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The Australian Water Association is an independent, not-for-profit association for water professionals, with an overarching mission to promote the sustainable management of water. AWA is Australia's peak water industry association, being the largest and most broadly based.

It represents and connects individuals and organisations working around the nation, integrating ideas and knowledge among people involved in regulation, consultancy, research, management and operations, drinking water, wastewater and stormwater disciplines.

AWA is represented in sectors including engineering, utilities, science and research, and manufacturing and has over 4,000 individual and 650 corporate members, nationally.

For latest updates, detailed program information and online registration visit: www.ozwater09.com.au

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Chairman's Welcome



Welcome to Ozwater 2009, the AWA's 23rd national conference and exhibition since the inaugural convention held in 1964.

Ozwater and AWA are synonymous with quality water conferences and exhibitions. In these days of water's enormous profile in all sectors of government and the wider community, there are many forums for discussion.

Ozwater is the pinnacle for balanced and informed presentations and debate, along with networking with more than 1000 national and international delegates.

Ozwater 2009's theme "From Challenges to Solutions" acknowledges the emerging and current solutions for the many challenges facing the water industry such as climate change, water shortages and skills shortages. These solutions are essential to ensure sustainability, not only for water but for the whole planet.

Australia is at the forefront in many aspects of water management; water resource management, water conservation, asset management and institutional arrangements are just a few examples. A further consideration is the interdependence of rural and urban user needs and the careful balance required between them. However, we are not alone in the challenges and it is important to ensure that the latest international trends and learnings are presented.

Consequently some 12 eminent speakers encompassing experiences, challenges and solutions from within Australia, Europe, Asia, the Indian sub-continent and the Americas are presenting under the themes of:

- Integrated Water Management
- Water and Wastewater Systems and Processes
- Policy and Strategy
- Emerging and Innovative Technologies and Research

The keynotes are supported by some 200 platform papers and a multitude of poster papers chosen from over 500 abstracts.

Choosing the papers was a challenge for the Program Committee and the band of paper reviewers; the outcome has been assurance of quality across the many subjects of importance to the water industry.

AWA's national partner, the Water Services Association of Australia, and international partner, the International Water Association, have their specialist themes integrated to ensure a balanced program.

Ozwater 2009 also presents the largest exhibition of water technologies, processes, equipment, materials and intellectual property ever assembled in Australia. The wide range of major multi-faceted companies, along with specialist suppliers of goods and services, ensures the opportunity to view and touch and to discuss particular needs with exhibitor's experts in one location.

Talking location, Melbourne's convention and exhibition complex is unique in providing an opportunity to get some fresh air while moving between the venues, something we should all take advantage of.

The famous Ozwater networking opportunities will be here – the welcome reception, the gala dinner, the exhibition drinks and the breaks throughout the day mean that you will be able to catch up with old acquaintances and make new ones.

Specialist workshops on Sunday and technical tours on Thursday provide opportunities for that little bit extra that the main conference and exhibition cannot cover. And accompanying persons have not been forgotten – a program has been organised to enable you to meet other accompanying persons and have the opportunity to experience some of the inimitable features of Melbourne and its surrounds.

Ozwater 2009 has all the ingredients to continue the internationally-acclaimed conference and exhibition established by previous Ozwaters. The only other ingredient is you – the delegates. I invite you to come along and contribute to the solutions required to the many challenges facing the Australian and international water industries.



Allen Gale
Chairman,
Ozwater 2009 Committee

Invitation from AWA's Chief Executive



Water is not just 'Flavour of the Month' it seems; when it comes to topical issues, water is 'Flavour of the Decade'. This is a double edged sword for those in the water industry. It is wonderful to be recognised, to be busy and to have lots of interest in our endeavours. The flip side however is that we all find it very hard to make the time to attend conferences.

But it is exactly because of the criticality of water and the demands placed on us as water professionals that we need to make time. The depth and strategic significance of the challenges that confront us – in Australia and around the world – demand innovative thinking and new approaches and technologies. Whether we are water professionals or we just have an abiding interest in water matters, it is important to take time to reflect; to share our experiences and learn from others; and to celebrate the achievements of our peers. This is the essence of Ozwater.

