Supplementary Information

Figure S1. Pictures showing glovebox used (panel **A**) and view of materials in glovebox ready for a run (panel **B**); Note that gloves used in procedure are not included for clarity of picture.





List S2. List of abbreviated steps, reagents, glassware, and equipment used in the glovebox for the At-211 isolation process.

Inside Glove Box Prior to Start of Run:

- 1. Capintec Dose Calibrator
- 2. Ludlum Alpha Probe
- 3. Ludlum Gamma Probe
- 4. Water jacketed short-path distillation head
- 5. (2) stirring hot plates with ring-stand support rods and clamps
- 6. (2) 50 mL round bottom flasks aluminum heating block
- 7. (2) small magnetic stir bars
- 8. Red plastic support stand for 50 mL round bottom flasks
- 9. Glassware clamps for connecting round bottom flasks to the distillation head
- 10. (1) box of Disposable gloves (to go over glovebox gloves)
- 11. Pipetters (10 uL, 250 uL, 1 mL, 5 mL)
- 12. Pipette Tips (1–10 uL, 20–250 uL, 0.1–1 mL, 1–5 mL)
- 13. Kimwipes and paper towels
- 14. (1) pair long handled tongs
- 15. (1) pair 4" forceps
- 16. (2) gallon size zipper bags for trash
- 17. Squeeze bottle of DI-H₂O
- 18. Powdered Sodium Bicarbonate
- 19. 20mL Concentrated HNO₃
- 20. (5) empty 20 mL glass scintillation vials
- 21. Empty Nalgene bottle for dissolution
- 22. Blue plastic bin for dissolution vessel secondary containment
- 23. Full and narrow range pH testing paper
- 24. 5 mL BD brand disposable bulb pipetters
- 25. 2 mL each 0.1M,0.5M,1M,4M solutions of HCl and NaOH for pH adjustment

Materials Prepped Outside Glovebox:

- 26. Trace Pure 8M HCl (Diluted freshly from concentrated HCl)
- 27. 20 mL of 8M HCl Equilibrated with Distilled DIPE
- 28. 10 mL of Distilled DIPE mixed with 8M HCl

Steps to perform a run:

- 1. Items 1–25 are in the glovebox prior to retrieving the target
- 2. Retrieve target from Cyclotron and count in dose calibrator
- 3. Bring target into glovebox and count in dose calibrator
- 4. Commence target dissolution
- 5. Prepare items 26–28 during target dissolution
- 6. Bring freshly prepared items 26–28 into glovebox and use as required following target dissolution
- 7. Isolated At-211 is brought out of the glove box in a clean lead pig place inside a plastic zipper bag

8. If a reductive distillation will be performed then those materials are prepared and brought into the glovebox immediately before that procedure will take place along with a fresh distillation head, (1) 25 mL & (3) 10 mL round bottom flasks with caps, and a crystalizing dish full of ice.

Figure S3. Pictures showing glovebox charcoal filter and vent tubing inserted into a charcoal-filtered Plexiglas container within a fume hood. (A) Picture of top of glovebox showing fan system and tube that goes to fume hood (see below). Note the black circular charcoal filter inside of glove box on upper left. (B) Picture of exhaust tube from glove box going into charcoal-filtered Plexiglas enclosure within fume hood.





Figure S4. Pictures of targets (bismuth face down) in modified 1L polypropylene containers within the glovebox. Note that the picture on the right has HNO_3 in the container and NOx fumes are observed. (The blue tray is used to keep the container from rolling).



Figure S5. Picture and schematic of an experimental setup that could be used to scrub the acid and NOx fumes before venting into the glovebox (not used in our studies). (A) Picture of experimental setup where the dissolution bottle is enclosed and air (or N2) is sent through the apparatus to move the NOx fumes into an acid scrubber. For description of how the lines flow see schematic below. (B) Schematic of acid scrubbing system that designed to be used in the initial dissolution step and in the HNO₃ distillation step.





Figure S6. Pictures of glassware used to remove HNO₃ by distillation and leave a colorless residue containing bismuth and At-211. (A) Aluminum covered glassware; (B) Glassware after heat is removed. (C) White residue being dissolved in 8 M HCl.





Explanation of At-211 Isolation Tables S7, S8, S10 and S11

The tables designated as **S7** and **S8** are provided to show the data for individual At-211 isolation runs conducted using wet chemistry.

