**Worksheet B**

**Dose Calibrator Settings for 90YCl3 Assay and NEMA Phantom Filling Instructions for Sections C and D**

**Materials**:

* Yttrium-90 Chloride (un-opened vial from Eckert and Ziegler, calibrated to be ~65 mCi in 4 mL on the day of phantom filling and scanning)
* NEMA IEC Body Phantom (lung insert containing air, 37 mm sphere in 12-o-clock position, all other spheres removed.)
* 3 mL syringe, 10 mL syringe, and 60 mL syringe
* Spinal needle (recommended that the tip be filed flat to avoid phantom damage)
* OPTIONAL: To reduce the likelihood of activity precipitation or interaction with the phantom material, 378 mL of 0.05 M citric acid solution (~10 grams per liter of water). If possible, the volume of this solution should be determined by mass measurements. Otherwise, use 378 mL of water, preferably de-ionized or distilled.
* 10 liters of water, preferably de-ionized or distilled. (OPTIONAL: ~90 grams of citric acid anhydrous to add to phantom background)

**Procedure**

1. Record the E&Z calibrated activity, calibration date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Place the un-opened vial of 90YCl3 into the bottom of a dose calibrator dipper for survey. Record your dose calibrator model:

Dose calibrator model: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Adjust the dial setting to your clinic’s standard setting for SIR Spheres (if applicable). Record the dial setting, activity reading, date and time:

Dose calibrator dial setting for SIR Spheres: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity reading for vial of 90YCl3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Adjust the dial setting to your clinic’s standard setting for Therasphere (if applicable). Record the dial setting, activity reading, date and time:

Dose calibrator dial setting for Therasphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity reading for vial of 90YCl3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_

1. Create a new dose calibrator dial setting to match the decay-corrected manufacturer calibration for your vial of 90YCl3. (Be mindful of calibration time-zone vs. local time-zone differences) **All subsequent dose calibrator measurements are to be made using this new dial setting.**

Decay-corrected E&Z calibrated activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_

Dose calibrator dial setting used to match calibration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity measured on new dial setting \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_

1. If a scale is available, measure the NEMA phantom mass with and without water in the background region. If a scale is not available, indicate “scale not available,” and record a nominal fill volume of 9700 mL. Ensure that the 37 mm sphere is empty.

Phantom mass (bkgd empty):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Phantom mass (bkgd full): \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calculated phantom background fill-volume: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (if not measured, use 9700 mL)

1. Using the 3 mL syringe, draw approximately 10 mCi from the vial of 90YCl3. The amount drawn should be determined by measuring the vial dose calibrator before and after. If you ordered 65 mCi in 4 mL, the drawn volume (on the day of calibration) should be approximately 0.615 mL.

Vial activity before drawing activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Vial after drawing activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity drawn and approximate volume: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Measure the 3 mL syringe in the dose calibrator (*Note: this is a relative measurement, because the dose calibrator dial setting is only valid for the vial geometry*). Inject the ~10 mCi of activity contained within the syringe into a 378 mL 0.05 M citric acid solution (or water). This yields approximately 0.0264 mCi/mL activity concentration. Rinse the syringe several times by drawing solution into the syringe, and then re-injecting. Once finished, survey the empty syringe in the dose calibrator. Dispose of the 3 mL syringe in an appropriate waste container.

Relative activity in syringe before injecting (A): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Relative activity in syringe after injecting and rinsing (B): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fraction of drawn activity injected ((A-B)/A): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Absolute activity injected into sphere (fraction calculated above

multiplied by drawn activity calculated in Step 7): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Carefully swirl the 378 mL solution to ensure uniform activity distribution, or wait ~10 minutes to allow for passive diffusion. Using the 60 mL syringe and spinal needle, draw approximately 40 mL of activity solution into the syringe. Carefully fill the 37 mm NEMA phantom sphere to the top of the sphere. Inject the remainder of the activity solution in the syringe back into the 378 mL volume, and dispose of the 60 mL syringe in an appropriate waste container. (*Note: if a 60 mL syringe is not available, this process can be performed with a 10 or 20 mL syringe, however it will require multiple syringe fills to completely fill the 37 mm sphere.*)
2. Calculate the activity in the 37 mm sphere by multiplying the activity concentration in your 378 mL solution by the nominal sphere volume (26.52 mL). This should be ~0.700 mCi.

Activity in 37 mm sphere: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Using a new 10 mL syringe, draw approximately 50 mCi of activity from the 90YCl3 vial. If you ordered 65 mCi in 4 mL, the drawn volume (on the day of calibration) should be approximately 3.077 mL. Note the approximate volume in the syringe. The 90YCl3 vial should be measured before and after drawing of activity. **For the post-draw assay, a volume equal to the cumulative drawn volume should be replaced (saline or water) to reproduce the initial activity geometry.** For example, if the vial originally had 4 mL, you drew 0.615 mL for the sphere and 3.077 mL for the background, approximately 3.692 mL of non-radioactive liquid should be returned to the stock vial prior to residual assay.

Vial activity before drawing activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time:\_\_\_\_\_\_\_\_\_

Vial after drawing activity \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity drawn and approximate volume: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Ensure that the NEMA phantom background has been filled with water, de-ionized or distilled. Although optional, we also recommend adding and dissolving ~90 grams of citric acid anhydrous to reduce the likelihood of activity precipitation or interaction with the phantom material.
2. Measure the 10 mL syringe in the dose calibrator (*Note: this is a relative measurement*). Inject the ~50 mCi of activity contained within the 10 mL syringe into the NEMA phantom background. Rinse the syringe several times by drawing solution into the syringe, and then re-injecting. Once finished, survey the empty syringe in the dose calibrator. Dispose of the 10 mL syringe in an appropriate waste container.

Relative activity in syringe before injecting (C): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Relative activity in syringe after injecting and rinsing (D): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fraction of drawn activity injected ((C-D)/C): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Absolute activity injected (fraction calculated above

multiplied by drawn activity calculated in Step 11): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time: \_\_\_\_\_

1. Calculate the sphere-to-background concentration ratio. If physical decay is significant, account for this in your calculations.

Activity concentration in sphere (E)

(step 10 result divided by 26.52 mL or measured volume of your 37 mm sphere): \_\_\_\_\_\_\_\_\_\_\_\_

Activity concentration in background (F)

(step 13 result divided by step 6 background fill volume): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sphere-to-background concentration ratio (E/F): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the total activity in the NEMA phantom (background + sphere).

Total activity in phantom: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date and time:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_