

Austria's new guideline for water losses

● The new Austrian Association of Gas and Water guideline on water loss is an update to a previous guideline and takes into account developments in the area to give up-to-date information on water loss management. **JOERG KOELBL** and **ROBERT GSCHEINER** give an overview of the new directive and its recommendations for assessment of water loss and measures of leakage reduction.

Dealing with the issue of water loss is a core task for every water company. The recognition, measurement and reduction of water loss must be an integral part of the management of water supply systems. By observing the development of water loss over time, valuable conclusions on the condition of the pipe network can be made. The exact identification and assessment of water loss is essential for the professional management of water supply systems.

For this reason, the Austrian Association of Gas and Water (OVGW) produced a guideline on this topic – OVGW W 63 (1993) in 1993. Due to many new findings in the field of water loss management, OVGW has developed a new guideline on this issue – OVGW W 63 (2009) in 2009 – entitled 'Water losses in water supply systems: assessment, evaluation and measures for water loss reduction'.

This new guideline is a milestone compared to both the old Austrian guideline and existing guidelines in other countries. Its purpose is to give water utilities a practical instrument for the identification and assessment of water loss, and to recommend measures for leakage reduction.

The new guideline considers national and international developments in water loss management, but also focuses on practical applicability for different supply structures in Austria. The guideline provides arguments for water loss reduction (e.g. ecological aspects, hygienic aspects, economic aspects, legal aspects and aspects of supply safety) and describes the factors influencing water losses (e.g. structure of supply system, type of soil, traffic, excavation work near pipes, pressure variations, maximal service pressure and service connection density). The core part of the guideline is the water balance and quantification and assessment of water losses. It also

describes the possibilities for leakage monitoring and measures for leakage reduction, and briefly outlines how to deal with water losses in storage tanks and in private systems.

Water balance

The volume of water losses from a defined supply system for a defined time period (usually this period is one year) is calculated on the basis of a water balance. The water balance considers all the metered and unmetered volumes within the defined supply system and is the basis for the calculation of water loss performance indicators. The water balance recommended by the IWA (see IWA Water Loss Task Force article 'Assessing non-revenue water and its components: a practical approach', August 2003 issue of *Water21*, available for download at www.iwapublishing.com; also Lambert & Hirner 2000, Alegre et al. 2006) is well-established as an international standard and has therefore been implemented in OVGW W 63 (2009). A standardised water balance is a precondition for international comparisons of water loss performance indicators.

Before calculating the water balance, the boundaries of the supply system need to be defined. To maximise the part of the supply system which is considered in the water balance calculation, the system input metering should be situated as near as possible to the water production points, and the system has to include the customer meters and bulk supply meters. The Austrian situation is somewhat unusual because the meters for system inputs from springs are often situated in storage tanks. Therefore the parts of the system from the springs to the storage tanks are not metered and not part of the system defined for the calculation of the water balance.

The guideline provides instructions for the assessment of accurate water balance data, e.g. there are several tips



Pipe burst (cast iron, diameter 200mm) in Innsbruck, Austria. Credit: Innsbrucker Kommunalbetriebe.

on how to assess the unbilled unmetered consumption or how to deal with meter inaccuracies and apparent losses.

Quantification and assessment of water losses

Water losses and failure rates are important indicators for the condition of a water supply network. For a comprehensive interpretation of the condition of a water supply system it is necessary to assess both water losses and failure rates.

The new guideline describes five water loss performance indicators (PIs): water loss ratio as percentages of system input (q_{VR}); real losses per mains length (q_L); real losses per service connection per day (q_{AL}); Infrastructure Leakage Index (ILI); and ratio of non-revenue water (q_{NRW}).

The performance indicator q_{VR} is still widely used but is insufficient for a technical interpretation of water losses. The ratio of non-revenue water q_{NRW} is also not recommended for technical interpretations.

The performance indicator q_L is recommended for rural structured systems with a service connection density smaller than 20 connections per kilometre. In the new OVGW guideline the classification for this PI is based on the German DVGW W 392 (2003), where: < 0.05 , $0.05 - 0.10$ and

service connection density (No./km)	real losses per connection per day [l/(connection*d)] at an average service pressure head of											
	20 m				30 m				40 m			
	<110	110-220	220-435	>435	<165	165-325	325-655	>655	<220	220-435	435-870	>870
10	A	B	C	D	A	B	C	D	A	B	C	D
	<85	85-170	170-340	>340	<130	130-255	255-510	>510	<170	170-340	340-680	>680
15	A	B	C	D	A	B	C	D	A	B	C	D
	<75	75-145	145-290	>290	<110	110-220	220-440	>440	<145	145-290	290-585	>585
20	A	B	C	D	A	B	C	D	A	B	C	D
	<60	60-120	120-245	>245	<90	90-185	185-365	>365	<120	120-245	245-490	>490
30	A	B	C	D	A	B	C	D	A	B	C	D
	<55	55-110	110-220	>220	<85	85-165	165-330	>330	<110	110-220	220-440	>440
40	A	B	C	D	A	B	C	D	A	B	C	D
	<50	50-105	105-205	>205	<75	75-155	155-310	>310	<105	105-205	205-410	>410
50	A	B	C	D	A	B	C	D	A	B	C	D

> 0.10 m³/(km x h) indicate low, medium and high water losses.