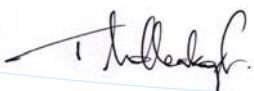
For over forty years now the Australian Water Association has brought together the best and brightest to explore and challenge. Ozwater is without doubt the biggest and best event on Australia's national water calendar. It offers:

- Leading national and international keynotes and invited speakers
- A comprehensive and substantive program of papers, peer reviewed to deliver outstanding quality and relevance
- An extensive exhibition
- Further support through parallel meetings, events and workshops

What makes Ozwater unique is its value proposition; it is run by and for the benefit of water professionals. Behind the scenes there has been a mountain of work done by Allen Gale (the Conference Chairman) and the Committee. Every one of these people is a volunteer who has committed their time and talent to delivering this event. It has been time well spent, as can be seen by the quality of the program and associated activities.

Occasionally one hears the complaint that Ozwater has too much on offer; that delegates cannot attend all the presentations that they would wish to. AWA makes no apology for the extensive coverage of topics and the breadth of the program on offer. What it means is that, whoever is the delegate, their investment in Ozwater will be amply rewarded.

I look forward to welcoming you to Melbourne for what will be an outstanding event.



Tom Mollenkopf
Chief Executive
Australian Water Association

From Challenges to Solutions

Ozwater is an event like no other, organised by the industry for the industry where the issues that drive the industry are discussed and future directions decided. Ozwater '09 will take place at the Melbourne Convention and Exhibition Centre, 16-18 March 2009 and will address the wide ranging issues that face the water industry today. These include major national water reforms, climate change and its impacts, technological advances and the challenges of human resources to name a few.

The theme for Ozwater '09 is 'From Challenges to Solutions' where the conference will address some of the important issues that impact on our industry. The Ozwater '09 Conference will feature inspirational international and national keynote speakers, numerous invited speakers, scientific and technical papers, case studies, workshops and poster sessions. This will be a water industry opportunity like no other to network and engage with industry leaders and experts from all over Australia.

As well as an international-standard three day conference, a major component of the event will be an extensive Ozwater '09 Trade Exhibition that will showcase the best of what the industry has to offer. Leading organisations from around the world will participate, exhibiting their products, services and innovations. In addition to the Ozwater '09 delegates, it is anticipated that thousands of trade visitors will attend the free exhibition. An exciting new floor plan layout will ensure maximum interaction between exhibitors, delegates and trade visitors.

There will be extensive multi-level networking and social activities that will offer the opportunity to engage leaders and industry experts on an individual basis and discuss and share issues important to you. No other water industry event in Australia receives the support or promotion as does Ozwater.



CONNECTING DISCOLOURATION COMPLAINTS TO EVENTS IN POTABLE WATER SUPPLY SYSTEM IN PERTH, WESTERN AUSTRALIA

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ABSTRACT

One of the key performance and compliance indicators for the water industry is customer complaints about discoloured water. In order to understand the usefulness and effectiveness of complaints data analysis, a case study was conducted in water supply zone in Perth, Western Australia. The desktop study evaluated a range of parameters and their association with discoloured water customer complaints over a five years period. Effects of main breaks on customer complaints were investigated. The study area was divided into ten supply zones. Initial analysis revealed that complaints happen in batch following a very long periods of isolated complaints. The percentage of batch complaints, defined as two or more complaints received in a single day from a single suburb, accounted for about 71% of all complaints received over five years.

Approximately 54% of all discoloured water complaints or 77% of all batch complaints over five-year case study period were attributable to burst water mains. This is a significant finding in understanding the cause of the customer complaints. The rest didn't have an association with main break events. Although it is difficult to find obvious reasons, unrecorded operational changes, fire fighting and maintenance activities might account for the rest. The results, therefore, indicated that events are the major causes of discoloration complaints albeit the presence of material causing discoloration in pipes is a prerequisite.

