

Sediment Monitoring for Turbine Abrasion

Sediments running through turbines cause abrasion similar to sandblasting. These situations generally arise in run-of-river hydropower plants where the absence of a large reservoir also means that river sediments run through turbines. It is generally agreed that larger sediment grains cause more damage than smaller ones. The head on a turbine is an important factor. Hardness of grains also is crucial. And, the curvature of streamlines is an important factor because it is this factor that makes sediment grains deviate from water streamlines, leading to impact on the turbine surfaces. For a given facility, monitoring sediments amounts to regular and periodic measurement of sediment concentration and *particle size distribution (PSD)*. By measuring PSD, the concentration of just the damaging large grains can be separated from the harmless fine silts. This separation is possible only with laser diffraction technology. Sequoia's LISST-Hydro and LISST-Infinite instruments are designed to obtain periodic measurements (say, at 15min. intervals) and present the results in strip charts such as one shown below.



This figure shows a display on plant operator's computer. The strip charts show (from bottom to top) total, fines, medium and coarse grain concentrations. The data are from an actual power plant.

Sequoia offers two instruments: LISST-Hydro for low concentrations, and an auto-diluting version LISST-Infinite for high concentration situations.

The instruments are installed at the intake to the turbine (or at the draft tube, but this is not recommended as particles may be broken/alterd during passing through the turbine). A sample stream passes through a measurement cell where multi-angle laser scattering is measured. This is processed to

compute the PSD. Although the PSD is available in 32 size classes, for the plant operators, only a 4-size strip chart is displayed. The PSD is reduced to a total, fine (<75 micron), medium (75 to 200 micron) and coarse (>200 micron) fraction. These size bins are based on some claims that only particles larger than 200 microns damage turbines (not credible). Different size bins can be selected by a user.

A LISST-Viewer software is integral to the system. It displays the strip charts, and it can be easily programmed to generate audible alarms when concentration in any of the 3 sizes exceeds the user-defined thresholds. The LISST-Viewer can display data from upto 5 instruments installed at a power plant.

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