The ²¹¹At in Target values are mCi amounts obtained by measurement of target in dose calibrator. The At-211 after decay values are the mCi remaining of the measured target amounts after decay correction for the time between the initial reading and isolation of At-211. The Isolated At-211 values are the mCi amounts of isolated At-211 solution measured in a dose calibrator. The % Recovery (actual) values are % yields for At-211 recovery if decay is not considered. The % Recovery (decay corrected) values are yields for At-211 recovery if decay is factored in.

The tables designated as **S10** and **S11** are provided to show data for individual At-211 runs when bismuth attenuation is factored in to better estimate the amount of At-211 in the irradiated target. Because only an estimate of the bismuth attenuation factor (\sim 1.33) has been obtained, the values shown must be considered approximate.

The At-211 Attenuation Corrected values are mCi amounts obtained by dividing the measured At-211 in the target by 0.75. The At-211 after decay are mCi amounts obtained by decay correction of the attenuation corrected At-211 values. The Isolated At-211 values are the mCi amounts of isolated At-211 measured in a dose calibrator. The Corrected % Recovery values are the estimated values for ²¹¹At recovery when decay and bismuth attenuation are factored in.

| | At-211 in Target | Isolation Time | Fraction of | Decay | At-211 | Isolated At-211 | % Recovery | % Recovery |
|---------|------------------|----------------|-------------|---------|-------------|-----------------|------------|-----------------|
| Run # | mCi | in minutes | Half-life | Factor | after decay | mCi | (actual) | Decay Corrected |
| 1 | 19.8 | 116 | 0.268 | 0.831 | 16.4 | 16.4 | 82.8 | 99.7 |
| 2 | 21.4 | 135 | 0.312 | 0.806 | 17.2 | 12.5 | 58.4 | 72.5 |
| 2 | 16.6 | 161 | 0.372 | 0.773 | 12.8 | 12.7 | 76.5 | 99.0 |
| 4 | 20.9 | 133 | 0.307 | 0.808 | 16.9 | 15.2 | 72.7 | 90.0 |
| 5 | 20.6 | 101 | 0.233 | 0.851 | 17.5 | 14.5 | 70.4 | 82.7 |
| 6 | 21.2 | 104 | 0.240 | 0.847 | 17.9 | 14.0 | 66.0 | 78.0 |
| 7 | 20.4 | 117 | 0.270 | 0.829 | 16.9 | 16.1 | 78.9 | 95.2 |
| 8 | 21.3 | 139 | 0.321 | 0.801 | 17.1 | 16.5 | 77.5 | 96.8 |
| 9 | 22.3 | 124 | 0.286 | 0.820 | 18.3 | 16.9 | 75.8 | 92.5 |
| 10 | 20.4 | 123 | 0.284 | 0.821 | 16.8 | 16.0 | 78.4 | 95.5 |
| 11 | 21.8 | 130 | 0.300 | 0.812 | 17.7 | 15.8 | 72.5 | 89.2 |
| 12 | 23.2 | 166 | 0.383 | 0.767 | 17.8 | 16.3 | 70.3 | 91.6 |
| 13 | 20.9 | 153 | 0.353 | 0.783 | 16.4 | 16.5 | 78.9 | 100.9 |
| 14 | 22.4 | 171 | 0.395 | 0.761 | 17.0 | 14.8 | 66.1 | 86.9 |
| 15 | 23.6 | 165 | 0.381 | 0.768 | 18.1 | 16.6 | 70.3 | 91.6 |
