costs for the four to five years of study and the opportunity of continued employment for a period of up to two years post graduation within the same Public Health Unit.

A critical element of the NSW Health program has been its strong commitment to trainees receiving a quality learning experience in the workplace. Most recently this objective has been progressed a step further with Aboriginal trainees working with the NSW Health program manager and their workplace senior officers to develop a professional training guide and Competency Manual for mapping professional development and training (NSW Health 2002). This document aims to provide a professional development guide for Aboriginal trainees and their supervisors, and creates a strong evaluative marker for assessing the quality of the professional training program. It is designed to

supplement the existing academic competency manual at the University of Western Sydney, rather than replace it, and to strengthen the auditing and accountability of Area Health Services to the development of a well-rounded Aboriginal environmental health officer.

State Government support

The Queensland Government recently committed four years of funding to a pilot initiative to employ environmental health workers in Cape York (Queensland Government 2002). This funding forms part of the State Government response to the Cape York Justice Study (Queensland Government 2001) and links with the directions identified in the *Queensland Health Aboriginal and Torres Strait Islander Environmental Health Strategy 2001-2006*.

Under the initiative, community councils will be able to employ environmental health workers "to identify and manage environmental health needs, particularly those associated with housing, water quality, mosquitoes, refuse, food safety and sewage" (Queensland Government 2002). An opportunity exists in this program to address every one of the employment, career, training and support needs identified by Indigenous practitioners (see Table 1) and to raise the bar generally on the resourcing of community-based workers.

The Western Australian Health Department has dedicated a number of environmental health officer positions and Aboriginal field support officers to attend specifically to Aboriginal communities throughout the State. One noteworthy feature of this project is that it utilises a variety of employment models for getting the professional support to where it is intended - the communities.

Rather than committing all positions to State government Public Health Units for example, agreements have been established between the Health Department's Office of Aboriginal Health and the various local government authorities closest to the

communities in remote Western Australia. Under these agreements environmental health officers work with Aboriginal support officers in local authorities "to provide to Aboriginal communities many of the essential services they provide to non-Aboriginal towns - inspections of buildings, infrastructure and food premises, waste management, water quality monitoring, town planning and environmental health education" (Office of Aboriginal Health 2001 p. 13). Getting local government involved in this way brings to Indigenous communities the same level of environmental health expertise expected by non-Indigenous populations. More broadly, the program has the potential to mainstream the resourcing of these communities and to develop long-term policy and program support for the training of Indigenous environmental health officers.

The Crossroads

The kinds of programs identified above represent concerted attempts by many in state and Commonwealth agencies, education and training institutions, and in the environmental health professional body to respond to the poor environmental health status of Indigenous communities. But as the following section exposes, the gains in no way reflect a profession-wide shift toward dealing effectively with Indigenous communities, nor for that matter, for building relationships and improved understanding of the issues confronted by Indigenous practitioners. Instead they represent the hard work and determination of a small but dedicated section of the environmental health profession (Indigenous and non-Indigenous), who share an interest in bringing Indigenous environmental health and its emerging practitioner base out of the margins, and into the broader discussion and planning frameworks of environmental health professional practice.

A lengthy and in-depth analysis of the threats to the future of this emerging

workforce (Stephenson 2002) has revealed a range of factors that impact on the success of Indigenous practitioners working within or alongside mainstream agencies. The findings of this research can be summarised as follows:

- Indigenous practitioners value being a part of a workforce development movement but believe many features of the support and training programs provided for them to be poorly conceived and badly managed, raising questions about the motives of those involved.
- Indigenous practitioners see benefit for themselves, and their communities, in pursuing the professional qualifications, but struggle at times to reconcile “white fella” training and practice with their own cultural norms and obligations.
- Indigenous practitioners want to act as brokers of information across cultures but are cautious of employers’ attempts to use their relationships with communities in ways that are insincere or risk compromising their own cultural identity.
- The rhetoric of working in partnership with Aboriginal and Torres Strait Islander communities is strong among many employing agencies. However, Indigenous practitioners question the reality of this rhetoric.
- Indigenous practitioners working in mainstream environmental health agencies find they are constantly exposed to relations of power that at times inhibit their programs, while at other times, help their cause.

The learning from this work clearly places the Indigenous environmental health workforce, and its communities’ issues, firmly at a crossroads. In order for the fledging workforce to continue to grow, it needs strong and sustained backing from its professional power base. Their issues and needs must be mainstreamed. The idea of mainstreaming should in no way be confused with the repressive and counterproductive notion of cultural assimilation. The two are remarkably different. Placing Indigenous environmental health on the mainstream agenda is concerned with the profession, educational institutions and government decision-making bodies *taking responsibility for, and acting on* the dismal environmental health conditions in Aboriginal and Torres Strait Islander communities nationwide. These have most recently been represented in the *Atlas of Health-Related Infrastructure in Discrete Indigenous Communities* (Bailie et al. 2002). Mainstreaming is therefore concerned with elevating Indigenous environmental health to “core business” status rather than leaving it as a series of ad hoc, unrelated or unconnected sideline activities.

Assimilatist views on the other hand are more concerned with creating structures and programs that force Indigenous communities and Indigenous environmental health practitioners to only think and act in the dominant, mainstream way. This kind of approach is unhelpful to the development of an Indigenous workforce, and is, as we already know, unsustainable and simply inappropriate. Indigenous practitioners are wise to individual and agency attempts to erode their cultural identity and self esteem. Potential benefits to mainstreaming their agendas therefore bring with them inherent risks. Consequently, in partnering in the mainstream, Indigenous practitioners have had to remain vigilant in looking closely at, and contesting, the conventional and dominant policies, practices and structures of government; the very systems of governance

that have inadequately served the needs of Indigenous populations in the past. As emerging professionals, they have also had to deal with non-Indigenous "experts" who benefit mostly from keeping them down.

Data from a five year research study (Stephenson 2002) revealed that both *traditional* and *contemporary* forms of power operate within the state to hinder Indigenous practitioners establishing new and meaningful working relationships with their client group (Indigenous populations across a range of urban, rural and remote settings). On the other hand, complex reciprocal relations of power also help Indigenous practitioners and their allies turn some of these inhibiting factors around.

Relationships between Indigenous and non-Indigenous professionals, Indigenous practitioners and community, and the state and community are key to the way power relations are played out in this case. Ozar (1993) sees any relationship between professional and client to be value-based, with the opportunity for professionals to take on an interactive association with their client group, if they so wish. By an *interactive* relationship, he refers to:

...[a relationship] in which both parties have unique and irreplaceable contributions to make in the decision-making process, with the professional offering expertise to help meet the client's needs, as well as a commitment to the professions central values, and the client bringing his or her own values and priorities and the value of self-determination, the ideal being that the two parties choose together how the professional shall benefit the client (Ozar, 1993, p. 167).

A long history of negative interactions between Indigenous populations and the Australian state amplifies the complexity of creating and maintaining interactive relationships between government and Indigenous communities. For Indigenous practitioners in government who aim to shift government relationships with community into the interactive zone, the challenge is equally significant, if not more so. These practitioners need institutional freedom to

work with community in ways that carry the full benefit of an interactive approach.

Importantly, this learning cannot be all one-way. The profound and at times acute needs of Indigenous communities extends this challenge to a host of other government, community and industry players (Indigenous and non-Indigenous alike), and to the environmental health profession as a whole. Together, we need to explore new ways of working with an entire section of the Australian population looking for a more effective relationship with the state. Evidence of success must be measured through meaningful and sustainable change such as measurable improvements to the health and wellbeing of Aboriginal and Torres Strait Islander people throughout the country.

Non-Indigenous environmental health professionals especially must therefore reflect upon their own work practices and shift their thinking on this issue in much the same way that Schein (1972) challenged Western professionals to do in the early 1970s. He urged those with privileged professional knowledge to challenge some of the norms within their own professions, and to take on stronger advocacy roles for improving society, rather than merely serving it. This call remains as relevant, if not more so, to the professions of today. In the context of this discussion, it reignites a call for appropriate action for, with, and on behalf of Aboriginal and Torres Strait Islander communities.

Practitioners in this field cannot achieve success in communities in isolation or without the support of government policies, effective planning and program implementation, and an adequate funding base. They require continual encouragement and support from workplace peers and managers, who themselves will need to engage in critical reflection - personally and professionally - in order to deal with a number of difficulties.

To over-come fear

Professional practice that involves working with the environmental health issues of Indigenous peoples may invoke a fear of the unknown. Entering into such work has potential to take some practitioners out of their comfort zone. They run the risk of having personally to account for, or feel guilt over, their own histories of poor performance or professional maltreatment of Indigenous populations. Others might simply feel poorly equipped and professionally inadequate to work in such a complex and often contested area of practice. They might suffer from a fear of being exposed.

To give space to Indigenous practitioners

Indigenous practitioners require personal and professional space to trial new ways of operating. If improvements in the living conditions of Indigenous populations are to take hold and be sustained, new ways of operating will be required. White, Western knowledge will assist Indigenous practitioners understand the gravity of the problem from a conventional perspective, but the task of securing improvement will also require a way of working that most non-Indigenous practitioners could never hope to come close to understanding.

To share power

Supervisors and directors with only limited understandings of the needs and proposals of their Indigenous colleagues will need to relinquish traditional power and control in order to support Aboriginal and Torres Strait Islander practitioner initiatives. Allowing Indigenous practitioners to set the agenda and identify mechanisms for improvement is just one important element of support. In honouring their commitment to empowering Indigenous practitioners, senior managers and policy makers will also need to act in ways that are consistent with their personal and organisational rhetoric.