INTRODUCTION

One of the key performance and compliance indicators for the water industry is customer complaints about discoloured water. Such discoloration is frequently caused by particulates from the reticulation system appearing at the customer tap. Little is understood of the origins of such material, yet it may cause between 60 and 80% of water quality related customer complaints.

The number of customer complaints due to discoloured water varies greatly over the world; in the Netherlands the annual average figure is 0.5 complaints per 1000 customers, 4 contacts per

1000 properties in UK, and the average in Australia is 6 complaints per 1000 customers. Within Australia there is a large variation ranging from 1.1 to 17.9 complaints per 1000 customers (Sandra K. 2007, Vreeburg and Boxall 2007, Prince et al. 2003).

In 1990, about 1,200 water quality complaints were registered yearly by a representative Dutch water utility which serves approximately 530,000 connections. In 2004 this number has decreased to approximately 250 per year. The decrease of complaints is ascribed to improved water quality management and the results of 10 years of joint research on the nature and causes of discoloured water. Discoloured water, caused by long-term accumulation and formation of sediment in drinking water networks, can basically be prevented in three stages: sufficient water treatment at the plant; removing sediment adequately through pipe flushing; and creating hydraulic conditions which prevent long-term settling of sediment (Van et al. 2004).

The use of customer complaints to identify discoloration risk is useful, but it is not suitable as a quantification tool. A customer complaint is a very subjective. This is neither reproducible nor reliable. Customers with bathtubs might have a higher complaints rate than customers with showers, since the discoloration of the water will be easily observed. The longer the discoloration lasts, the larger the risk of a customer complaints. Customers tend to get used to a certain level of discoloured water and stop reporting to the water utility. In most countries the number of customer complaints determines the cleaning frequency.

There were several other factors that appeared to affect the likelihood of dirty water customer complaints. These were: the size and nature of the incident particles; the complexity of the associated reticulation network; the presence of an undulating topography in the street of concern; and the presence of a dead end (Polychronopolous et al. 2003).

Polychronopolous et al. 2003 found that there was an apparent contribution from topography (streets with an undulation) and street location to the incidence of customer complaints, based on their desktop study for South East Water in Melbourne.

Dead end streets had a disproportionate number of dirty water customer complaints relative to through streets, comprising some 10% of the streets in the zone, but accounting for almost 50% of the customer complaints.

Previous studies were inconclusive regarding contribution of break main events to dirty water complaints. For example, two separate studies concluded that the events that trigger these complaints are largely unknown (83%) with 17% attributable to system management and operation (Prince et al. 2001, Polychronopolous et al. 2003). In a real distribution system, it is hard to account for all operational changes. However, it is possible to analyse major incidents and understand how complaints pattern varies.

To separate the incident related complaints, it is necessary to separate the complaints into at least two categories: the first is when a suburb registers batch complaints in a single day and the second is when a suburb registers isolated complaints in a single day. The former one can be suspected to be due to some form of incidents. The later one is considered to be due to other reasons. In this study, efforts are made to understand the connection between discoloured events and customer complaints by separating the batch complaints from isolated complaints.

STUDY SITE DETAIL

In order to understand the usefulness and effectiveness of complaints data analysis, a case study was completed. Zone 1 water supply situated in Perth, Western Australia was used. The zone is controlled by Water Corporation of Western Australia. It was selected, because it has exhibited high levels of customer complaints relating to discoloured water, thereby providing a large amount of relevant data for analysis.

The Zone 1 water supply is located in the city of Perth, Western Australia and is situated north of the Swan River. It supplies water to approximately 33,000 properties.

The Zone 1 area is made up of a number of Perth suburbs, which are fed by two reservoir systems. The two systems are known as Tank 1 and Tank 2. Both reservoirs receive treated water from the same source. The source water itself is made up of both treated ground and borehole water. The treated water is separated into two reservoirs due to topographical conditions in the area. The two supply reservoirs service different suburbs within the Zone 1 area. The following details the different suburbs serviced by each reservoir:

Tank 1: A, B, C, D, and E

Tank 2: I and J

Both tanks 1 and 2: H, F, and G.

