Creating a Quality Culture - Lessons Learned in IMSERC

Core Facilities Colloquium

February 8, 2019
FTIR Background

- Fourier Transform Infrared Spectroscopy (FTIR) is a technique used to characterize bonding environments in materials.

- Analysis can be performed in transmission or attenuated total reflection (ATR) modes.
Timeline

- Pre-2008: Analytical Services Lab acquired a BioRad FTS 60 from a faculty member that had not received tenure.
  - Instrument was > 10 years old
  - If a user closed lid by dropping, the detector would be knocked out of alignment and instrument would not function
  - Only one staff member able to fix
  - Finally replaced when instrument became completely inoperable

- 2009 Purchased Tensor-37 FTIR with Pike ATR attachment with Ge crystal
  - Within 2 months crystal was pitted and signal degraded.
  - Discovered through inspection. Users did not inform staff of any degradation.
  - Crystal was repolished on multiple occasions. Until it cracked beyond repair.
Timeline Continued

- **2010-2012 Ad hoc troubleshooting**
  - Replaced crystal once
  - Put lock tight and set screws on all adjustable parts
  - Stressed handling of the ATR in training
  - Still typically uncovered issues through inspection

- **August 2012**
  - Decided to switch to diamond coated crystal to avoid degradation issues

- **April 2013**
  - Crystal shattered. Discovered on inspection
  - At current rate, would need to more than double rates to replace broken crystals
May 2013 – Engaged users
- Explained issue we were observing
- Instituted pre and post signal intensity measurement with success criteria

August 2013 – Crystal cracked again!
- User was a frequent user analyzing polymers (i.e. soft) materials
- Sent whole attachment back to vendor for failure analysis
- Pike found tension on clutch 50% too high
- Repaired clutch and replaced crystal free of charge

September 2013 – Today
- No issues with ATR crystal!
Take Home Messages

- Issues were not technically difficult
- We assumed problem was related to users use of instrument
  - Lack of notification reinforced this assumption
- The disconnect between users and staff made identifying the source of the problem much more difficult
  - Users may have been accustomed to issues in the lab and not reported
  - Users may have been concerned that they would be blamed for the issue
  - Users may not have known how to recognize the problem
  - Users may have been indifferent
- Director and staff were trying to recover instrument, but were only treating the symptom
  - Neither staff, nor users had sufficient data to resolve on their own
How We Changed

- Implemented “bug report”
  - Jan 2019, this was replaced with NUcore issue reporting
  - Remember that if users are not reporting issues, that does not mean issues are not occurring
  - Cores must have a mechanism to solicit feedback from users that is a positive experience

- Built in time for quality checks into budget and make sure staff agree that times are reasonable
  - If quality is not resourced, it won’t happen
  - Director needs to have involvement with quality, or it won’t happen
  - Staff need to generate instrument characterization / study validation baseline data before an incident occurs

- Quality and safety incidents shared with group
  - Director and staff must be able to share the experience in a positive manner, while holding each other accountable

- Emphasize quality over availability
  - Cores must be able to take instruments down and inform users why it is happening
How We Changed

- Eliminated broken systems or chronic errors
  - If an instrument is important, it must be fixed or replaced
  - Don’t ask end users to troubleshoot on a regular basis
  - Eliminate nuisance errors

- Included quality check as part of every training or service delivery
  - How do measurements / deliverables stand on their own

- Simplified operations
  - Isolated incompatible experiments
  - Minimized user reconfigurations of instruments
  - Invested in automation

- At the end of each issue, ask these questions:
  - Who could have been impacted by the incident? Have they been notified?
  - How could we have caught it earlier?
  - How can we eliminate exposure of users to this in the future?
  - Who else in the community should be notified so they do not have to learn the same lesson?

- Share defining incidents as part of staff and user training
  - Explain why we operate in the manner we do
  - Most extreme example of this is: http://mentalfloss.com/article/501147/retrobituaries-karen-wetterhahn-chemist-whose-poisoning-death-changed-safety