To learn together

In each of the above cases, supervisors, directors and other non-Indigenous practitioners will need to work openly with their Indigenous colleagues so that mutual learning is seen as an integral part of the problem-solving process. Indigenous and non-Indigenous practitioners alike will need to keep an open mind on strategies and actions, and be prepared to teach, and to be taught by, each other.

To value cultural diversity

For this learning to be effective, and for it to avoid perpetuating unhelpful stereotypes in the workplace, understandings of Indigenous Australian culture must reject any notion of homogeneity within the groupings of Indigenous practitioners. Mainstream environmental health officers need to take care when dealing with Indigenous practitioners and their communities in order that Indigenous cultural practices "are not seen as static or fixed or single ways of being" (Solomon 1999, p. 127).

To smooth the way

Environmental health practitioners in positions of influence will need to take a pro-active role, and must inculcate the same sense of collaboration and learning in their junior staff. Indigenous practitioners will be looking to senior staff not only to accept responsibility for Indigenous environmental health development, but also to work with them in setting the pathway for the future.

Conclusion

There is little argument today among policy makers, program managers and service providers that Indigenous environmental health is a crucial area for long-term support if sustained improvements are to be seen in Aboriginal and Torres Strait Islander Communities (Stephenson 1999b). Supportive measures need constant review, re-development and/or reinforcement if Indigenous peoples themselves are to be empowered to bring about and maintain these improvements.

These supportive measures need to embed program and policy responses to the far-reaching health and infrastructure concerns of Indigenous Australian populations into the core business of mainstream environmental health agencies. At the same time Indigenous practitioners who work within mainstream structures and who strive

to improve the health and living conditions in Indigenous communities, need to be aware of, and be able to negotiate, both the dominant organisational structures and the intricate relations of power they are a part of in order to keep the agenda alive and outcome focused.

Endnote

1. An earlier version of this paper was presented to the 29th Australian Institute of Environmental Health National Conference in Sydney, 20-25 October, 2002.

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Sustainable Population Health: A Pressing Priority for Community Wellbeing

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Recent developments in primary health care, preventive care, early intervention programs, population health constructs and coordinated care trials in Australia have explored the idea of changing our emphasis in health care from responsive acute care to more integrated, whole population community wellbeing management. This idea accepts that much illness and even trauma experienced by individuals in our communities can be prevented, mitigated or managed in a more constructive and positive manner than has previously been the case. Much disabling illness need not occur at all and can be avoided through better community based management models, education programs, and lifestyle changes that contribute to more healthy communities. As in the wider business world, we are becoming more cognisant of the fact that prevention is not only an appealing idea in terms of health outcomes and quality of life, but that it is good for business also. It can moderate demand for costly health care, assist consumers to understand how to live healthier and fulfilling lives and overall help to sustain a much more dynamic community. This article, based on work in a rural health service in South Australia, points to some elements of sustainable primary care that appear to have potential to take us where we need to go. It asks whether we have the capacity and the will to make the necessary investment in sustainability to ensure our future or whether we are to remain bound in a reactionary model of health care rather than considering the impact of wider social and physical environments as part of the overall community health equation.

Key Words: *Sustainability; Wellbeing; Population Health Maintenance; Service Integration*

The concept of a more sustainable, natural environment is as appealing in the health arena as it is in wider contexts, but it also carries profound implications for our priorities and actions in the community generally. It means the need for greater awareness and understanding by individuals about what supports healthy lifestyles and it requires much higher levels of consumer participation in and responsibility for their actions in the world generally. However, as attractive as the concept is, is it really workable and realistic in our current context?

In his recent book *The Future Eaters*, which deals with the state of Australia's

population and economy, Tim Flannery writes: "It is almost certain that the social inequality that has increasingly begun to characterise Australian society will grow" (Flannery 1994, p. 370).

Flannery is concerned that the Australian economy in general will no longer be able to support the standard of living to which Australians have become accustomed. Recent trends in economic rationalism suggest the same scenario, but for rural populations the difficulties are compounded. The wealth that they are able to generate is diminishing and the pre-eminence of rural production over other export earners has been replaced by the dominant mining and

mineral industry in Australia. Flannery observes that:

Until the early 1980s agricultural products were the single most important income earners for Australia. Since then, a rapid growth in mineral exports has superseded agriculture, so that today mining earns Australia more than 29 billion dollars, while agriculture earns only 16 billion dollars. All other export earnings (including all manufacturing) earns around 11 billion dollars (Flannery 1994, p. 372).

The reduced capital being generated for rural community use will inevitably mean that the distribution of wealth, in the form of cash and social services as well, will be affected. In such situations, those who lack economic security and power will have access to lower standard services and support structures. Rural communities have already experienced a significant change in population demographics and the current rural recession can only serve to continue this trend. Although some growth is occurring in allied primary industries, in tourism and aquaculture, the Eyre Region in South Australia, for example, is still dependent upon agriculture to a large extent and profit margins in this production are constantly under pressure reducing individual family income and affecting overall community wealth (Harvey 1996).

Others have recognised the link between the sustainable environment view and sustainable health (Brown 1992, 1998; Terris 1999) and the need for different countries to manage their contributions to health care differently in the future in order to develop a sustainable and healthy environment (Moynihan 1998). Such a sustainable environment is increasingly becoming a prerequisite for individual health as we enter a new era in preventive primary health care in which the state of the environment will become a major determinant of disease management and wellbeing. However, we are still not, as a nation, recognising the importance of wellbeing in the general equation of economic activity. As Heilbroner notes, the inexorable

demands of economic productivity tend to impact adversely upon the health and wellbeing of those populations it encounters:

Populations are pressed into new occupations without heed for the effect on their health, economic security, or opportunities for development, but again solely to serve the requirements of expansive capital. Governments are cajoled and pressured to adopt policies, both with respect to 'home' and 'host' nations, that facilitate the process of internationalisation of capital, justified not by any broad consideration of human requirements around the globe, but according to a calculus of 'economic efficiency' that is measured almost exclusively by the touchstone of profitability (Heilbroner 1998, p. 134)

Brown suggested that our current generation could actually be the healthiest generation of any human population, past or future, as the impact of our polluted and poisoned environment begins to define the health and wellbeing of our communities:

It could be suggested that the present European population may be the healthiest the human species will ever know, with a life expectancy of over 80 years sandwiched between the defeat of infectious and lifestyle diseases, and the risk of projected environmental hazards (Brown 1992, p. 225).

The idea that the notion of constantly expanding economies and good health are mutually compatible and able to co-exist is seen as an impossible dream towards which our health care system should no longer strive. The principle of sustainability in an economic and environmental sense (Suzuki & Dressel 1999) can be applied equally well to a new way of shaping our ideology of health care and building a preventive approach to community wellbeing (Brown 1992).

As part of the sustainable health argument, Callahan cites Illich who argued a similar case for de-schooling society in the seventies (Callahan 1998). The argument suggests that our health system, like education, has become institutionalised and

no longer serves the needs of communities; it is no longer responsive to the values and aspirations of people and it alienates individuals from control of their own consciousness and their own values (Illich 1971). Once schooling or health systems are controlled by institutions, the power of the individual to determine their existence within these structures is lost and with this loss comes other ills such as stigmas associated with being more or less successful within a particular regime.

Illich has written of the "medicalization" of our health system (Illich 1971, p. 32), and Edwards now calls for an "Illich Collaboration", somewhat like the Cochrane Collaboration, to make readily available information on the relative harms of medical care and to examine the phenomenon of increased consumption of medical services as societies become wealthier (Edwards 1999, p. 58).

Illich concluded that:

If doctors were differently organised, if patients were better educated by them, for them and with them, if the hospital system were better planned, the accidents which now result from contact between people and the medical system could be reduced (Illich 1971, p. 39).

Callahan concurs:

Carlson and Illich espouse a de-professionalisation and deregulation of medicine to induce people to be more responsible for their own health and to be free to pursue that health as they saw fit (Callahan 1998, p. 18).

Essentially, this argument reduces to the same premise being implied through the coordinated care approach in Australia. This requires a re-thinking of social and health priorities to allow communities to invest resources in primary social support structures by moving or substituting them from the costly and generally excessive acute end of the health system:

It also seems clear now that if health promotion and disease prevention, at present much championed, are ever to achieve parity with acute-care medicine, we must be

prepared to rethink today's medical priorities to make the potential gains in health status efficacious. More generally, a serious transformation will require taking money away from the acute-care sector, including research into the cure of many lethal diseases, and using it instead for prevention research and massive educational efforts designed to change health-related behaviour (Callahan 1998, p. 19).

To complicate this argument, there is also a strong movement in our community today towards an economically rational view of capital and of service provision. This translates into the view that health care, like education and other public sector commodities, has become a "marketable good" and that this view "has come to prevail over the view that health care is a public good" (Lee & Paxman 1997, p. 2). At the same time the World Health Organization (WHO) defines health as "a state of complete physical, mental and social well being and not merely the absence of disease or infirmity". However, everything is currently seen in financial terms and systems are planned that way. Outcomes are measured against a certain cost structure and in this cost structure only certain elements are considered. So how are we realistically to attain the vision of a well society when we are not really considering all of the elements that contribute to such a state?

In the farming industry, for example, there is no real costing of environmental degradation, poison build up or occupational health and safety in the production costs of the food farmers produce (Callahan 1998). The same premise exists in the fishing industry. There is no attempt to value the maintenance of nature's capital base (Baum 1998, p. 249) in the process of farming and harvesting. Indeed if we did so we would have a very different set of economic growth figures to contend with (Suzuki & Dressel 1999, p. 214). Callahan also notes that:

...the environmental movement has tried to alert us to the fundamental tension between the ideas of constant economic growth and ever improved standards of living, and the preservation of a healthy environment (Callahan 1998, p. 34).