DATA AND METHOD OF ANALYSIS

Five years worth of discoloured water complaints data for all the associated suburbs were analysed.

The complaints data extends from 01 January 2003 to 31 December 2007. These data provides an extensive detail of complaints trends for the Zone 1.

Complaints were separated into two categories. The first is the batch complaints, more than two complaints occurring in a single suburb and on a single day. The second is isolated complaints occurring sparsely. Dates and suburb of distribution system events are matched with complaints. When matching, efforts are made to take the flow direction.

RESULTS AND DISCUSSION

To gain a clear visual understanding of the trends, Figures 1 and 2 were produced. The graphs show the complaint percentages and how incident related complaints (or batch complaints), defined by more than two complaints registered in a single suburb and in a single day, varied over five years period of analysis. Figure 2 shows the percentage of complaints that are associated with batch complaints. The percentage of batch complaints was ranging between 40 and 80% with an average of 71% over five years, indicating the significance of such complaints.

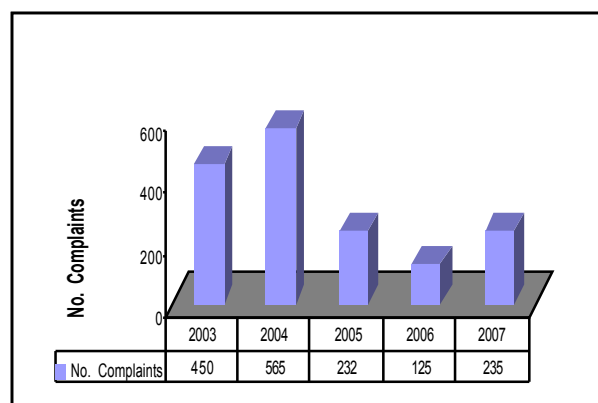


Figure 1: Number of complaints over five years period of analysis.

Figure 3 shows the number of complaints/1000 persons during the five years (2003–2007) vs. suburbs. It provides evidence of how customer complaints were recorded across suburbs. Australian Drinking Water Guidelines recommend a customer complaints level 4/1000, by 2013 the level is expected to drop to (3 complaints/1000 persons).

On average, the suburbs which belong to tank 1 (A, B, C, D and E) recorded the highest complaints/1000 persons and the suburbs which belong to tank 2 (I, and J) recorded the lowest complaints while the suburbs which belong to both Tank 1 and Tank 2 (F, G) are in the middle, except H which shows the lowest average comp/1000 person. Air scouring took place in suburbs served by Tank 2 system between

9/10/2003 and 11/11 /2003, but not in Tank 1 system. The discrepancy might be due to difference between Tank 1 and Tank 2 distribution systems in terms of air scouring.

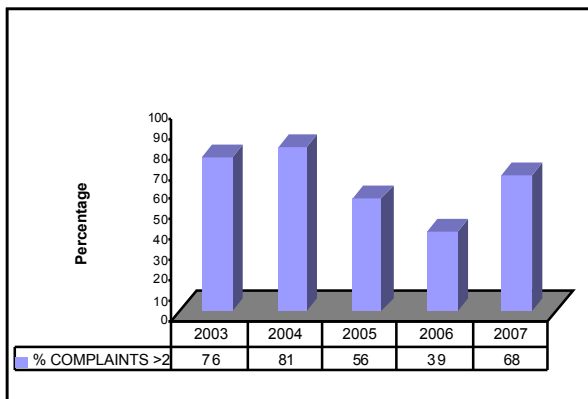


Figure 2: Percentages of batch complaints, more than two complaints registered in a single suburb and in a single day, over five-year period of analysis.

