Placing a Sample in the Emanation Chamber

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Abstract

Give an overview of procedures to place a sample in the emanation chamber at SDSM&T. We put the first assay sample in our emanation chambers on Tuesday January 26, 2016. Attempting to achieve very low levels of dust we used IPA with lint-free wipes, nylon brushes, a UV light to spot contaminants and a black-out cloth to more easily see the dirt. The black-out cloth was dusty, so we had to clean what we accidentally introduced with wipes. Then using nylon brushes we tried to remove the lint form the wipes. We took pictures of the process and will begin assaying the sample as soon as possible. We used a torque wrench to re-seal the the chamber lid.

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1 First Assay Sample Placement Attempt Jan 26, 2016

1. Took off the circular metal stand and uni-strut pieces attached which serve to hold the Large emanation chamber lid and put it on the floor.

2. Took off the lid to the small emanation chamber, and placed it on the large chamber lid holder -- 1 bolt is not removable given the vacuum port curving over it.

3. Initially, we did not change the copper O-ring[1]

4. After replacing the lid and tightening the bolts with a star pattern 3 times, the chamber had a noticeable leak. We expect both chambers to be held at the mTorr level for weeks. The large emanation chamber can do this, we need to guarantee, each time we place the sample in a chamber we can evacuate to mT with no measurable rate-of-rise.

5. We replaced the copper O-ring with a knife edge the chamber lid

[1] It wasn't easy to move by hand, thinking that meant it would re-seal well.

6. Using a torque wrench[2] (3/8" driver, with 5/16" box-end adapter) set to 141 in lbs—1 in lb less than the maximum torque for our bolts we tightened 20 bolts (4 bolts are inaccessible due to the size of the wrench) and achieved a leak-tightness at the 20 mTorr level.

2 Chamber Cleaning Procedure

I. Use UV light to check for dirt in the chamber

II. Use IPA and lint-free wipes to clean the inner surfaces[3].

III. Place bag over the chamber lid to block incoming dirt

IV. Use the black-out clean-room cloth to more easily spot dirt

V. Use more IPA and lint-free wipes to clean any newly introduced dust

VI. Use nylon brushes to remove lint introduced by the (lint-free) wipes

VII. Replace the bag and remove the black-out cloth

VIII. Place the sample in the chamber an avoid self-shielding of the surface area of the sample

IX. Re-seal the chamber lid with the torque wrench set to τ¡142 in lbs

2.1 Using a Black-Out Cloth & Avoiding More Dirt

In order to avoid this mess it's a good idea to use a bag (flat worked for us) to cover the emanation chamber lid during the opening (and during any re-arranging--it does get hot, and the smell of IPA is quite strong) and closing of the black-out cloth. Doing this gives a rough approximation of dust that the cloth generally holds since the dust will fall onto the bag. The amount of particles released *may* decrease with continued use if we store it well.

2.2 Sample Placement

If the sample can be cleaned, make sure it is. The goal is to measure the steady state Radon content in the sample (some samples may be housed in bagging,

[2]The accuracy of the wrench is ± 1 in lb.

[3]It may be prudent to clean the lid as well. We skipped that this time.

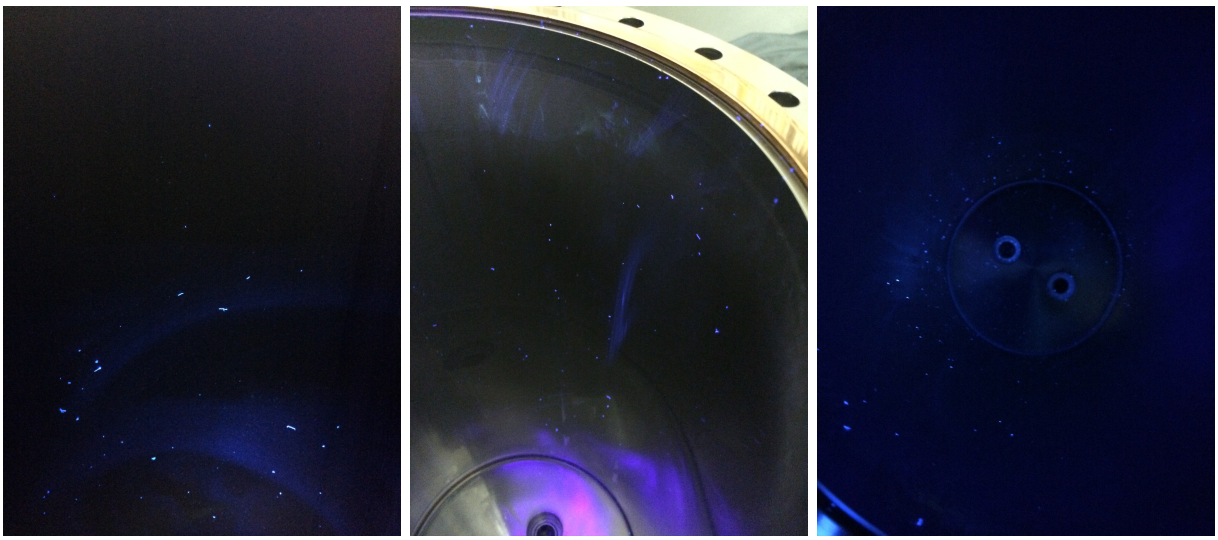

Figure 1: **Left:** UV light illuminating dust, dirt, & lint before any cleaning with IPA or wipes/brushes. **Middle:** Small Emanation Chamber (S.E.C.) open after attempting to block light, and spot dirt more effectively with the UV black-out cloth. We just ended up introducing more dirt by opening the cloth over the open chamber. **Right:** UV light illuminating dust, dirt, & lint after cleaning with IPA, gentle lint-free wiping and nylon brushing from bottom to top.

Figure 2: Rubber sample after cleaning the chamber, placed ot avoid self-sheilding of radon emanating from the surface.