And Brown also suggests:

Intervention in the physical and social environment, before and not after the damage is done, has always been a characteristic of successful health promotion. The range of interventions on behalf of either health or environment highlights the high cost of failing to act before the event (Brown 1992, p. 223).

Sustainable Economy

Our current model of economic growth is based on a “gift” of natural resources that is finite and diminishing rapidly. The belief that it is all there for us to harvest as efficiently as we are able and at no ultimate cost to us is short sighted. Through initiatives in primary health and our developing understanding of social health concepts, communities are becoming more aware of the long-term impact of the way we interact with our environment and how this ultimately affects our wealth and our health. The model of sustainable systems or “steady state” economics and funding is as applicable to health care provision as it is to environmental wellbeing and sustainable primary production processes. It appears that there are some lessons we can learn from the sustainable environment arguments that can be applied to the struggle to evolve a sustainable health system.

Sax is also concerned with the sustainable environment argument and the impact of this thinking upon prospective health and wellbeing. He observes:

The human rights framework may well provide useful guidance in responding to current public health challenges. The framework may also direct our attention to the warnings that growing world populations and expanding economies may be putting at risk the natural stocks and resources that sustain us, such as safe fresh water and fertile soil. Atmospheric ozone depletion and the greenhouse problem could lead to changes in global climate with serious consequences for health in coming decades (Sax 1998, p. 15).

In the health industry we are yet to quantify the long-term health costs of

lengthy exposure to chemicals and sprays (Suzuki & Dressel 1999). Also, the real impact on health and wellbeing of remote living, unbalanced and excessive diets, of psychological and emotional pressures (Marmot 1998), of failing businesses and lives in rural communities or of maintaining healthy, natural Aboriginal communities, has yet to be determined. Alarming, rural males, for example, have adopted life styles and work practices that are essentially inimical to their wellbeing. They have become a high-risk group with up to three times the death rates from lung cancer, driving accidents and suicide as women in the same age groups (O’Hehir 1996).

O’Hehir writes that:

...rural males are drinking, driving, smoking and working themselves to death in the belief that the hard life is actually healthy (O’Hehir 1996, p. 5).

And that:

Men’s ill health is not purely physical. It is psychological, sociological and physical and as such, much of our lifestyle and learning behaviours, particularly in relationships with females, need to be relearned (O’Hehir 1996, p. 15).

Current measurement of trends in community illness are still looking at health in terms of the number of people who get sick, how long they need to be treated and how much time they take up in the hospital system. This is the current health paradigm (Keleher 1999), which takes little cognisance of whole community health or the value of maintaining clean water or chemical-free food supplies. Consequently little of the available health budget is spent on ensuring people do not get sick because most of it, and more, needs to be spent on those who are already sick. We cannot get far enough ahead of spiralling demand to begin effectively to prevent breast cancer or prostate cancer or stomach cancer, because we cannot afford to develop the living and working practices that will prevent exposure to the dangers and life practices that cause these problems. The coordinated care trials

offered the prospect of quantifying data around illness prevention and testing ways of putting improved primary health systems in place to reduce the incidence of crisis arising from chronic illness and this work has led to other innovative approaches, especially in rural communities (Harvey 2000, 2001).

Clearly, if people live healthy, stress-free lives they will live longer, but they will eventually get sick and possibly need medical intervention from doctors and the acute health system. Social programs can only mitigate the physical limitations of the organism it is serving to a limited degree and no doubt, as people do live longer, they will develop illnesses that demand even more specialised treatment. Preventive programs may simply shift the cost of care forward in time (Burton et al. 1995; Fries 1993; Weinberger et al. 1996). The point is, however, that the quality of people's lives can be improved by providing more primary health intervention, education and healthy lifestyle advice to communities:

The evidence is now overwhelming that, with a decent environment and sensible health habits, most (but not all) people can live long and healthy lives without much help from medicine (Callahan 1998, p. 173).

Haggerty makes a similar point in his discussion of social and environmental contributions to ill health and the future of universal access to health care in the United States:

Our new surgeon general has articulated that the most prevalent and destructive disorders among young people today are violence, injuries, homicides, suicides, drug abuse, new infections such as human immunodeficiency virus, chronic disease and resistant tuberculosis. Behind all of these problems lies social disadvantage, which includes poverty, racism, social isolation, stresses of living, poor housing, and, perhaps most important of all, lack of meaningful jobs. The health professions alone cannot solve these problems, but we can demonstrate their relation to the profoundly destructive health problems of children and join as partners with others to create advocacy for a more equitable society and, in

the process, reduce these destructive disorders (Haggerty 1998, p. 774).

No one will live forever, but they could enjoy a much better quality of life if the disease agents and the destructive influences over their lives are removed from or limited within the environments where people live (Lee & Paxman 1997).

No doubt our ageing population will produce different and greater demands on our social security and medical systems. By the year 2031, there will be an estimated 21% (5.1 million people) of the population of Australia over the age of 65 (Australian National Report on Population (ANRP) 1994, p. 20) compared to only 11% of our existing population. In rural communities, the percentage of aged people may be even higher in relation to the total population as many young people are forced to the cities to find work, leaving their ageing parents to retire in small country centres. These trends will also swell the ranks of the aged in other rural communities and these people will need support at home or in institutions such as nursing homes and aged care facilities. With 9.3% of all aged people over 70 years currently in residential care (ANRP 1994), we can expect the figure to grow considerably in the future. As people live longer and families can no longer provide the total support that aged people with increasingly complex needs will demand, our health systems will come under additional pressure to improve efficiencies and spend limited resources more effectively (Fries 1998, 2000).

The Department of Veterans' Affairs (DVA) estimates that currently there are around 342,000 entitled veterans and their dependents seeking assistance with an average age of 71 years. About 37% are over 75 years and 5% over 85 years. By the year 2000, this figure will almost double to 68% of the treatment population greater than 75 years. Also, there will be an estimated 19000 veterans suffering from some form of dementia by the year 2004 (Fries 1998, 2000; Medza 1995).

Such trends have particular relevance for rural regions. Health services will need to gear up for large populations (relatively) of aged and dependent people, and if O'Hehir is to be believed, populations in the upper years will continue to contain a disproportionate number of women. The UN report also identifies this trend and notes that, "In June 1992, the sex ratio for the age group 65 years and over was 76 males per 100 females" (ANRP 1994, p. 21). Clearly, women are going to be living longer than men in the future and may therefore have increasingly complex health needs as they do so.

Future Options

So, what can we expect to see in terms of health care delivery in our culture? Can we expect any change in funding priorities or policy directions or is the picture one of having to continue to do more with less? DVA, for example, recognises that community based care for aged people suffering from dementia in particular is a realistic option, but more funding will need to be provided to support such initiatives (Fries 1998, 2000; Medza 1995). Undoubtedly, more funding will be required to meet the health needs of the ageing population, but coordination and integration of existing services to gain added health efficiencies and improved outcomes will also be an important consideration.

In the developing world, many of the archaic practices that wealthier nations can afford to export to poorer countries still exist and are proliferating. The standard of a country's social system is determined by the standard of that country's balance of payments and as Australia's situation is not good, we are hardly likely to see sudden developments in an enlightened social health, welfare and education model given our existing and growing international burdens.

This reality could mean that large-scale pro-active programs may not be adequately planned for or funded and that health care

in particular will remain a reactionary process dealing as best it can with problems (some of which could be avoided by better education and information practices) as they arise. In this scenario, many of the lifestyle and environmental issues that contribute to disease and finally to the need for medical intervention could remain unrecognised. The social conditions of people's lives have direct and powerful impacts on health and on the potential for people to manage issues or problems that may arise. People in some communities are better placed to deal with general health issues, and social problems, than are people in other communities.

Some of the current developments in our social and political reality to be considered in this wider perspective are:

- Due to recent events in the history of the state, funding constraints have been placed on all public sector operations. Government is looking to be more cost-efficient and to save money where previous projected costs may even have required *real increases* in funding in order to meet need.
- Where possible, services are being combined or run in conjunction with other support groups to limit duplication of services and reduce the cost of maintaining public sector infrastructure.
- In rural areas the proportion of older people is increasing and the number of active young people in the communities is decreasing. The services in rural communities are therefore being aimed more at the needs of elderly people and aged care than at the needs of younger people.
- Psychological services are in demand as the pressures of work or the pressures of not having work and the changing nature of the rural

economy take a toll on people at all levels of the community.

- Social services are being reduced across the board as the need for support, counselling and crisis care for families, young people, the aged, single women, Aboriginal people and the unemployed is increasing. A UN report notes that: "The levels of care and services available to older Aboriginal and Torres Strait Islander peoples, particularly in rural and remote areas, is considerably lower than that available to the wider Australian community" (ANRP 1994, p. 68).
- There is a common perception in government (and in the developing new society) that private organisations are able to provide more efficient and cost-effective services to communities. Government instrumentalities are being dismantled in preparation for a "user pays" culture. The social security safety net is there for those who are unable to pay, but the intention is to reduce the number of recipients of free or government funded care and support in all areas.

Against this background of changing and emerging needs in the Eyre Region, the SA HealthPlus coordinated care trial offered an opportunity to demonstrate the efficacy of early intervention, better service coordination and improved data networking around individual patient needs. The SA HealthPlus model established several new elements in the management of care for patients with chronic illness (care plans, service coordination, schedules of services, alternative service purchasing arrangements, data integration, service utilisation tracking, preventive education, and rehabilitation programs).

This Trial provided a strategy for dealing with many of the issues outlined in the

earlier community needs assessment carried out there. It set out to change the way health was perceived within the community by medical staff, by patients and by carers. Beyond this, the SA HealthPlus coordinated care process was designed to move health service management into a new era of outcome funding in which the concept of early intervention and funding of relevant preventative services was fundamental to improving overall community health and wellbeing. Through the SA HealthPlus experiment, health services were able to evolve a model of care based on demonstrated need and supported by relevant integrated data on clinical conditions as well as social and emotional need.