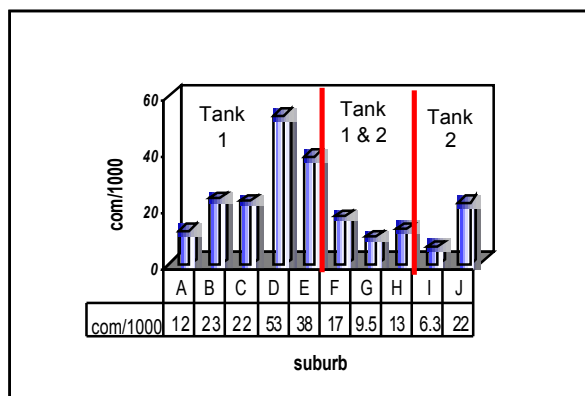


Figure 3: Summation of customer complaints/1000 vs. each suburb for five years from 2003 to 2007.

RELATING DISCOLORATION PERIODS TO RECORDED ACTIVITIES/FAULTS

Earlier it was shown that out of all complaints about 71% complaints were batch complaints. It is also important to relate high complaint periods to associated water activities/ faults that were completed or occurred during periods of high customer complaints. For example, certain maintenance activities or pipe bursts. This is because only burst pipes or fire hydrant maintenance are recorded but not other hydraulic events. Therefore, pipe bursts and fire hydrant maintenance activities were matched with original complaints data, especially by identifying discolouration events. A discolouration event can be defined as a period when an abnormally large number of customer complaints relating to discoloured water occurred, whether it is in one particular suburb or across a number of suburbs.

Such analysis revealed that approximately 54% of all discoloured water complaints over five-year case study period can be attributed to burst water mains. In other words, about 54% of total complaints or 77% of batch complaints can be attributed to burst water mains or fire hydrant operations. This is a significant finding in understanding the cause of the customer complaints. Figure 4 shows the relation between burst pipes and number of complaints. Some adjacent suburbs were affected by each other; for example: the burst pipe in D affected on number of complaints at E, because it is downstream of D.

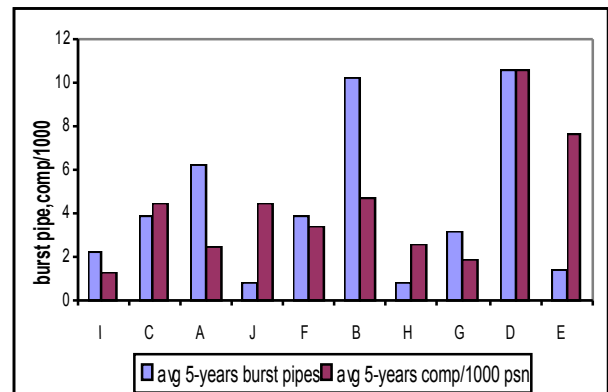


Figure 4: The 5-year summary of burst pipes and complaints/1000 person for all suburbs.

Table 1 provides details on the high complaints periods that were recorded over 2003 and the associated activities/faults that were recorded by the Water Corporation during those periods. From an initial inspection of all cases, where an associated activity could be identified, either a burst water main or the replacement of fire hydrants was the cause for the discolouration. For almost all cases except for one or two isolated discolouration events, which had no obvious cause the complaints were on a single day, or low and spread across a number of days. These events can therefore be considered as minor discolouration events and their respective causes were most likely localised and not usually associated with discolouration events. It is therefore, simpler when understanding specifically why such activities/faults lead to discolouration issues and forming appropriate recommendations to deal with the problem.

Although the majority of complaints could be attributed to burst water mains, there were still events, which had no obvious cause. In addition to the possible causes previously mentioned, another possibility for the complaints is from pipe bursts which occurred some time before or after the high complaints dates and therefore, were not recorded as associated activities/faults or hydraulic reasons. Hence, it needs further investigation, when new discolouration events are recorded in the future.

Figure 5 shows the number of burst pipes and complaints/1000 person over five years period of analysis. As shown in this Figure there are good agreement between the number of burst pipe and com/1000 person except some suburbs which have a high number of complaints with small number of burst pipe because it was affected by burst pipe in neighbouring suburb, which is upstream. For example, E was affected by D.

