

MCERTS Bulletin 14

Random versus Systematic uncertainty

MCERTS site performance requirements are for total daily volume to be measured to a target total uncertainty of $\pm 8\%$ at a confidence level of 95%.

The total uncertainty (X) in discharge is calculated at a number of flowrates across the range by combining the various component uncertainties (for example, X_c , X_b , X_n , and X_m for a rectangular throated flume). Since the component uncertainties are truly independent they are combined in quadrature (root-sum-square) and include any data treatment/telemetry error.

However, contributions to the overall measurement uncertainty may include factors which are not directly attributed to the flow measuring primary or secondary device (for example, double-counting or under-counting of "significant" flows). In this case, uncertainties are combined arithmetically (added).

Example

A rectangular throated flume is used to measure final effluent discharge. The flume is located at the works outlet. This is the only flow meter used to determine discharged flow on the site. A flow-v-uncertainty curve is developed for the primary/secondary device, based on the site survey. The Permit holder provides diurnal flow data and the total uncertainty, expressed as a percentage of total daily volume, is calculated as $\pm 4.6\%$ based on the diurnal flow data provided. Total daily volume is calculated as $90\text{m}^3/\text{day}$.

Washwater is abstracted from downstream of the flume and returned to the inlet works. Washwater is therefore double-counted. The daily volume of washwater returned to the inlet works is estimated as $<3\text{m}^3/\text{day}$ ($\pm 25\%$) or $<3.3\%$ of total daily volume.

Because the washwater is always added, the contribution to the overall uncertainty can be dealt with in two different ways:

- Ignore the effect of the washwater and add the errors arithmetically. In this case the total uncertainty for the flow measurement arrangements at the site would be $\pm 7.9\%$ ($4.6 + 3.3$)
- Set the flow recorder so that a constant $3\text{m}^3/\text{day}$ is subtracted from the recorded daily volume before archiving. In this case the total uncertainty for the flow measurement arrangements at the site would be $\pm 5.4\%$ $\{(90 \times 4.6) + (3 \times 25)\}/90$