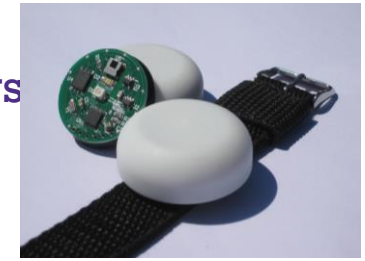
Improvements in electronic dosimeters



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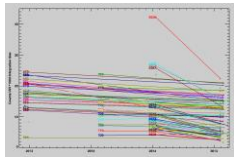
Electronic dosimeter badges have been used since 2009 to study human behaviour and health.

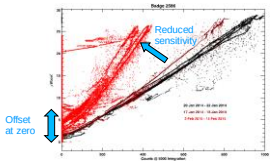
Many improvements were implemented in 2015 to enhance the instrument's performance.

Calibration stability, part 1

In 2015, we noticed that many badge calibrations have changed over the years. These changes are more significant in units produced since 2013.

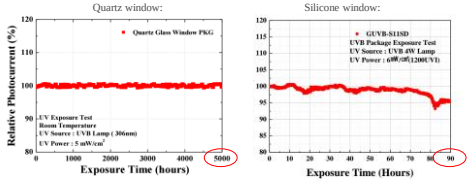


Looking more closely at each badge, we found two problems: reduction of sensitivity, and offset at low UV values.



Calibration issue #1: Reduced sensitivity

We started our investigation at the sensor. In 2011, there was a minor change in the sensor's part number. No details were provided at the time, but the manufacturer had replaced the sensor's quartz window with a clear silicone encapsulant. At our request, they provided data that shows the silicone becoming more opaque to UV with time and exposure.



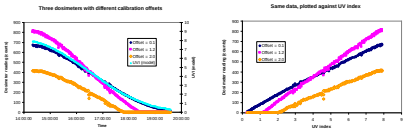
* Note the different timescales for each graph. Extrapolated over a year, this easily explains the observed reduction of sensitivity.

Resolution: After discussions, the manufacturer agreed to re-launch the quartz window version of the sensor.

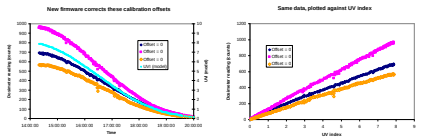
Calibration stability, part 2

Calibration issue #2: Offset

Calibration offsets have crept into some recent units returned from the field. Offsets cause insensitivity to low UV levels.

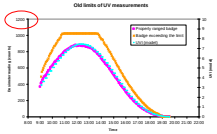


Resolution: The cause of this offset is still unknown, but an extensive firmware revision has eliminated it completely:

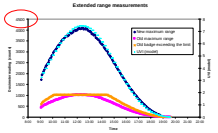


Extended measurement range

Dosimeters have an adjustable measurement range. In previous revisions, UV levels beyond this range were lost. This resulted in unusable data.

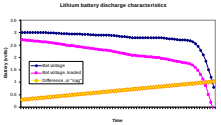


Dosimeters can now extrapolate beyond the previous upper limit, extending the measurement range.



Battery management

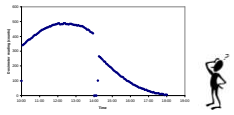
Lithium batteries are difficult to measure, as their voltage does not decline linearly as the battery discharges.



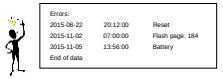
Dosimeters now measure the battery's "sag" when a large load is applied. Sag increases linearly with discharge.

Error handling

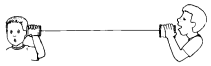
When unexpected features appear in the data, it is useful to have additional information to help understand what happened.



If the dosimeter detects a problem, like a battery replacement, static reset, or memory failure, a specific error message is logged with a timestamp. This error log is kept in a separate data space.



Communication



The communication routines have been completely overhauled, resulting in a faster and more robust link between users and their data.

Conclusion

These enhancements have further improved the quality of the UV dosimeter badge. We are very pleased with the result.

We enjoy supporting quality research, and we are proud to make such research possible.

For more information, please visit us at www.scienterra.com.