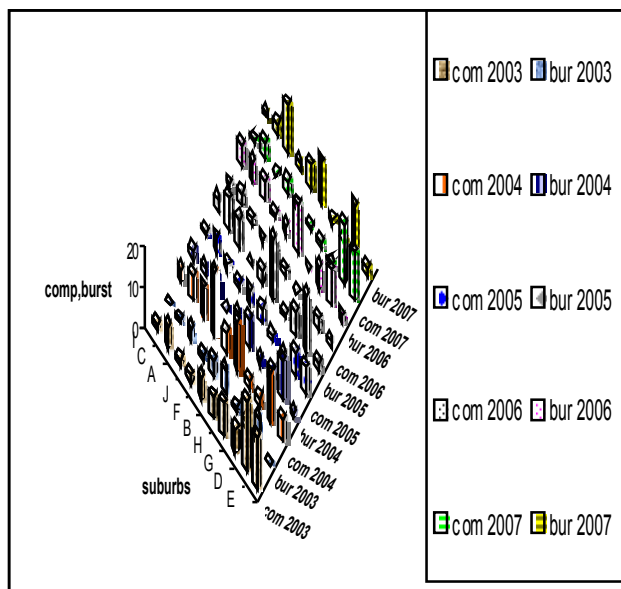


Figure 5: Discoloration complaints events and burst pipe events over five-year period of analysis.

SUMMARY AND CONCLUSION

In general suburbs which had higher population and the ones at the end of the supply system registered more complaints. All the complaints received by Water Corporation were sorted into two categories to understand the usefulness of customer complaints analysis and its relation to hydraulic disturbances in the form of events such as fire hydrant replacement or main breaks. Batch complaints, defined as more than two complaints received from a single suburb in a single day, accounted for about 71% over the five-year period of study.

Out of those 71% batch complaints, events such as burst main or fire hydrant replacement accounted for almost 54%. The rest of the batch complaints did not have an associated specific event recorded. Although it is difficult to find obvious reasons, unrecorded event, or hydraulic disturbances within Water Corporation might account for the rest. These events could be operational changes, fire fighting and maintenance activities. The results, therefore, indicated that events are the major causes of discoloration complaints. Logically the air scoured suburbs recorded lower complaints per 1000 persons, indicating possible role of the presence of material in the pipe at the time of disturbance.

Overall, the study provided a clear evidence of link between discoloration event and hydraulic disturbances, mainly main break events and fire hydrant replacement. Although air scouring improved no of complaints/1000 persons, frequency of break main events did not stop complaints from occurring. Sediment accumulation is a prerequisite for complaint to occur. Therefore, improvement on frequency of break main events and careful management of fire hydrants can greatly help improve the number of complaints as well as understanding of accumulation of sediments.

ACKNOWLEDGMENT

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Table 1: Discoloration Events and Corresponding Faults/Activities

DISCOLOURATION EVENT				CORRESPONDING ACTIVITIES/FAULTS		
Event	Date	Suburbs	No. Com.	Activity/Fault Type	Date of Activity	Suburbs of Fault/Activity
1	01/01/03	D, E	32	Burst Water Main	01/01/03	D
2	06/05/03 to 14/05/03	C, D	24	Burst Water Main Burst Water Main Fire Hydrant Replace	06/05/03 10/05/03 06/05/03 to 14/05/03	D D C, D
3	09/06/03 to 23/06/03	A, B, C, D, E, F	43	No Obvious Cause	-	-
4	17/08/03 to 27/08/03	A, B, C, D, F, G, H, I, J	59	Fire Hydrant Replace Burst Water Main Burst Water Main Burst Water Main	16/08/03 20/08/03 22/08/03 25/08/03	D D G C
5	01/09/03 to 09/09/03	D, E	63	No Obvious Cause	-	-
6	04/10/03 to 12/11/03	A, B, C, D, E, F, G, H, I, J	130	Burst Water Main Burst Water Main Burst Water Main Burst Water Main Air scouring of Tank 2 system	06/10/03 16/10/03 23/10/03 03/11/03 11/11/03 9/10 /2003 - 11/11 /2003	F F D J D