| 16 | 21.1 | 160 | 0.370 | 0.774 | 16.3 | 15.9 | 75.3 | 97.2 |
| 17 | 16.9 | 153 | 0.353 | 0.783 | 13.2 | 14.2 | 84.0 | 107.3 |
| 18 | 20.9 | 137 | 0.316 | 0.803 | 16.8 | 16.5 | 78.9 | 98.2 |
| 19 | 20.8 | 169 | 0.390 | 0.763 | 15.9 | 14.4 | 69.2 | 90.7 |
| 20 | 21.7 | 177 | 0.409 | 0.753 | 16.3 | 12.2 | 56.2 | 74.6 |
| 21 | 20.6 | 193 | 0.446 | 0.734 | 15.1 | 11.8 | 57.0 | 77.7 |
| 22 | 21 | 191 | 0.441 | 0.737 | 15.5 | 9.0 | 42.9 | 58.2 |
| 23 | 19.9 | 207 | 0.478 | 0.718 | 14.3 | 13.8 | 69.3 | 96.6 |
| 24 | 23 | 179 | 0.413 | 0.751 | 17.3 | 10.4 | 45.2 | 60.2 |
| 25 | 20.3 | 234 | 0.540 | 0.688 | 14.0 | 11.5 | 56.7 | 82.4 |
| 26 | 20.1 | 167 | 0.386 | 0.765 | 15.4 | 13.6 | 67.5 | 88.2 |
| 27 | 23 | 246 | 0.568 | 0.675 | 15.5 | 14.1 | 61.4 | 91.0 |
| 28 | 25.6 | 155 | 0.358 | 0.780 | 20.0 | 14.3 | 55.9 | 71.7 |
| 29 | 21 | 173 | 0.400 | 0.758 | 15.9 | 13.8 | 65.7 | 86.7 |
| 30 | 20.2 | 226 | 0.522 | 0.696 | 14.1 | 9.9 | 48.9 | 70.2 |
| 31 | 22.9 | 137 | 0.316 | 0.803 | 18.4 | 15.8 | 68.8 | 85.7 |
| 32 | 20.3 | 155 | 0.358 | 0.780 | 15.8 | 11.4 | 56.1 | 71.9 |
| 33 | 22.5 | 148 | 0.342 | 0.789 | 17.8 | 13.0 | 57.9 | 73.4 |
| 34 | 20.2 | 159 | 0.367 | 0.775 | 15.7 | 12.9 | 64.1 | 82.6 |
| 35 | 21.2 | 143 | 0.330 | 0.795 | 16.9 | 13.2 | 62.2 | 78.2 |
| 36 | 20.5 | 153 | 0.353 | 0.783 | 16.0 | 10.5 | 51.0 | 65.2 |
| 37 | 21.6 | 149 | 0.344 | 0.788 | 17.0 | 15.5 | 71.8 | 91.1 |
| 38 | 20.7 | 255 | 0.589 | 0.665 | 13.8 | 8.6 | 41.4 | 62.3 |
| 39 | 19.5 | 208 | 0.480 | 0.717 | 14.0 | 13.0 | 66.7 | 93.0 |
| 40 | 22.2 | 201 | 0.464 | 0.725 | 16.1 | 13.1 | 59.0 | 81.4 |
| 41 | 19.9 | 152 | 0.351 | 0.784 | 15.6 | 16.0 | 80.4 | 102.5 |
| 42 | 21.2 | 166 | 0.383 | 0.767 | 16.3 | 12.8 | 60.4 | 78.8 |
| 43 | 19.8 | 150 | 0.346 | 0.787 | 15.6 | 8.2 | 41.4 | 52.7 |
| 44 | 17.4 | 150 | 0.346 | 0.787 | 13.7 | 13.3 | 76.4 | 97.2 |
| 45 | 19.8 | 173 | 0.400 | 0.758 | 15.0 | 16.3 | 82.3 | 108.6 |
| 46 | 18.6 | 153 | 0.353 | 0.783 | 14.6 | 17.8 | 95.7 | 122.3 |
| 47 | 20.3 | 262 | 0.605 | 0.657 | 13.3 | 13.1 | 64.5 | 98.1 |
| 48 | 20.1 | 288 | 0.665 | 0.631 | 12.7 | 14.3 | 71.1 | 112.7 |
| 49 | 19.7 | 166 | 0.383 | 0.767 | 15.1 | 10.2 | 51.6 | 67.3 |
| 50 | 16.7 | 305 | 0.704 | 0.614 | 10.2 | 11.1 | 66.5 | 108.3 |
| 51 | 17.1 | 142 | 0.328 | 0.797 | 17.5 | 11.1 | 64.9 | 63.5 |
| 52 | 21 | 269 | 0.621 | 0.650 | 13.7 | 11.3 | 53.7 | 82.6 |
| 53 | 19.6 | 185 | 0.427 | 0.744 | 14.6 | 13.8 | 70.4 | 94 7 |
| | 20.7 | 171 | 0.727 | | 15.8 | 13.6 | 66.2 | 86.5 |
| Std Dev | 1.7 | 46 | | Std Dev | 1.8 | 2.3 | 11.7 | 14.8 |

Table S7. Spreadsheet showing data for initial wet chemistry At-211 isolation runs (without bismuth attenuation correction).