Patients, through the care planning process and the problems and goals strategy (Battersby et al. 2001) were encouraged to articulate their health problems in terms of social and emotional factors as well as clinical factors. The impact of this process was that the GP, the patient and their service coordinator formed a more empowered and informed team looking at health and wellbeing in a much more holistic way than was the case previously. This process created the possibility of GPs working as care coordinators funded to manage patients to stay well instead of only having time to treat them when they became ill.

The essential vision for the Region was the creation of a sustainable model of rural health care based on early intervention and prevention to achieve defined outcomes for the whole population. This goal can be characterised by the following elements outlined by Callahan in his recent discussion of modern health care systems:

...the scientific view that the key to population health lies in the background educational, social, economic and environmental features of society and in the successful deployment of effective health promotion and disease prevention programs;
(2) the social ideal, which understands the struggle against disease, accident, and illness

as a matter of solidarity, requiring common effort (for all are mortal) and common sacrifice (for not all needs and desires can necessarily be satisfied) and aiming for a common, collective good health; (3) the economic conviction that only a steady state, economically sustainable medicine oriented to population health ought to be politically acceptable in the future; and (4) the moral ideal of a recognition by individuals that their personal behaviour will significantly determine their life-time health prospects and that they have a social obligation to take care of themselves for their own sake as well as that of their neighbor" (Callahan 1998, p. 170).

Conclusion

Health care, like other wider economic systems, is becoming increasingly concerned with sustainability, prevention, early intervention and long-term management of wellbeing. This implies a need to move the health care agenda beyond a reactionary, crisis based acute care model to a more fully integrated preventive care model based on the recognition that "health" is a function of numerous social and environmental variables.

As part of this vision, as described above, it is becoming more obvious to investors in production generally that the short-term focus on maximising profits without regard to wider environmental factors is increasingly becoming bad business. The health sector is no different. Unless health professionals become more involved in community care, education, prevention, self-management and consumer empowerment processes, the health system will collapse in the future under the weight of acute care needs. Much of what manifests today as illness (diabetes, cardiovascular disease, respiratory disease), and which is burdening our health systems, is essentially preventable and if not totally preventable it is manageable.

By taking this wider view of health and wellbeing it will be possible to invest our finite resources more effectively to optimise the benefits of those resources to the whole community. This concept implies recognition of key elements of a healthy society upon which healthy individuals are predicated:

- broad based education and consumer participation in society
- the role and impact of work in wellbeing
- the idea of healthy sustainable environments, both natural and social
- the major role of lifestyle choice on individual and community wellbeing
- implementation of early intervention and prevention programs more extensively rather than expansion of endpoint interventions
- the idea of quality of life as opposed to quantity of life and the need to optimise quality years or life lived through broader approaches to wellbeing

This transition to sustainable approaches to health will be gradual, as it is in the wider business world, but we are increasingly becoming cognisant of the importance of a longer-term view of how we live and work and how we are essentially the result of major environmental determinants. Health in future will therefore depend more on how we treat and manage these determinants and not so much upon how we treat individual patients whose life and wellbeing is the consequence of larger factors and ultimately omnipotent factors that determine our lives.

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Legal Risk Management with Food Safety Templates¹

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How one goes about managing risk might depend upon the “risk” that person believes he or she is trying to manage. In business, the businessman is likely to focus on those things that are “bad for business” and for such a person, he or she will seek to minimise exposure to events that could affect the business’s bottom line. The company employee who is seeking to advance through the corporate ranks will tend to personalise risk. He or she will seek to minimise those events that might affect career aspirations.

There is then the person who performs statutory functions that are enacted to serve and protect the wider community. His or her “career” is very much dependent upon effectively discharging the statutory function. His or her employer will usually be a statutory authority whose “business” is community focused. The environmental health officer falls into this category. One of the risks the environmental health officer needs to manage is the risk to the community resulting from a failure to discharge effectively his or her statutory functions. Accordingly, when one comes to consider legal risk management with food safety templates, it is desirable to look at risk from the various perspectives, including risk from:

- the business perspective
- the career perspective
- the community perspective.

These perspectives are not necessarily mutually exclusive. What is valuable for a career might also be valuable for business.

Application of the Law to the Discharge of Functions

There has been a marked shift over the years in the way the courts have treated the discharge of statutory functions and the way

that the tort of negligence has been applied. Formerly, the law was not so insistent on government authorities and government employees discharging their government functions. So, for example, if the government authority or employee were given a discretion about whether or not to perform a function, he/she would rarely be held responsible if someone suffered damage or injury by the decision of the authority or the employee not to exercise the function.

The law then evolved to a point where there was a virtual insistence by the courts that if an authority or employee elected to exercise its or his/her function, then it or he/she had to continue to discharge the function. The law has now evolved still further. There appears to be an insistence on a government authority exercising its government discretion where the consequences of it not acting could reasonably be expected to result in damage or harm.

At the same time the law on negligence has evolved. While it is still predicated on the concept of “duty of care”, how one comes to determine the duty of care (and more pertinently how to discharge the duty of care) has changed. In broad terms, the duty of care and the discharge of the duty of care are regarded more as concepts to be

determined by community standards and expectations than from the perspective of the individuals involved.

Evolution is not something to be feared. Greater scrutiny and the imposition of tougher standards are not something that only the courts have imposed. They have been imposed by the media and by regulatory bodies and, in a sense, the courts' recent approach simply reflects community standards. Regardless of how the law might have evolved, the courts have long said that if you perform a government function you should not do so negligently.

The Food Safety Program and the Food Safety Program Template

According to section 39(1) of the Food Act 1984 (Vic), before registering or renewing or transferring the registration of any food premises the Council must:

- (a) *inspect the premises; and*
- (b) *be satisfied that all the relevant requirements of the Act with respect to the premises have been complied with.*

In addition, where the food premises are declared premises, section 39(2) requires Council to be satisfied that:

- (a) *if the premises are to be governed by a "standard food safety program", that the program complies with section 19DC of the Act;*
- (b) *in any other case, there is a food safety program for the premises that complies with section 19D of the Act; and*
- (c) *no other ground for refusal of the registration, renewal or transfer exists.*

Section 39(1) and 39(2) are in mandatory terms. They are, therefore, statutory duties and, because section 39(2) requires the Council to be satisfied that the declared food premises has either a standard food safety program that complies with section 19DC or a "non-standard" food safety program that complies with section 19D, an

understanding of these sections is imperative.

The Food Safety Programs

According to section 19D:

A food safety program for a food premises is a written document that:

- (a) *systematically identifies the potential hazards that may be reasonably expected to occur in each food handling operation that is to be, or that is being, conducted at the premises; and*
- (b) *identifies where, in a food handling operation, each hazard identified under paragraph (a) can be controlled and the means of control; and*
- (c) *provides for the systematic monitoring of those controls; and*
- (d) *provides for appropriate corrective action when that hazard, or each of those hazards, is found not to be under control; and*
- (e) *provides for the regular review of the program by the proprietor of the food premises; and*
- (f) *provides for appropriate records to be made and kept by the proprietor of the food premises demonstrating action taken in relation to, or in compliance with, the program.*

The Standard Food Safety Program

Section 19DC describes the standard food safety program as follows:

A standard food safety program is a food safety program for a food premises that complies with the following conditions:

- (a) *it has been created using a food safety program template in accordance with the instructions set out in the food safety program template; and*
- (b) *the food safety program template is specified as suitable for use under section 19DB for a food business of the class that is being carried out at, on or from the food premises."*

This in turn refers the reader to section 19DA where one ascertains that a "food

safety program template” is a written document that:

(a) *contains a set of instructions to enable the proprietor of a food premises to create a food safety program that complies with section 19D; and*

(b) *has been registered by the Secretary under section 19DB.*

Determining Compliance with Sections 19D and 19DC

This is ultimately a matter for the Environmental Health Officer (EHO). Only he or she can determine whether the food safety program provided to Council (Local Government Authority) as part of the registration/renewal/transfer complies with section 19D or 19DC (as the case may be). The Act provides no real guidance. While one would expect that it would be easier to assess a standard food safety program than a non-standard program, Council cannot insist upon a proprietor submitting a standard program.

The important thing from a risk management perspective is that the officer who makes the decision keeps detailed notes regarding the consideration of, and deliberation upon, the food safety program. A checklist would be desirable. The checklist ought to mirror the provisions of the Act so that the officer can “mark off” each element of the Act as he or she reviews the food safety program.

File notes and checklists can be vital aids to the Council and EHOs should anything ever go wrong and they find themselves as the subject of public scrutiny or litigation. As a general rule, it assists in defending litigation or responding to public scrutiny if the Council or officer can find documentary evidence that an assessment of the food safety program was in fact carried out - rather than to leave it open to speculation.

File notes and checklists can, of course, be a double-edged sword. Whereas a good file

note and a thorough checklist can aid a Council, a poor file note, or poorly completed checklist, can often be as damaging if not more damaging than no file note/checklist at all. It is critical, therefore, that whatever file notes or checklists are taken, that they be accurate and thorough and if a file note or checklist indicates that follow up work is to take place, there should be another file note to indicate that the work has been carried out.

Registration without a Food Safety Program

There is, apparently, an ability to allow registration of declared food premises without the existence of a food safety program. The ability to do so is found in section 39A(1).

