



Thematic Week: Water services for supply and sanitation

Thematic Axis: Technological capacity, determining factors and solutions

Title: Pressure management in water supply networks. Technological means

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Summary:

Pressure Management is the foundation for effective leakage management.

In many countries it has been widely recognized for at least 30 years that pressure has a fundamental influence on average leakage rates in distribution systems and therefore an ever-increasing number of countries and Utilities are now recognizing that good pressure management is the fundamental foundation of good leakage and infrastructure management.

The weight of evidence now available, and the ever improving reliability with which technical and economic predictions can be made, are such that progressive Utilities can no longer afford to ignore investigating possibilities of pressure management in their systems.

Pressure management for leakage control, in its widest sense, can be defined as “The practice of managing system pressures to the optimum levels of service ensuring sufficient and efficient supply to legitimate uses and consumers, while reducing unnecessary or excess pressures, eliminating transients and faulty level controls all of which cause the distribution system to leak unnecessarily”

In many cases pressure management addresses not only the effect of real losses but also the cause making it one of the most efficient tools for sustainable control of real loss.

Pressure management programs often have positive impacts on apparent loss reduction and revenue recovery, especially in relation to theft and authorized unbilled consumption. Where customers have roof tanks, pressure management often improves effectiveness of ball valve closure, and improves metering accuracy by reducing the duration of extremely low flows (‘ball valve tails’) which some meters cannot record.

The presentation will show how simple is the idea of implementing a pressure control system and, yet, how effective can be this system be for leakage management.

Key words: Economic; Leakage, Pressure-Management, Pressure Control Valve (PCV).

Introduction:

The aim for this paper is to show how straightforward the installation is of pressure control, how effective pressure control can be at sustaining leakage levels and the economics of pressure control. This will be demonstrated by using three case studies from Campbeltown and Tarbert in Argyll and the City of Inverness all from the Highlands and Islands of Scotland.

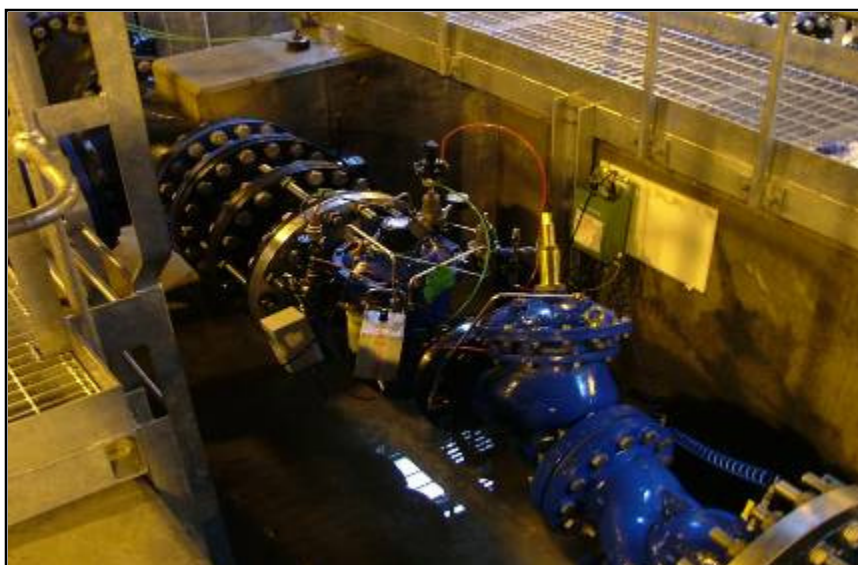
Installation of Pressure Control:

Pressure control can be as simple as this example:



This example uses a 50mm BERMAD model WD-923 hydrometer with low flow bypass on a 90mm HPPE water main. Install cost was approximately 6000 Euros. Install time is approximately 1 week including the chamber and cover.