| | At-211 in Target | Isolation Time | Fraction of | Decay | At-211 | Isolated At-211 | % Recovery | % Recovery |
|-----------|------------------|----------------|-------------|--------|-------------|-----------------|------------|-----------------|
| Run # | mCi | in minutes | Half-life | Factor | after decay | mCi | (actual) | Decay Corrected |
| 1 | 19.1 | 235 | 0.543 | 0.687 | 13.1 | 15.1 | 78.8 | 114.8 |
| 2 | 19.2 | 240 | 0.554 | 0.681 | 13.1 | 14.7 | 76.6 | 112.5 |
| 3 | 21 | 190 | 0.439 | 0.738 | 15.5 | 17.3 | 82.5 | 111.9 |
| 4 | 19.9 | 253 | 0.584 | 0.667 | 13.3 | 13.7 | 69.0 | 103.4 |
| 5 | 17.7 | 335 | 0.774 | 0.585 | 10.4 | 13.5 | 76.0 | 130.0 |
| 6 | 17.5 | 149 | 0.344 | 0.788 | 13.8 | 15.0 | 85.7 | 108.8 |
| 7 | 17.5 | 207 | 0.478 | 0.718 | 12.6 | 7.4 | 42.3 | 58.9 |
| 8 | 18.4 | 150 | 0.346 | 0.787 | 14.5 | 17.8 | 96.7 | 123.0 |
| 9 | 18.8 | 149 | 0.344 | 0.788 | 14.8 | 16.0 | 85.1 | 108.0 |
| 10 | 20 | 262 | 0.605 | 0.657 | 13.1 | 13.2 | 66.0 | 100.4 |
| 11 | 19.7 | 163 | 0.376 | 0.770 | 15.2 | 14.9 | 75.6 | 98.2 |
| 12 | 19.18 | 209 | 0.483 | 0.716 | 13.7 | 15.3 | 79.5 | 111.1 |
| 13 | 20.7 | 176 | 0.406 | 0.755 | 15.6 | 15.5 | 74.9 | 99.2 |
| 14 | 19 | 253 | 0.584 | 0.667 | 12.7 | 16.0 | 84.2 | 126.2 |
| 15 | 21.3 | 255 | 0.589 | 0.665 | 14.2 | 17.9 | 84.0 | 126.4 |
| 16 | 20.2 | 245 | 0.566 | 0.676 | 13.6 | 14.3 | 70.8 | 104.8 |
| 17 | 18.7 | 139 | 0.321 | 0.801 | 15.0 | 15.6 | 83.4 | 104.2 |
| 18 | 20.3 | 155 | 0.358 | 0.780 | 15.8 | 16.1 | 79.3 | 101.6 |
| 19 | 18.8 | 149 | 0.344 | 0.788 | 14.8 | 13.8 | 73.4 | 93.2 |
| 20 | 18.2 | 119 | 0.275 | 0.827 | 15.0 | 16.4 | 90.1 | 109.0 |
| 21 | 20 | 136 | 0.314 | 0.804 | 16.1 | 16.3 | 81.3 | 101.0 |
| 22 | 19.3 | 124 | 0.286 | 0.820 | 15.8 | 15.9 | 82.2 | 100.2 |
| 23 | 18.5 | 130 | 0.300 | 0.812 | 15.0 | 15.8 | 85.1 | 104.8 |
| 24 | 23.2 | 172 | 0.397 | 0.759 | 17.6 | 13.6 | 58.6 | 77.2 |
| 25 | 20 | 119 | 0.275 | 0.827 | 16.5 | 18.7 | 93.5 | 113.1 |
| 26 | 20.2 | 116 | 0.268 | 0.831 | 16.8 | 18.9 | 93.6 | 112.7 |
| 27 | 19.9 | 118 | 0.273 | 0.828 | 16.5 | 18.8 | 94.5 | 114.1 |
| 28 | 21.6 | 122 | 0.282 | 0.823 | 17.8 | 14.4 | 66.7 | 81.0 |
| 29 | 20 | 126 | 0.291 | 0.817 | 16.3 | 17.8 | 89.0 | 108.9 |
| 30 | 17.6 | 115 | 0.266 | 0.832 | 14.6 | 15.1 | 85.8 | 103.1 |
| 31 | 19 | 121 | 0.279 | 0.824 | 15.7 | 17.4 | 91.6 | 111.1 |
| 32 | 19.03 | 119 | 0.275 | 0.827 | 15.7 | 18.0 | 94.8 | 114.7 |
| 33 | 21 | 126 | 0.291 | 0.817 | 17.2 | 19.3 | 91.9 | 112.4 |
| 34 | 26 | 123 | 0.284 | 0.821 | 21.4 | 26.5 | 101.9 | 124.1 |
| 35 | 12.39 | 119 | 0.275 | 0.827 | 10.2 | 14.0 | 112.6 | 136.2 |
| 36 | 18 | 132 | 0.305 | 0.810 | 14.6 | 15.6 | 86.8 | 107.2 |
| 37 | 18.1 | 132 | 0.305 | 0.810 | 14.7 | 17.3 | 95.6 | 118.1 |
| 38 | 17.7 | 124 | 0.286 | 0.820 | 14.5 | 9.6 | 54.0 | 65.9 |
| 39 | 18.9 | 110 | 0.254 | 0.839 | 15.8 | 17.4 | 91.9 | 109.5 |
| 40 | 20.4 | 127 | 0.293 | 0.816 | 16.6 | 19.3 | 94.7 | 116.1 |
| 41 | 23.3 | 143 | 0.330 | 0.795 | 18.5 | 17.8 | 76.6 | 96.3 |
| 42 | 19.1 | 129 | 0.298 | 0.813 | 15.5 | 15.4 | 80.8 | 99.4 |
| 43 | 20.1 | 118 | 0.273 | 0.828 | 16.6 | 12.3 | 60.9 | 73.6 |
| 44 | 19.8 | 125 | 0.289 | 0.819 | 16.2 | 18.2 | 91.9 | 112.3 |
| 45 | 18.6 | 131 | 0.303 | 0.811 | 15.1 | 15.8 | 84.9 | 104.8 |
| 46 | 18.9 | 148 | 0.342 | 0.789 | 14.9 | 14.9 | 78.9 | 100.0 |
| 47 | 21.69 | 137 | 0.316 | 0.803 | 17.4 | 16.9 | 78.0 | 97.1 |
| 48 | 24.3 | 123 | 0.284 | 0.821 | 20.0 | 17.9 | 73.5 | 89.4 |
| 49 | 20.2 | 142 | 0.328 | 0.797 | 16.1 | 14.0 | 69.2 | 86.9 |
| 50 | 15.8 | 116 | 0.268 | 0.831 | 13.1 | 14.3 | 90.3 | 108.7 |
| 51 | 20.2 | 125 | 0.289 | 0.819 | 16.5 | 14.5 | 71.9 | 87.8 |
| 52 | 21 | 124 | 0.286 | 0.820 | 17.2 | 14.7 | 70.0 | 85.3 |
| 53 | 20.1 | 152 | 0.351 | 0.784 | 15.8 | 16.7 | 83.2 | 106.1 |
| 54 | 19.9 | 125 | 0.289 | 0.819 | 16.3 | 17.7 | 89.0 | 108.7 |
| 55 | 18.6 | 159 | 0.367 | 0.775 | 14.4 | 15.7 | 84.5 | 108.9 |
| Avg Value | 19.6 | 155 | | | 15.3 | 15.9 | 81.5 | 104.4 |
| Std Dev | 2.0 | 50 | | | 2.0 | 27 | 12.3 | 14.9 |