Section 39A(1) provides that “despite section 19C and 39”, the Council may register/renew/transfer registration even though “in its opinion” one or more of the relevant requirements of the Act with respect to the premises has not been complied with. Opposed to the statutory duty imposed by section 39(1) and 39(2), section 39A vests Council with a statutory discretion. It is a discretion because Council may choose whether or not to allow registration/renewal/transfer in the absence of a compliant food safety program.

There are, however, some constraints in relation to the exercise of this discretion. They come in the form of section 39(2).

Section 39(2) reads:

(a) *in the case of a failure to do something by a specified time that has passed, that the thing will be done within a new time specified by the registration authority; or*

(b) *in the case of a failure to do something that it is no longer possible to remedy, that it is not likely that a similar failure will occur again; or*

(c) *in any other case -*

(i) *that the failure to comply poses no immediate risk to the health of any person; and*

(ii) that the failure to comply can, and will, be remedied within the time specified by the registration authority."

The most relevant part of section 39A(2) is that contained in paragraph (c). It requires the Council to determine whether the failure to submit a food safety program or to submit a compliant food safety program could pose an immediate risk to the health of any person. The discretion found in section 39A(2) is typically one that would be exercised with caution. One would think that there is little public benefit in allowing registration without a compliant food safety program and some identifiable disbenefit in doing so.

A person who is aggrieved by a Council decision to refuse registration/renewal/transfer has, of course, the right of appeal to the Magistrates' Court [see section 42(1)] and, while no one likes the prospect of constant appeals, sometimes it is better to endure them than to risk the consequences of the alternative. Where a discretion is being exercised, it is all the more important that comprehensive file notes and checklists be taken or followed.

The Food Safety Practice Standards

The Food Safety Practice Standards (2001) produced by the Australian Institute of Environmental Health (Vic Div) succinctly sets out the policy context within which the assessment of food safety programs takes place (as well as more generally in performing EHO functions):

Local government authorities, as an industry, meet these legislative obligations by consistently applying industry best practice standards and professional practice

standards.

In terms of the food safety program it quite correctly says:

Consequently, the registering authority needs to have evidence that the business (to which it is giving permission to operate through the registration process) has a food safety program that effectively manages the risks to food safety. Conversely, the business proprietor is required to demonstrate that its food safety program is managing food safety risks.

There is not much more that one can add to that publication.

Enforcement and Inspection Policy

As a broad proposition, the law recognises that Councils and Council employees have limited resources and limited time. The practices advocated in the Institute's Food Safety Practice Standards can quite legitimately be considered in the context of these limitations.

There is, therefore, a legitimate place for "prioritising" when it comes to the inspection and enforcement functions of a Council. Some Councils have, in recognising the need to prioritise, formulated or begun to formulate their own policy or standards in relation to these functions.

This is a desirable thing from a risk management point of view. There will be times when a Council or employee will be called upon to explain why it or he or she decided to act in a particular way or to not act. Being able to point to a well considered and well articulated policy or standard will assist in answering such questions.

Endnote

1. An earlier version of this paper was presented to the Australian Institute of Environmental Health (Vic Division), 71st State Conference, Mansfield, 5-6 September 2002.

References

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Legislation (as amended)

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New Food Labelling Requirements: Food Standards Code

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The aim of this paper is to revisit and clarify the intent of the new labelling and other information requirements, which make up Part 1.2 of the New Code, the Food Standards Code (Food Standards Australia New Zealand 2002) and then to concentrate on the issues which have already become problematic. The paper aims to enhance information previously sent to Environmental Health Officers (EHOs) by Dunn, Son & Stone (DS&S). This includes:

- Quick Guides for new labelling
- And a “check list” of the types of breaches DS&S look for in labelling.

And these in turn supplement:

- Part 1.2 of the New Code
- The FSANZ Users Guides to the various Standards in Part 1.2.

Information is available on the FSANZ website: www.foodstandards.gov.au

Part 1.2

Part 1.2 comprises labelling and other information requirements:

Standard 1.2.1	Application of Labelling and Other Information Requirements
Standard 1.2.2	Food Identification Requirements
Standard 1.2.3	Mandatory Advisory Statements and Declarations
Standard 1.2.4	Labelling of Ingredients
Standard 1.2.5	Date Marking of Packaged Food
Standard 1.2.6	Directions for Use and Storage

Standard 1.2.7	Reserved (Representations about Food)
Standard 1.2.8	Nutrition Information Requirements
Standard 1.2.9	Legibility Requirements
Standard 1.2.10	Characterising Ingredients and Components of Food

Standard 1.2.1 Application of Labelling and other Information Requirements

Food for retail sale - sale to the public and for catering purposes - those foods for use in restaurants, canteens, schools, caterers or self catering institutions, where food is for immediate consumption must bear a label setting out all the information prescribed in the Code.

Exemptions

- The food is other than in a package; or
- The food is in inner packages not designed for sale without an outer package other than individual portion packs with a surface area of no less than 30cm², which must bear a label containing a declaration of certain substances in accordance with Clause 4 of Standard 1.2.3; or
- The food is made and packaged on the premises from which it is sold; or
- The food is packaged in the presence of the purchaser; or
- The food is whole or cut fresh fruit & vegetables, except sprouting seeds or

similar products, in packages that do not obscure the nature or quality of the fruit or vegetables; or

- The food is delivered packaged, and ready for consumption, at the express order of the purchaser; or
- The food is sold at a fund raising event.

Note

Food not for retail sale or catering purposes must have:

- Food identification details
- Name of food
- Lot marking
- Name & address of supplier

And, where requested, must be accompanied by sufficient information to enable the purchaser to comply with the requirements of the Code.

1.2.9 Legibility

Apart from mandatory warning statements, which require minimum print size of 3mm (1.5mm for small packages - less than 100sq cm total surface area).

The only requirements are:

- Legible
- Prominent
- Distinct contrast to background
- In English

Standard 1.2.2 Food Identification Requirements

Name of Food

- Prescribed name when so declared.
- Otherwise - a name sufficient to indicate the true nature of the food.

The name of the food, in the absence of many compositional Standards and associated prescribed names, becomes critical in identifying characterising ingredient and/or component for declaration or where a representation may be false, misleading or deceptive.

In August FSANZ published a guideline on representations about foods which assist manufacturers in naming foods and using terms, such as fresh natural, and so on.

Lot Marking

Exemptions:

- An individual portion of ice cream or ice confection; or
- In small packages, and the bulk packages and the bulk container in which the food is stored or displayed for sale includes lot identification.

Name and address of supplier

It is made clear that a PO Box does not meet this requirement.

Standard 1.2.4 - Labelling of Ingredients

The main changes relate to listing water in descending order by proportion by weight rather than water added at the end of the list, and the requirement that compound ingredients - ingredients themselves made up of more than one ingredient e.g. Jam - comprising 5% and above must list all ingredients, and below 5% must list any additives still performing a technological function. In addition, there have been changes to requirements for generic ingredients e.g. Fruit, vegetables and the additive class names.

Exemptions

- The food is labelled with the name of the food which would otherwise be those ingredients listed in the ingredient list; or

- The food is an alcoholic beverage standardised in Part 2.7 of this Code; or
- The food is contained in a small package; or
- The food is liquid milk and milk products and cream and cream products sold in glass bottles with no label other than that on the foil cap.

Standard 1.2.5 - Date Marking

Where a food requires a Use by Date for health or safety reasons, it will be an offence to sell it past that date. With no health or safety consequences, the food must have a Best before Date. It will not be an offence to sell past the Best before Date as long as the food is still suitable and marketable.

Exemptions

- The best-before date of the food is two years or more; or
- The food is -
 - (i) an individual portion of ice cream or ice confection; or
 - (ii) in a small package, except where the food should be consumed before a certain date because of health or safety reasons.

There are tightly prescribed formats for Use By and Best before Dates.

Standard 1.2.5 Clause 5

- The best-before date and use-by date must consist at least of the day & month for products with a best-before date or use-by date of not more than 3 months; or
- The month and the year for products with a best-before date or use-by date of more than 3 months.

Figure 1: Decision Tree – Whether a food needs a Use By Date to address health issues

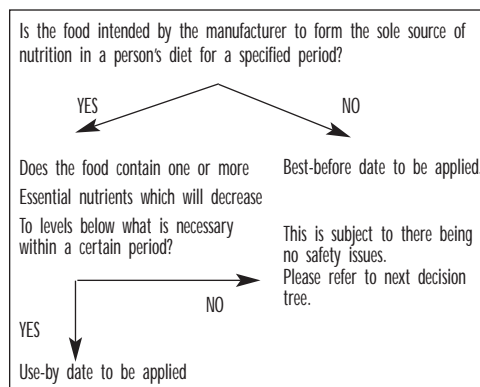
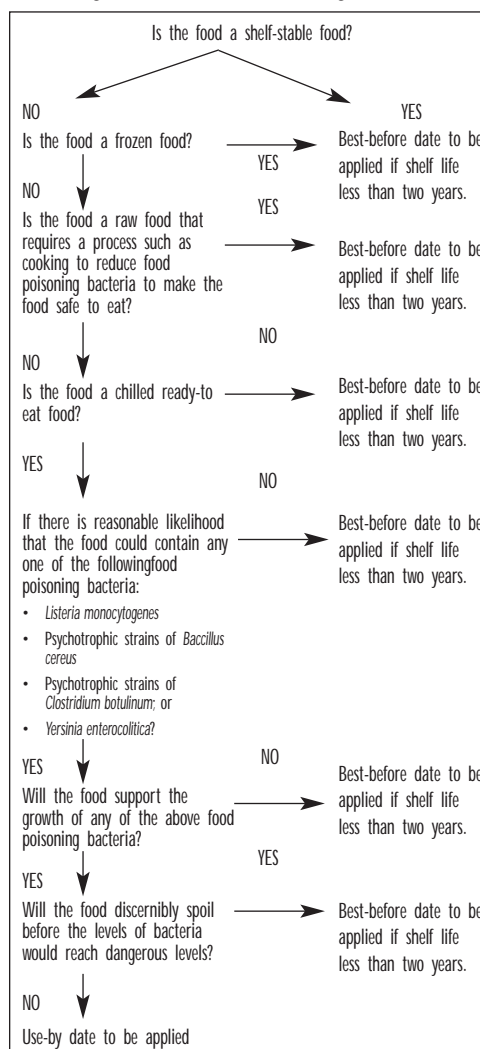


Figure 2: Decision Tree – Whether a food needs a Use By Date to address safety issues



- The best-before date and use-by date must be expressed in uncoded numerical and chronological form, other than the month, which may be expressed in letters.
- The day, month and year so expressed within the best-before or used-by date must be distinguishable.

