HSE Water Leak Detection

This fact sheet provides guidance to HSE Estates/ Maintenance Managers on water conservation and leak detection. The HSE spends €8m per annum on water supply and waste water treatment. Water costs vary considerably across the country from a high of €3.04 per m3 to a low of €1.49 per m3 (2015). However, 20 out of 34 Local Authorities, charge above the national average €2.31 per m3.

The Irish national average for **Unaccounted For Water (UFW)** is 42% (2008) which is double the UK average. Forfas indicate that the majority of UFW (58%) occurs on the consumer pipe work from boundary stop cock. Greater then average UFW can be found in the following in distribution networks; Wasterford, Galway, Ballina, Ennis, Killarney, Tralee, Athlone, Letterkenny, Castlebar, Mullingar and Tuam.

The primary objective of leak detection is to establish and then reduce the level of Unaccounted For Water in healthcare water systems. High levels of UFW are a waste of water resources and expenditure but can also cause problems including;

1. Recontamination of treated water
2. Reduce water pressure at the outlets
3. Reduce in number of hours of storage capacity

The implementation of water conservation requires accurate information on water flow into the water system, to determine the level of UFW. Various leak detection and control techniques can then be used to reduce leakage, or prioritize pipeline repair/ replacement on a value for money basis.

Flow rates of individual leaks and bursts etc. are pressure dependent. Input Water Pressure should be 2.2bar or 22psi as the minimum desirable level, with 4.5bar or 65psi the maximum desirable level. Above 4.5bar pressure reduction measures (i.e. install pressure reducing valves) should be considered. High pressure can increase UFW levels, while lower pressures can cause service problems at the water outlet. There are 3 main types of leakage;

1. Small background losses which seep from pipe work joints etc.
2. Reported bursts, where water is visible on the surface or supply interrupted.
3. Unreported bursts which show no visible signs above ground.

Small undetected leaks over a long period of time are more expensive than obvious pipe bursts which are addressed relatively quickly.

Water Meters

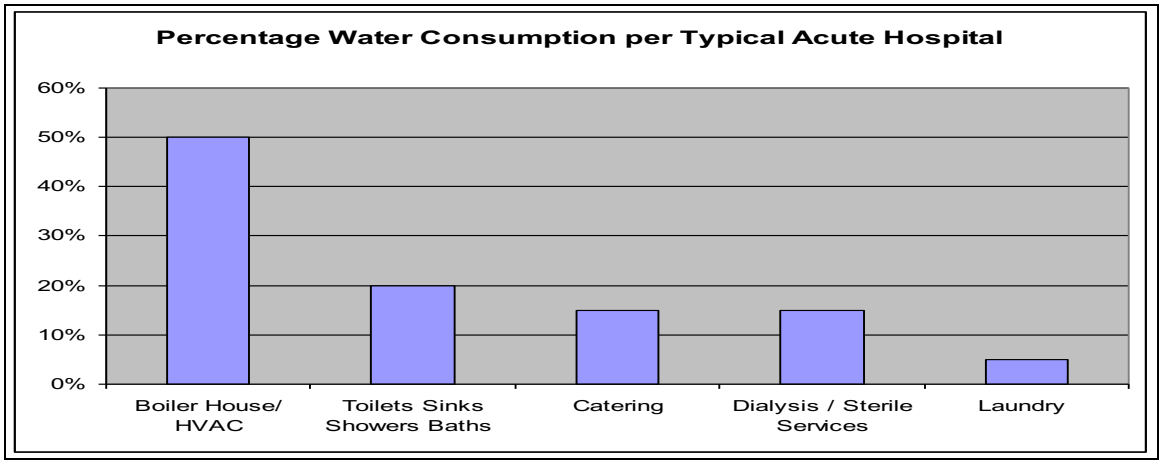
Appraise the accuracy of water meters (turbine or electromagnetic (pulse). The accuracy of turbine water meters deteriorate with the volume of water throughput, and the length of time installed. Meters should be sized proportional to the flow rather that to the diameter of the water mains pipe. Check meter calibration and verify the unit volume in which the meter is recording i.e. litres or gallons.

The following water operational records should be prepared and reviewed:

1. Schematic Drawings of Water Infrastructure System.
2. Average and Maximum Flow meter readings
3. Input Water Pressure readings (Typically 2.2 Bar or 22 psi minimum)
4. Water infrastructure (pipes, valves and hydrants) condition survey
5. Local Authority Water Invoices.

Water Audits

Temporary additional sub metering may be necessary to confirm the performance of a permanent meter or when flow readings are required from a pipeline that cannot be taken out of service. Data Loggers are electronic devices capable of capturing data from flow meters and/or pressure sensors. Data Loggers provide active management of the water system, particularly the control of water leakage.



The Minimum Night Flow calculation requires data logged Night Time Flows in order to get the Minimum flow, which typically between the hours of Midnight and 06:00am, when demand is at its lowest. The Minimum Night Flow is then broken down into components of legitimate demand which, when subtracted from the logged minimum flows provides an estimate of Unaccounted Water.

UFW = Minimum Night Flow – Accounted for Water @ Minimum Flow Hour

(Accounted for Water = Metered Demand + Unmetered Demand @ Minimum Flow Hour)

Performance Indicators for Unaccounted for Water can be expressed by i) volume m3/day ii) by property or connection, litre/property/hr, or by iii) mains length, m3/m/hr which is most common. Healthcare water usage is expressed as Litres per Patient Bed Day.

Table 2 Water Usage Guidelines (Litres per Patient Bed Day) Courtesy Thames Water UK.

Litres per Patient Bed Day	Acute Hospital > 100 Beds	Long Stay Hospital > 25,000 Patient Bed Days per Year	Long Stay Hospital < 25,000 Patient Bed Days per Year
Good	**< 530**	**< 330**	**< 217**
Average	**531 - 700**	**331 – 411**	**218 - 297**
Poor	**711 – 1,137**	**412 – 689**	**298 - 379**

For more information on water conservation refer to HTM 07-04 Water Management and efficiency for healthcare buildings.

Determine Leak Location

There are a number of techniques used for leak detection and location, depending on the particular application. Leak noise correlation relies on the principals of soundings i.e. detecting noise generated by a leak. This involves a correlator with two sensors, which use cross correlation to determine the difference in time it takes leak noise, travelling along the pipe wall, to reach the two sensors. When the difference in time between the leak noises reaching the two sensors is measured, and the velocity of sound in the pipe is known, then the position of the leak relative to the sensors can be calculated. Noise correlation is most successful on metallic pipes. Alternatively direct Soundings using an electronic sounding stick is more successful on plastic or cement pipes.

L= ½ (D - (V x Td))

D = Distance between the two Correlators.
L = Shortest distance from Correlator to Leak.
V = Velocity at which leak noise travels in the pipe material.
Td = Time difference between sound arriving at each Correlator.

The main disadvantage of direct soundings on valves, hydrants, stop taps, and other pipe fittings, is that it will only identify the leak noise at the accessible pipe fitting. And unlike noise correlation it will not pin point the exact location of the leak between the pipe fittings. Leak noise Soundings Operator experience is important in achieving satisfactory results. There are a number of water leak detection specialist companies available in the Irish market including in no particular order: GMC, LARSEN Water Management, Lowflo and SES Water Management.

References: Water Services Training Group – Guidance Manual: Network Management – Leakage Control 2009.