The ILI was chosen as the decisive PI for all supply structures. Compared to other water loss PIs, the ILI also considers essential influencing factors like the average service pressure and the service connection density, as well as the mains length and the length of service connections. Therefore the ILI is the only PI that enables performance comparisons of differently structured water supply systems.

To calculate the ILI, the Current Annual Real Losses (CARL) are divided by the so-called Unavoidable Annual Real Losses (UARL). The ILI indicates the multiple by which the real losses are higher than the unavoidable annual real losses. The unavoidable annual real losses are a theoretical (reference) value which was developed and calibrated by the IWA Water Loss Task Force on the basis of statistical analysis of international data, including 27 different water supply systems in 20 countries (Lambert & Hirner 2000). The ILI is also part of the IWA PI system (Alegre et al. 2006). The UARL factors in length of mains, number of service connections, average length of service connections from property boundary to measurement point and metre of average service pressure.

The assessment of water losses is based on the World Bank Institute banding system: class A, ILI < 2, low water losses; class B, ILI 2-4, medium level of losses; class C, ILI 4-8, high losses; class D, ILI > 8, very high water losses.

For the assessment of water losses on the basis of the simpler PI qAL, 'real losses per service connection per day', a classification scheme (Table 1), which enables the consideration of the structural parameters 'density of service connections' and the 'average service pressure', is provided. This classification scheme has been created on the basis of the UARL formula. Therefore, the assessment is not only compatible with the direct ILI calculation but also enables a quicker assessment (note: also class A to D).

Measures for leakage reduction

According to the IWA methodology in water loss management, the following methods for water loss management are stated in the guideline: infrastructure management; active leakage control; pressure management; and speed and quality of repair.

Infrastructure management includes short and long term measures at different assets of the supply system for enabling an undisturbed water supply with the required quality, volume and adequate pressure. Besides a detailed description of common active leakage control of measures like district metered areas (DMAs) and several leak detection methodologies like listening sticks, ground microphones, noise loggers, noise correlators etc., the new guideline also describes an innovative alternative to DMAs for leakage monitoring. With flow measurements or combined measurements of various parameters (e.g. flow, pressure, noise) at selected points in large zones, smaller 'virtual zones' can be created. OVGW W 63 (2009) is the first water loss guideline which recommends this technology for leakage monitoring.

Because the amount of leakage very much depends on the service pressure, the guideline also describes the methodology of pressure management. Short-time pressure variations (pressure transients) should be avoided in particular. Unnecessary high pressure leads to higher burst

Table 1: Section of classification scheme for qAL, 'real losses per connection per day' (Koelbl 2009)

frequencies and increases water losses. It must be noted that the pressure management philosophy in central Europe, especially in Austria, Germany and Switzerland, is clearly different to the IWA philosophy. In these countries, pressure reduction under a level of 30 m to 40 m service pressure head is seen as an urgent measure in a system of poor infrastructure condition and is seen more as a fight against the symptoms than against the real cause. Therefore, pressure management is seen as a temporary measure and the implementation of pressure management instead of implementing necessary maintenance measures is not recommended. To assure a sustainable infrastructure management with pipe networks in good condition, it is necessary to operate the systems under adequate pressure. Of course, unnecessary high pressures should be avoided even in systems in a good condition.

The OVGW W 63 (2009) guideline appendix provides instructions for action in water loss management and gives examples of water balance and performance indicator calculation and the assessment of water losses. ●

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References

Alegre, H, Baptista, JM, Cabrera, E, Cubillo, F, Duarte, P, Hirner, W, Merkel, W & R Parena (2006): *Performance Indicators for Water Supply Services. Second Edition, Manual of Best Practice*, IWA Publishing, London, UK. ISBN 1843390515.

Koelbl, J (2009): *Process Benchmarking in Water Supply Sector: Management of Physical Water Losses. PhD-thesis, Schriftenreihe zur Wasserwirtschaft, 56, Graz University of Technology, Austria.* ISBN 978-3-85125-055-8.

Lambert, A & W Hirner (2000): *Losses from water supply systems: Standard terminology and recommended performance measures. IWA Blue Pages*, London.

OVGW W 63 (2009): *Water Losses in Water Supply Systems: Assessment, Evaluation and Measures for Water Loss Reduction. Austrian Association for Gas and Water (OVGW), Vienna, Austria. Available at www.ovgu.at*

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