Whether a food needs a "Use by Date" to address health issues, and is the food intended by the manufacturer to form the sole source of nutrition in a person's diet for a specified period can be shown as a Decision Tree (Figures 1 and 2)

Standard 1.2.8 - Nutrition Information Panels

Under the old Code a nutrition information panel (NIP) was only required where a nutrition claim was made.

Under the new Code a label on a package of food must include a NIP.

Exemptions

- Sold at fund-raising events; or
- An alcoholic beverage standardised in Part 2.7 of this Code; or
- A herb, a spice, a herbal infusion, water; or
- Vinegar and related products as standardised in Standard 2.10.1; or
- Salt and salt products as standardised in Standard 2.10.2; or
- Tea, decaffeinated tea, decaffeinated instant or soluble tea, instant or soluble tea, coffee, decaffeinated coffee, decaffeinated instant or soluble coffee, instant or soluble coffee, as defined in Standard 1.1.2; or
- An additive as defined in Standard 1.3.1; or

- A processing aid as defined in Standard 1.3.3; or
- Fruit, vegetables, meat, poultry, and fish that comprise a single ingredient or category of ingredients; or
- In a small package; or
- Gelatine as defined in Standard 1.1.2; or
- Water or mineral or spring water as defined in Standard 2.6.2; or
- Prepared filled rolls, sandwiches, bagels and similar products; or
- Jam setting compound.

There have already been applications to FSANZ to have other foods exempted e.g. Mineral water.

The average quality of each nutrient is the quantity determined from one or more of the following:

- The manufacturer's analysis of the food; or
- Calculation from the actual or average quantity of nutrients in the ingredients used; or
- Calculation from generally accepted data;

Which best represents the quantity of the substance that the food contains, allowing for seasonal variability and other known factors that could cause actual values to vary.

FSANZ recognised the potential cost to businesses and set up a nutrition panel calculator (NPC) on its website - together with worked examples in its 120 page Users' Guide.

Issues

As with many of the new requirements, the medium and large manufacturers have addressed the issues some time ago, but it is

the smaller manufacturers and many retailers who are having problems.

Examples of these are:

- Many “cottage” type manufacturers produce a variety of products, but in small quantities
- Manufacturers providing food for functions at short notice
- Various pack sizes
- Odd products that do not easily fit into the FSANZ NPC.

Standard 1.2.10 - Characterising Ingredients and Components of Food

This will prove to be one of the more reasonable requirements.

Intent - to enable the consumer to make an informed choice based on what has variously been described as the value or characterising ingredients and/or components.

As in the European Union, this Standard not only replaces many prescriptive Standards, but applies to a far broader range of foods.

Characterising component or ingredients are those which:

- It mentioned in the name of a food; or
- Is usually associated with the name of a food by the consumer; or
- Is emphasised on the label of a food in words, pictures or graphics; or

But does not include:

- An ingredient or a category of ingredients which is used in small quantities for the purposes of a flavouring; or
- An ingredient that is the sole ingredient of a food; or

- A category of ingredients that comprises the whole of the food; or
- A category of ingredients which, while appearing in the name of the food, is not such as to govern the choice of the consumer, because the variation in the quantity is not essential to characterise the food, or does not distinguish the food from other foods.

There are editorial notes in the Standard and examples in the Users' Guide of the application of this Standard.

The name of the food and other representations become critical in determining which ingredients or components must be declared.

FSANZ has produced a *Users' Guide for Representations about Food*. This Guide clearly addresses many previously “grey” areas.

Exemptions

- Food assembled in the presence of the purchaser; or
- Food for catering purposes; or
- Food delivered packaged and ready for immediate consumption at the express order of the purchaser; or
- Prepared filled rolls, sandwiches, bagels and similar products; or
- Food sold at fund raising events; or
- Food in a small package; or
- Food standardised in Standard 2.9.1; or
- Cured and/or dried meat flesh in whole cuts or pieces; or
- Alcoholic beverages standardized in Part 2.7 of this Code.

Important Note

Where the food is unpackaged or made and packaged on the premises from which it is sold, the % declaration of the characterising ingredients and components must be:

- Displayed on or in connection with the display of food; or
- Provided to the purchaser on request.

Standard 1.2.3 - Mandatory Warning and Advisory Statements and Declarations

For reasons of health and safety, the new Code requires that certain information is provided on labels. This information may be in the form of a prescribed statement (which includes warning statements), an advisory statement or a specific declaration depending on the degree of risk to health and safety of consumers.

I have left this Standard until last because of its impact and possible consequences of non-compliance. It is important to note that even though a food may be exempt from bearing a label, this Standard will still apply - even to foods sold at fund raising events. With respect to mandatory warning statements, these must be displayed on or in connection with the display of food. With mandatory advisory statements and the declaration of certain substances in foods, the information must be displayed or provided to the purchaser on request. The Dunn, Son & Stone Quick Guide, the FSANZ Users' Guide and the Standard 1.2.3 itself are clear in application and the foods concerned.

Warning statements are required in very specific foods, which are rarely sold unpackaged. These foods include: condensed, modified and skim milk and products, Royal Jelly and food containing Royal Jelly, Kava, Infant Formula, Infant Foods and formulated supplementary sports foods which all have strictly specified wording.

Mandatory Advisory Statements cover:

- Unpasteurised milk and liquid milk products
- Food containing aspartame
- Unpasteurised egg products
- Foods containing quinine
- Food containing guarana/guarana extracts
- Food containing phytosterolesters (Standard 2.4.2)

As well as:

- Irradiated food, formulated meal replacements, formulated supplementary foods and those for young children, as well as formulated supplementary sports foods.

In general these sit outside the common ingredients and in some cases specific Permission is required in the Code for their use.

While not ignoring the importance of these foods, I concentrate on the area of most significance, that of the mandatory declaration of certain substances in foods. This poses a huge challenge to all suppliers of foods and to enforcement agencies. The substances include allergens and those to which some consumers are intolerant. The levels, which cause adverse reactions, and the knowledge that will be required of the suppliers of foods containing these substances will require intensive education. The legal consequences of non-declaration are obvious.

Substances in Question

The presence of any of the following substances must be declared:

- Cereals containing gluten and their products, namely, wheat, rye, barley, Oats and spelt and their hybridised strains other than where these

substances are present in beer and spirits standardised in Standards 2.7.2 and 2.7.5 respectively.

- Crustacea and their products
- Egg and egg products
- Fish and fish products
- Milk and milk products
- Nuts and sesame seeds and their products
- Peanuts and soybeans, and their products
- Added Sulphites in concentrations of 10mg/kg or more
- Royal Jelly presented as a food or Royal Jelly present in a food
- Bee pollen
- Propolis

Examples of Complexity

Table 1 contains 33 foods which may contain Sulphites (Sulphur Dioxide). Foods containing these foods as ingredients might also have a sulphite level above 10mg/kg. This highlights the difficulty “non-technical” people might have in meeting their obligations under the Standard.

Table 1: Foods Which May Contain Sulphites (Additive Codes 220-225, 228).

0.1	Preparations of food additives	350 mg/kg
3	Ice cream & edible ices <i>subcategory: ice confection sold in liquid form</i>	25 mg/kg
4.1	Unprocessed fruits & vegetables <i>Subcategory: grapes packed with permeable envelopes</i>	10 mg/kg
4.1.3	Peeled &/or cut fruits & vegetables <i>Subcategory: products for manufacturing purposes</i> <i>Application: apples & potatoes only</i>	200 mg/kg
4.1.3	Peeled &/or cut fruits & vegetables <i>Subcategory: root & tuber vegetables</i>	50 mg/kg
4.2	Frozen unprocessed fruits & vegetables <i>Subcategory: frozen avocado</i>	300 mg/kg
4.3	Processed fruits & vegetables <i>Application: ginger only</i>	20 mg/kg