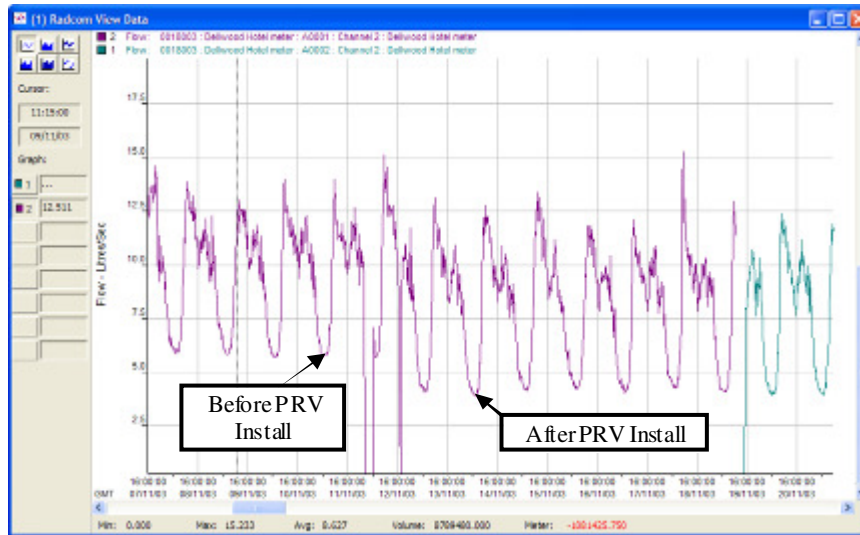
Our pressure management schemes can be as complex as the Inverness Quads; pressures are reduced from 175 meters down to 17.5 meters at night:



The above install took six months to construct as the chamber is 6 meters deep and the flanges and all fittings are PN25 rated. The install cost was 850,000 Euros.

Effectiveness of Pressure Control:

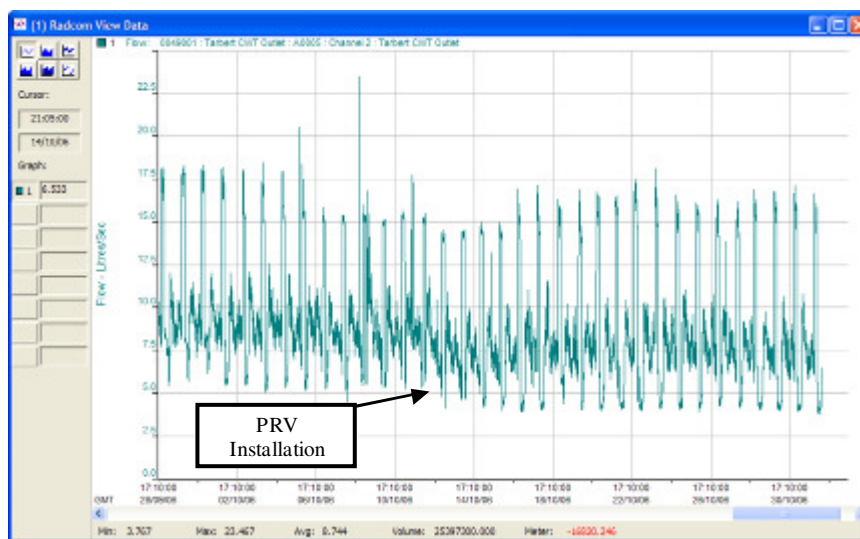
The effectiveness of a pressure control scheme must be measured by data collected prior to and after install. In Campbeltown we created a pressure controlled area by removing a Kent Helix 3000 meter and replacing it with a 100mm Bermad model WD-923 pressure reducing and sustaining hydrometer. This allowed the continuous monitoring of the flow data to measure night line reduction, also to control and monitor the pressure and allow at a later date the installation of electronic pressure control.



There are a number of important factors that relate to the monitoring of the effectiveness of a Pressure Managed Area (PMA):

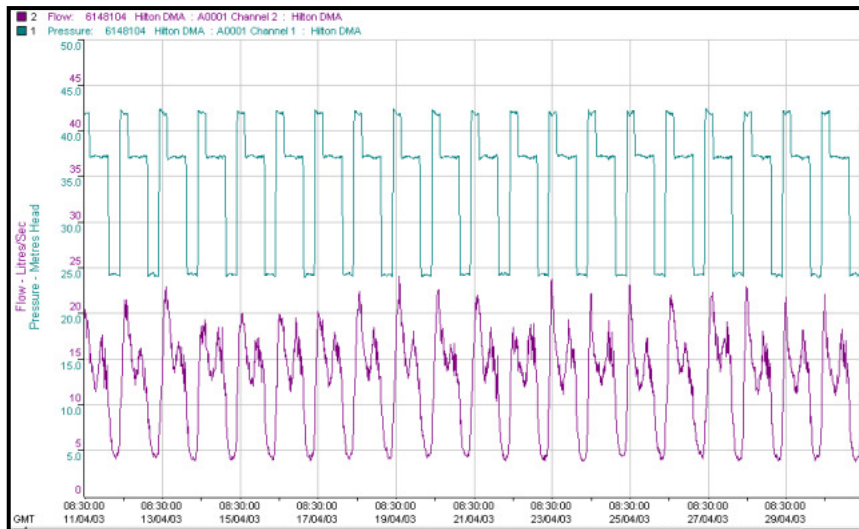
1. Flow data monitoring – Daily Input volume and Night line monitoring.
2. Inlet and Outlet Pressure monitoring – indicative of PRV effectiveness, servicing requirement and available night time pressure control.
3. Burst frequency – Measure of burst frequency before and after installation.

