Tech Note 1

14 May 2009

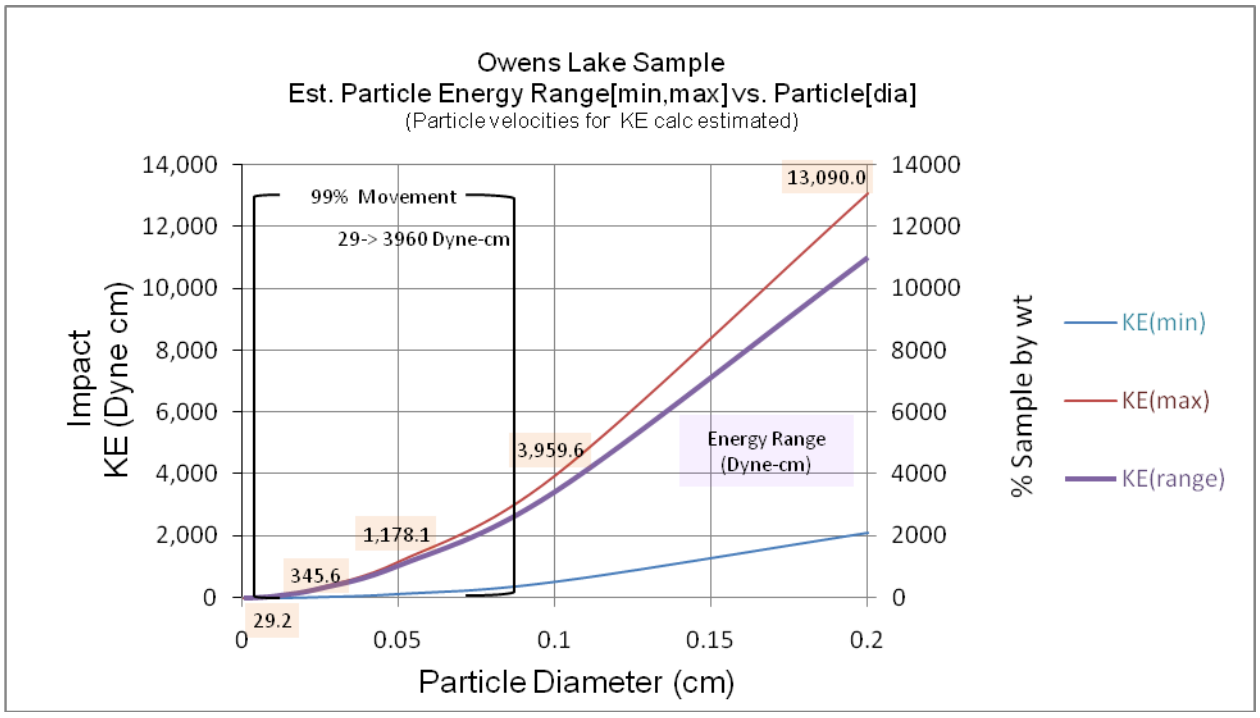
Radial symmetry response calibration

IMPORTANT

The radial symmetry response pattern supplied with your Sensit™ saltation sensor applies only to the kinetic energy output. The radial symmetry response does not apply to the particle impacts output because the energy used in the test is less than the energy of typical saltating particles. It is possible very fine particles are effected but these do not contribute to movement with any significance. And, as far as threshold determination is concerned, they do not break loose until substantial saltation is obtained.

EXPLANATION

Once a particle impact exceeds the sensor's trigger threshold, the particle count (PC) "impact" output is generated. Circuit trigger threshold for the PC output is so close to zero that virtually no data is subject to effects of crystal variations. This is especially true considering the energy range of saltating particles. The following real analysis demonstrates this effect.



This figure is an analysis depicting the percentage saltating energies typical to the fine to medium sand found at a location called "Dirty Socks Dune" at the South end of Owens Dry Lake, Keeler, CA.

Minimum and maximum KE (kinetic energy) are calculated based on;

- The minimum particle diameter traveling at a minimum estimated velocity.
- The maximum particle diameter traveling at a maximum estimated velocity.

Particle diameters used for this analysis are determined by the diameters available from a sieve analysis of a sample taken at the site as shown below.

Sieve No. 10	gm	%
10	0	0%
18	0.1	0%
35	27.8	7%
60	220.5	54%
120	134.8	33%
230	22.9	6%
Pan	1.3	0%

This data was compiled by the Great Basin Air Pollution Control District (GBAPCD), Keeler, CA.

Particle velocities are estimations based on a general rule of thumb proposed by P.R. Owen (1941) that states particle velocities are generally about $10 * U^{*(cm/s)}$.

- Minimum velocity is estimated as threshold velocity for a given particle diameter.
- Maximum velocity is estimated as $10 * U^{*(cm/s)}$.

The range of KE is the maximum minus are the minimum particle energy per particle diameter. This analysis verifies early estimates (Sensit, 1981) that anticipated particle impacting energy dynamic range should be about 10^5.

CONCLUSION

The graph shows the range where 99% of the actual field data lies despite the fact that much higher impacting energies are present. Most importantly, the particle count (PC) output is correct for all impacts exceeding the calibration threshold specification. As shown, the minimum calculated impacting energy is 29.2 Dyne-cm and sensor response threshold specification for this sensor is 9.24 Dyne-cm (for sensor gain of 10X). Therefore, using gain 10X, all impacts are counted so there is no radial symmetry concern for the PC output. The response threshold for the gain selection of 1X is 38.5 Dyne-cm. This roughly translates to missing 6% of all data, i.e., particle diameters less than 63 microns and some very low velocity data of 125 micron diameter particles. If velocities are not identified, one may say that when using the gain setting of 1X, the minimum particle diameter where data cuts off is at about 100 microns.