

COMPONENT ANALYSIS OF REAL LOSSES

Component Analysis of Real Losses is now an internationally accepted concept for analysis of Annual Real Losses, Night Flow Analysis, and separation of Zonal inflows into components of leakage and components of consumption.

This part of the 'Concepts' Section of LEAKSSuite Library contains two early published papers by Allan Lambert in which he developed the concept of Bursts and Background Estimates of Leakage, in order to provide a conceptual background to the work of the UK National Leakage Control initiative 1991-95.

[Accounting for Losses – the Bursts and Background Estimates Concept](#) – was published in the UK Journal of the Institution of Water and Engineering Management in 1994. It was then incorporated into the UK Managing Leakage Reports published in 1995, following which it was adopted by UK Utilities before spreading to many other countries.

In the 1994 paper, the Pressure Correction Factor PCF simulating the pressure: leak flow relationship was assumed to follow the Leakage Index LI Curve, then widely used in the UK as a graph. Lambert had fitted and used an empirical equation $LI = 0.5 \times AZNP + 0.0042 \times AZNP^2$ but when John May published the [Fixed and Variable Area Discharges \(FAVAD\)](#) concept in 1995, he quickly realised and acknowledged that FAVAD was a more hydraulically correct form of equation, and became a strong supporter promoting the use of FAVAD and its simplified alternative form of the N1 power law.

In 1996, Lambert and John Morison – Allan's former colleague from Welsh Water – published a second paper [Recent Developments in Application of 'Bursts and Background Estimates' Concepts for Leakage Management](#), in which the pressure:leak flow relationship could represent 100% fixed area leakage paths (power law 0.5), or 100% variable area leakage paths (power law 1.5), or any intermediate combination of power law between 0.5 and 1.5..

The Bursts and Background Estimates was Initially known as BABE, but as internet searches for that acronym sometimes generated inappropriate results, the term Component Analysis was increasingly also used. Component Analysis and FAVAD together form the foundation for much of the international modelling of real losses which has occurred over the last 26 years, including development of an equation for [Unavoidable Annual Real Losses UARL](#) (using a simplified linear pressure:leak flow rate relationship) for the 1st IWA Water Loss Task Force published in 1999, which is used in the calculation of the [Infrastructure Leakage Index](#).

Allan's initial approach to Bursts and Background Estimates water losses in water distribution systems derived from his hydrological knowledge of the [Penman–Monteith equation](#), which approximates several components of net evapotranspiration (ET) from land and water surfaces using input combinations of a significant number of influential interacting key parameters (daily mean temperature, wind speed, relative humidity, albedo ...)

References:

Lambert, A.O. Accounting for losses -the bursts and background concept. *Journal of the Institution of Water & Environmental Management*, 1994, **8**, (2), 205-214

Lambert, A and Morrison, J.A.E, *Journal of the Chartered Institution of Water and Environmental Management*, 1996, 10, April, 100-104