4.3.1	Dried fruits & vegetables	3000 mg/kg
4.3.1	Dried fruits & vegetables <i>Subcategory: desiccated coconut</i>	50 mg/kg
4.3.2	Fruits & vegetables in vinegar, oil, brine or alcohol <i>Subcategory: products made from bleached vegetables</i>	750 mg/kg
4.3.4	Fruit & vegetable spreads including jams, chutneys and related products <i>Subcategory: chutneys, low joule jam & low joule spreads</i>	285 mg/kg
4.3.5	Candied fruits and vegetables	2000 mg/kg
4.3.6	Fruit & vegetable preparations including pulp	350 mg/kg
4.3.6	Fruit & vegetable preparations including pulp <i>Subcategory: fruit & vegetable preparations for manufacturing purposes</i>	1000 mg/kg
4.3.8	Other fruit & vegetable based products <i>Subcategory: imitation fruit</i>	3000 mg/kg
6.4	Flour products (including noodles & pasta)	300 mg/kg
7.2	Biscuits, cakes and pastries	300 mg/kg
8.3	Processed comminuted meat, poultry & game products	500 mg/kg
8.4	Edible casings	500 mg/kg
8.5	Animal protein products <i>Subcategory: gelatine</i>	750 mg/kg
9.1	Unprocessed fish & fish fillets (including frozen & thawed) <i>Subcategory: uncooked crustacea</i>	100 mg/kg
9.2	Processed fish & fish products <i>Subcategory: cooked crustacea</i>	30 mg/kg
9.4	Fully preserved fish including canned fish products	30 mg/kg
9.4	Fully preserved fish including canned fish products <i>Subcategory: Canned abalone (paua)</i>	1000 mg/kg
11.2	Sugars and syrups	450 mg/kg
12.3	Vinegars and related products	100 mg/kg
14.1.2	Fruit & vegetable juices & vegetable juice products	115 mg/kg
14.1.3	Water based flavoured drinks	115 mg/kg
14.2.1	Beer & related products	25 mg/kg
14.2.2	Wine, sparkling wine & fortified wine	GMP
14.2.4	Fruit wine, vegetable wine & mead (including cider & perry) <i>Subcategory: fruit wine, vegetable wine & mead containing greater than 5g/L residual sugar</i>	300 mg/kg
14.2.4	Fruit wine, vegetable wine & mead (including cider & perry) <i>Subcategory: fruit wine, vegetable wine & mead containing less than 5g/L residual sugar</i>	200 mg/kg
14.3	Mixed alcoholic drinks not elsewhere classified	250 mg/kg
20	Mixed foods <i>Subcategory: sauces and toppings, including mayonnaises and salad dressings</i>	350 mg/kg

Dried fruits for example might contain up to 3000 mg/kg of Sulphur Dioxide, where 10 mg/kg is a very small amount. Many products containing dried fruits e.g. muesli, muffins, or fruit bars, easily exceed this level

but have a history of non-declaration in packaged foods. Part of the solution is not only knowing which foods might contain these substances, but also the amounts that are of concern.

It is the duty of the food business to request, or to be provided with, sufficient information to enable it to comply with all aspects of the Code. As currently occurs with major supermarkets for example, their suppliers must complete checklists, which ask whether any of these substances are in the foods provided. A similar system will

need to find its way down to the corner shop, or take away, or even the Red Cross street stall.

One of the offences in question is Section 10A of the Food Act: "A person must not sell food that the person ought reasonably to know is falsely described and is likely to cause physical harm to a consumer of the food who relies on the description".

It is important to access the Food Standards Code and the related guidelines to make sure that compliance is achieved.

Endnote

An earlier version of this paper was presented to the 71st Australian Institute of Environmental Health (Victorian Division) Conference at Mansfield, Victoria, 5-6 September 2002.

Reference

Food Standards Australia New Zealand 2002, *Food Standards Code*, Vol. 2, September, Food Standards Australia New Zealand, <www.foodstandards.gov.au/foodstandardscode/>

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Developments in Sewer Gauging

Andrew Kasmarik

Asset Management Division, Sydney Water Corporation

Gauging Improvements

During 2001 and 2002, Sydney Water carried out a number of projects designed to improve the reliability and accuracy of sewer gauging.

The projects carried out were:

- Flo-rig tests
- Revised standardised gauging procedures
- Improved non-conformance procedures
- Re-submittal database
- Run charts for gauging up-time
- Research into measurement equipment
- Communication with modellers
- Tankers for wet weather flows
- Contractors use of IICATS and HYDRA

Future Improvements

From the findings of the completed projects, the following projects have been identified and are in various phases of completion:

- Contractors moving to telemetry of all gauges
- Investigating use of GPS to locate gauges
- Resubmittal database imminent

- New field measurement equipment research in progress
- Improved hydrograph checking software being researched.

Flo-rig Tests

All contractors and auditors took part. The objectives were to explain why the auditors' results passed the acceptance criteria <50% of the time, while contractors tests passed >80% of the time, and to review the methods used by all contractors.

The Flo-rig tests involved installations of gauges in controlled laboratory flow channels and then using field calibration techniques to calibrate the gauges. The objective of the tests was to discover the reasons behind the continued failure of the auditors to match the calibration results of the contractors.

Sydney Water has developed calibration criteria designed to check for bias and accuracy of each gauge. They are a combination of plots and indices, designed to assess the accuracy of the gauging locations.

Each site has to pass quantitative criteria. The auditors review 10% of sites against the same criteria and expect to achieve the same pass. Auditors found they were only achieving passes for 50% of sites and so the project was initiated.

Typical field gauging process

The gauging flo-rig approximates field conditions so that one of the variables is eliminated in the trial. The flo-rig has two accurate flowmeters installed to allow

comparison of the field measurements with the real flow. A magnetic-flow meter is installed at the beginning of the rig and a well-calibrated v-notch weir was installed half way down the flo-rig. These two devices were checked against each other and showed excellent agreement. There was therefore high certainty that the “true” results were believable.

Flo-rig tests: Test 1

The flo-rig tests (Figure 1) showed a wide variation between contractors and auditors and also wide variation from the “true” results. Under the low flow conditions, the field flow measurements were up to 50% different from the true results. Apart from one set of readings, all field flow measurements were biased higher than the true results. The degree of difference and the scatter of results was not expected and led to further flo-rig testing.

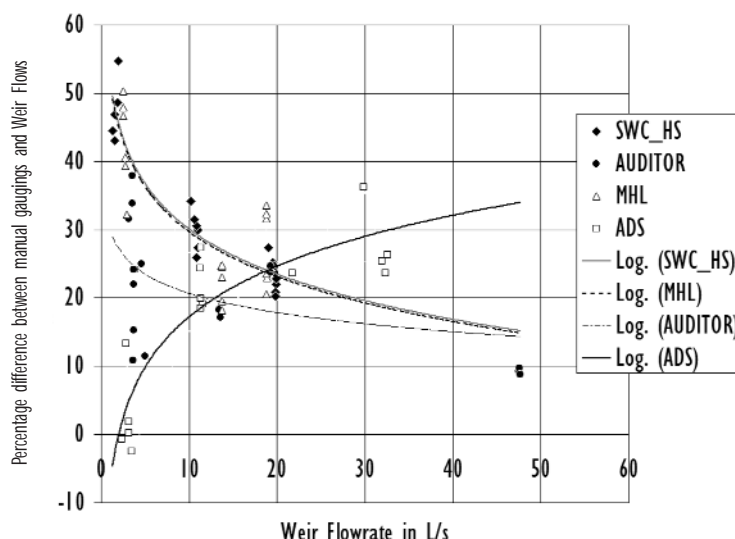
was estimated to be between 20 and 50% higher than the true depth, although this was difficult to verify, as there is no method currently of measuring the true depth except by ruler and eye measurement. The eye has great difficulty finding the average depth between the peaks and the troughs in the turbulent flow.

Flo-rig tests: Test 2

A second trial (Figure 2) was carried out under more ideal flow conditions. The velocity was kept below 1m/s and the depths were all greater than 50mm. There was still found to be a positive bias between true and field flow measurement, but it was now between 5 and 20% above true flow.

The differences were now found to be related to the different methods used to measure average velocity. The Australian Standard for Flow Gauging in Rivers, AS3778, calls for multiple point velocities to

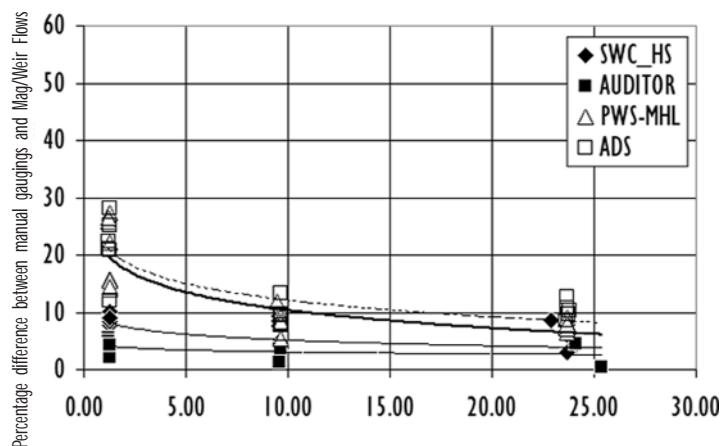
Figure 1: Flowrig Test 1 Results 15/10/01 - All P



The reasons for the excessive bias were related to the flow conditions in the flo-rig. The velocity of the flow was over 1 metre per second and the depth was less than 50mm at low flows. The turbulence of the flow meant that measurement of the depth

be measured and flow weighted using a strict formula. All the measurement teams were found to be using different interpretations of the standard. The maximum bias that can be attributed to the computation method was 15%.

Figure 2: Flo-rig 2 Test Results 9/11/01



In addition, measurements were being taken at different locations with respect to the flow-meter devices. This was also seen to be affecting measurements. The exact impact on results was not calculable from the tests carried out.

