**LAWRENCE LIVERMORE NATIONAL LABORATORY**

**NP Swab Testing**

Top Priority Tests

1. Pull (Tensile/Elongation) Test
   1. Goal: Mimic pulling the NP Swab out of the NP space.
   2. Test: Secure both ends of the NP Swab and apply a tensile force until the swab breaks.
      1. Record: Load, Extension, Location of the Break Point on the Swab
   3. LLNL Status: Ready for testing
2. Rotational Test
   1. Goal: Mimic rotating the NP Swab in the NP space for sample collection.
   2. Test: Secure both ends of the NP swab and apply a rotational force at the handle until the swab breaks.
      1. Record: Torque, # of Rotations, Location of the Break Point on the Swab
   3. LLNL Status: Confirming necessary hardware is onsite for this test.

Additional Tests (Need To Be Put in Priority Order)

* Crush/Compression Test
  + Goal: Mimic the NP Swab head getting pushed and squeeze into the NP space.
  + Test #1: Lay the NP Swab head between 2 flat plates and apply a compression force until the NP Swab head is compressed to half it’s original width.
    - Record: Load, Extension
    - Record the weight of the swab pre/post testing to evaluate whether material is lost due to crushing.
  + Test #2: Hold the NP Swab just below the head and apply a compression force (axially) until the NP Swab head is compressed to half it’s original height.
    - Record: Load, Extension
    - Record the weight of the swab pre/post testing to evaluate whether material is lost due to crushing.
  + LLNL Status: Ready for testing
* Push (Compression) Test
  + Goal: Mimic pushing the NP Swab into the NP space.
  + Test: Secure both ends of the NP Swab and apply a tensile force until the swab breaks.
    - Record: Load, Extension, Location of the Break Point on the Swab
  + LLNL Status: Ready for testing
* Break Test
  + Goal: Mimic the breaking of the NP Swab in the Vial.
  + Test: Standard 3-point bend test to measure the load required to break the swab at the break point.
    - Record: Load, Extension
  + LLNL Status: Ready for testing
* Insertion Test
  + Goal: Mimic pushing the NP Swab into the NP space.
  + Test: Secure one end of the NP swab and push the other into the simulated NP Space.
    - Record, Load?, Extension?
  + LLNL Status: Have ordered an NP Space model to evaluate ease of insertion of the NP Swab into the NP Space – needs evaluation prior to testing beginning. It might be possible to combine this with the Instron and measure the insertion forces.
* Abrasion Test
  + Goal: Mimic the NP Swab rubbing against the interior of the NP space.
  + Test #1: Place the NP Swab head between two flat plates (coated with a mucosal lining surrogate) and apply a small loading force. Pull the NP Swab straight out from between the two flat plates.
    - Visually evaluate the surface of the swab and the plates to determine if the NP Swab is leaving particulates behind or if an unacceptable amount of damage is happening to the mucosal lining surrogate.
  + Test #2: Place the NP Swab head between two flat plates (coated with a mucosal lining surrogate) and apply a small loading force. While rotating the NP Swab, pull it out from between the two flat plates.
    - Visually evaluate the surface of the swab and the plates to determine if the NP Swab is leaving particulates behind or if an unacceptable amount of damage is happening to the mucosal lining surrogate.
  + LLNL Status: Have ordered mucosal lining surrogate – needs evaluation prior to testing beginning.
* Flexural/Fatigue Test
  + Goal: Mimic the flexibility of the NP Swab (and the bending forces it will see).
  + Test #1: Secure handle of the NP Swab and bend the head of the NP Swab downward (or upward) a fixed distance.
    - Record: Load, Extension
  + Test #2: Secure the handle of the NP Swab and bend the head of the NP Swab downward (or upward) a fixed distance. Release the NP Swab to it’s neutral position and repeat the bending.
    - Record: Load, Extension
  + LLNL Status: Confirming necessary hardware is onsite for this test
* Absorption/Release Test (Non-Biological)
  + Goal: Determine the fluid uptake and release properties of the NP Swab.
  + Absorption Test: Submerge the NP Swab in the surrogate material.
    - Record: Weight of the NP Swab before and after submersion.
  + Release Test: Submerge the NP Swab in the release material.
    - Record: Weight of the NP Swab before and after submersion, Measure the amount of fluid released using the spectrophotometer
  + LLNL Status: All hardware is onsite and ready for use. Appropriate material surrogates need to be determined.