This graph demonstrates the reduction on a Distribution Input (DI) meter at Tarbert WTW in Argyll of a scheme that was commissioned in October 2006:

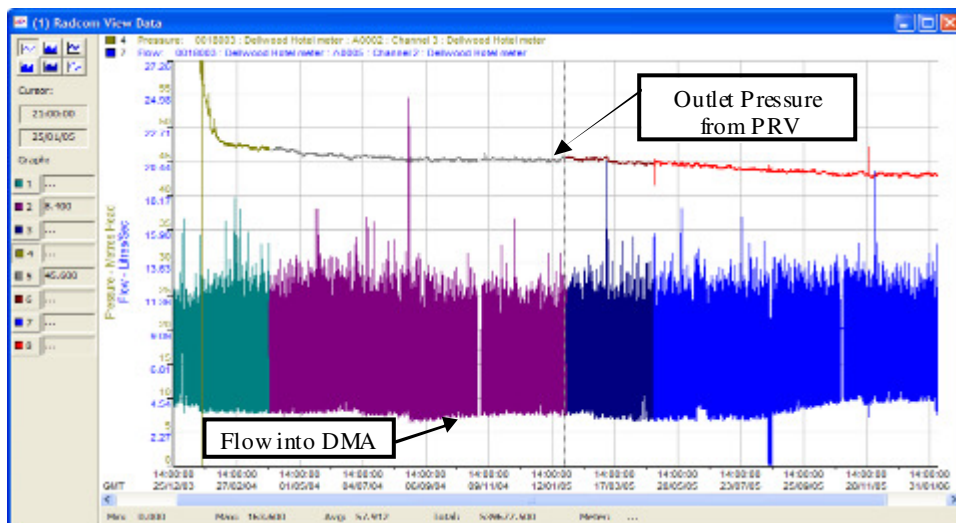


As you can see a nightline reduction of 1.2 l/sec has been attained through pressure control.

This is a graph of one of the Inverness Quads showing its performance reflected in a DMA downstream, the top graph is pressure and the bottom the flow into the DMA :



In Campbeltown the effectiveness of pressure management on long term sustainability of leakage is demonstrated by the maintenance of a low natural rate of rise of the nightline. This resulted in the Campbeltown WOA nightline being managed between 15 – 20 l/sec, previously this area was running at 30-35 l/sec.



Economics of Pressure Management:

The technical benefits of pressure management are clear but the economics require a clear precise measurement of network activity – numbers of burst pipes and services, costs of repair, burst reoccurrence rates, measurement of water lost and most importantly the nominal cost of water per cubic meter. In Scottish Water there are systems that can measure all of this but we still cannot state the cost of water per m3 per WOA.

Economic example of Tarbert in October 2006

I have assumed a cost of water per cubic meter of 30 cents (Euro).

Activity	Costs	Savings
Chamber Construction	11000 Euros	
Pressure Control Valves	4500 Euros	
Loggers	3750 Euros	
Total Cost of Install	19250 Euros	
Maintenance of PRV's	1200 Euros per year	
Cost of Water saved – 120 cubic meters per day		13,140 Euros per year
Burst reductions – 6 bursts per year at 850 Euros per burst		5,100 per year
Active Leakage control (ALC) costs (2 weeks per year)	6000 Euros per year	
Totals	19250 Euros install 7200 Euros per year	18,240 Euros per year
Payback	$19250 / (18240 - 7200) = 1.75 \text{ years}$	

This example shows that even allowing for maintenance of the PRV's twice per year, two ALC sweeps per year the payback period for a Pressure Management scheme is about 1.75 years.

The effective life of a PRV is typically 20 years.

Closing Statement:

At this point we should pause and reflect. Pressure Management is only one of a number of tools to reduce and manage leakage but it is the one tool that will pay you back many times more than leakage detection. Pressure management must be carried out only after the creation of DMA's, active leakage control is in place and working and a system of monitoring of pressure critical points has been installed. Then and only then can you effectively install, monitor, measure and maintain a pressure management system.

Pressure and flow control valves, correctly maintained, controlled and monitored are one of the most effective methods of creating a sustainable leakage management system.

References:

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