Flo-rig tests: Test 3

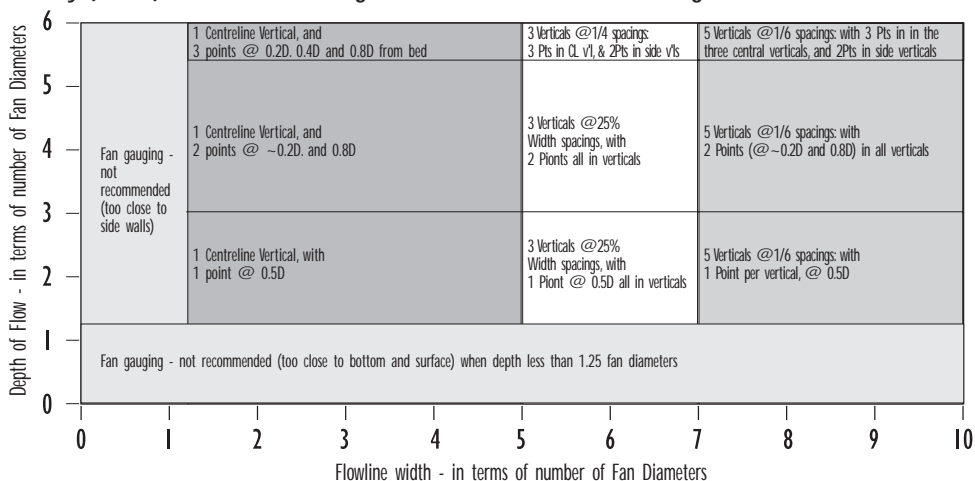
A later trial compared depth measurement in the high velocity flo-rig for a wide variety of people with different levels of skill in flow measurement. A true depth measurement was obtained using an ultrasonic depth measurement sensor calibrated against a board set at a known distance from the sensor head.

The results above confirmed the difficulty that all people had in measuring the true depth and confirmed the positive bias in the measurements. The bias was evident even with people who knew the tendency to over measure the depth and who were then trying to compensate for the turbulence. This indicates the need for a new depth measurement devise to replace the simple ruler in the flow.

Flo-rig tests: Standard method

The flo-rig tests resulted in standard methods being proposed and adopted by all contractors for average velocity computation (Figure 3). In addition,

Figure 3: Flo-rig tests: standard method
Steady (+/-5%) flow conditions – guidelines for current meter usage



agreement was reached as to where measurements would be taken to remove another source of difference between auditors and gauging companies (Table 1).

Table 1: Flo-rig tests: standard method

In steady flow conditions, the following calculation guidelines for defining average X_n velocity are given:-

- > Where only a single point velocity is taken for the whole section, it should be multiplied by 0.875, to give the average
- > Where only one point is taken in a vertical, the average vertical velocity is taken as equal to the point velocity
- > Where more than one point is taken in a vertical, the average vertical velocity shall be calculated as the average of the recorded point velocities
- > Where more than one vertical has been observed, the "Mean-Section" method as specified in AS3778 shall be used, with reduction factors of 0.875 being applied to the side verticals' velocities, to give the side segment velocities.

Non-conformance Procedure

The non-conformance procedure had the following features:

- Carried out in consultation with modellers and gauge contract team
- To allow modellers to raise non-conformances and to track non-conformances
- System implemented
- Additional system being implemented to track changes to the gauging database either because of non-conformances or contractors' own revisions.

All of the gauging data are used by modellers to calibrate sewerage system models. Even though the gauging companies follow good quality assurance procedures, data anomalies are present. The modellers needed a procedure for logging their non-conformances and tracking the progress of the non-conformance and the following data resubmittals. Data resubmittals are also initiated by the gauging companies when their own systems discover data non-conformances. Databases have been created

to track the data changes and made available to the modellers so they are aware of data changes as they occur .

Non-conformance Tracking

Run-charts for gauging up-time

The process is completed and ongoing. The most frustrating data non-conformance for the modellers is missing data, especially in the important wet weather periods. The data supply contracts have penalties for non-supply of crucial data, but this was not found to be sufficient to ensure continuous data supply.

Run-charts have been developed to track data supply. These have been found to improve the performance of the contractors simply because of the scrutiny they attract. The run charts are examined monthly at contract meetings and reasons for poor data supply are explained. The contractors have developed process improvement systems to capture the common reasons and allow analysis. This has led to huge improvements in data reliability.

Modeller Communication

The new requirements can be summarised as:

- Modellers propose new sites using agreed forms
- All information required has to be filled in on forms
- Modellers visit all sites before installation
- Modellers also provide plot of site showing sewers and streets.

All of the above investigations led to the realisation that the site selections were the biggest determining factor in achieving high levels of conforming data, with high levels of reliability. To improve the site selection, modellers are now required to identify the sites following a prescribed format with

minimum levels of essential information. The modellers must supply high quality maps of the proposed network along with pipe and manhole information. They must also supply schematics of the proposed network and alternate gauge locations.

The modellers then attend the sites with the gauging operatives and identify site problems together. Decisions are then made on site to move gauging locations or abandon them if the ability to supply data is in any way compromised. This system has resulted in major improvements in data supply quality and reliability.

IICATS

Sydney Water has a corporate SCADA system to monitor its assets. Many of the sewer pumping stations are monitored on the SCADA (which Sydney Water calls IICATS) and can be used as flow meters by the gauging companies. Sydney Water has made access to IICATS available to the contractors to help them monitor the system independently of their own gauges. Some of the sewer gauges are monitored in IICATS in parallel with the contractors telemetry systems. Access to IICATS is a valuable tool in these instances as well.

Future Improvements: Field Measurement Equipment

- Access in a manhole is very restricted
- Parallax error is a large issue.

The trials and studies described previously have identified several improvement opportunities for the future. Depth measurement in sewers is very difficult due to the cramped conditions in a manhole. Parallax is a very large issue in addition to the difficulties described above in measuring true depth in turbulent conditions.

A new measurement device is required to replace the simple ruler.

- Currently looking for a portable

ultrasonic to measure depth

- Could be used to concurrently measure velocity and depth
- Velocity probe takes up significant volume
- Raises level and changes velocity in small pipes.

Concurrent depth and velocity measurement would also be desirable. Flows can fluctuate in the time between the depth and velocity measurements. In addition, the velocity probe is large enough to change the depth in low flow conditions. A device is required to concurrently take the depth and velocity measurement to eliminate this error.

Future Improvements: Hydrograph Checks

- Current desk checks involve review of whole hydrograph
- Hydrographers/analysts fail to find many errors
- Need to develop a coarse screening process to highlight possible errors and reduce workload.

The gauging companies' data analysts currently have a difficult job to review all the supplied data. Data are collected continuously at 15-minute intervals so it is inevitable that some spurious data points are missed. There is a plan to develop coarse screening methods to allow the analyst to only look at suspect data and thus reduce errors and speed up data review.

Conclusion

All the above changes have occurred in an atmosphere of harmony and collective desires to improve the process of data collection and supply.

Acknowledgments

I should like to thank my data suppliers, ADS Environmental, Manly Hydraulics Laboratory and Sydney Water Environmental Measurement Services for their cooperation and assistance. I also thank the modelling teams for the assistance they have given in identifying problems and taking part in the problem solving activities. Without their dedication to improving quality, these improvements could not have occurred.

Endnote

An earlier version of this paper was presented to *Waterscape 2002*, the Australian Water Association (NSW Branch) Conference, Parramatta, NSW, 23-24 May, 2002.

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Environmental Health Risk Assessment:

Guidelines for Assessing Human Health Risks from Environmental Hazards

Commonwealth Department of Health and Ageing and enHealth Council

Commonwealth Department of Health and Ageing and enHealth Council, 2002, 227pp, ISBN 0 642 82091 0

The assessment and management of human health risks is probably the most important function undertaken in environmental health, and to varying degrees, is conducted on a daily basis by all environmental health practitioners. There are numerous models of risk assessment available, however, there has been limited information available on the proper application of risk assessment to environmental health issues in an Australian context. In response to this, the enHealth Council has recently released these Guidelines that provide a national approach to Environmental Health Risk Assessment (EHRA).

The Guidelines present a general EHRA methodology that can be applied to a range of environmental health hazards. The methodology is based on the well accepted US National Academy of Sciences model of risk assessment but with the addition of an initial stage 'issue identification'. The methodology proposes the following five stages for EHRA: issue identification, hazard identification, dose-response assessment, exposure assessment and risk characterisation. The Guidelines identify that a key outcome for EHRA is to provide the basis for more informed decision-making and therefore support the risk management process. The Guidelines also emphasise the need for the overall process to be conducted within an environment that engages stakeholders and provides for a high level of risk communication and community

consultation.

Following from a background discussion on risk assessment and a description of the EHRA methodology (an "Australian Framework for Risk Assessment"), the Guidelines go on to comprehensively cover each of the stages in EHRA. For the first stage, issue identification, a process for identifying and contextualising environmental health hazards is presented. For the hazard identification stage, the Guidelines describe in detail the role of toxicology and epidemiology in examining the capacity of an agent to cause adverse effects. In the chapter on dose-response assessment, the merits and applications of various approaches for characterising dose response relationships are discussed. The next section on exposure assessment then describes a range of issues to consider for environmental monitoring, sampling and analysis, and includes a discussion on exposure modelling. For the final stage, risk characterisation, the Guidelines describe various issues to consider when integrating the information from the previous stages to arrive at a determination of the risk for a particular circumstance.

The main body of the text then concludes with two useful chapters on how to appraise risk assessments and on the setting of environmental health criteria. Following from this are eight appendices that describe key issues for applying EHRA to particular circumstances, such as contaminated sites,

air pollutants, food, water, cancer and microbial risk assessment. Also described in the appendices are various Australian and international models of risk assessment.

Overall, these Guidelines provide a comprehensive overview of the health risk assessment process, and provide a sound framework for EHRA. The Guidelines will be of great benefit to environmental health practitioners and managers in government when preparing or reviewing risk assessments, as well as for other persons

preparing risk assessments of environmental health hazards. When used in conjunction with the other publications of the enHealth Council (e.g. Health Impact Assessment Guidelines), these Guideline documents are bound to have a positive impact on environmental health practice and on the decision making processes surrounding environmental health risk management. As such, I would highly recommend these Guidelines to environmental health practitioners and scientists and suggest that they are always readily accessible.

Note

Pdf versions of these Guidelines and the full range of other enHealth publications are available through their website: <http://enhealth.nphp.gov.au/>

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