Table S8. Spreadsheet showing the data for recent "optimized" wet chemistry At-211

 isolation runs (without bismuth attenuation correction).

Figure S9. RadioHPLC chromatograms of ²¹¹At solutions prior to (panel A) and after (panel B) a final purification step. The following radiochromatograms are provided to show that in some distillations of [²¹¹At]At only one species is observed. (**A**) Isolated ²¹¹At solution run on Dionex AS-20 column prior to the distillation step; (**B**) Isolated ²¹¹At solution run on Dionex AS-20 column after conducting the distillation step. Note that the retention times for [²¹¹At]At are different than those in Figure 3 in the manuscript as the conc. of NaOH was slightly different.



| | At-211 in Target | At-211 Attenuat. | Isolation Time | Fraction of | Decay | At-211 | Isolated At-211 | Corr. % Recovery |
|----------|------------------|------------------|-----------------------|-------------|-----------|--------------|-----------------|---------------------|
| Run # | mCi | Corr. (mCi) | in minutes | Half-life | Factor | after decay | mCi | (attenuat. & decay) |
| 1 | 19.8 | 26.4 | 116 | 0.268 | 0.831 | 21.9 | 16.4 | 74.8 |
| 2 | 21.4 | 28.5 | 135 | 0.312 | 0.806 | 23.0 | 12.5 | 54.4 |
| 2 | 16.6 | 22.1 | 161 | 0.372 | 0.773 | 17.1 | 12.7 | 74.2 |
| 4 | 20.9 | 27.9 | 133 | 0.307 | 0.808 | 22.5 | 15.2 | 67.5 |
| 5 | 20.6 | 27.5 | 101 | 0.233 | 0.851 | 23.4 | 14.5 | 62.1 |
| 6 | 21.2 | 28.3 | 104 | 0.240 | 0.847 | 23.9 | 14.0 | 58.5 |
| 7 | 20.4 | 27.2 | 117 | 0.270 | 0.829 | 22.6 | 16.1 | 71.4 |
| 8 | 21.3 | 28.4 | 139 | 0.321 | 0.801 | 22.7 | 16.5 | 72.6 |
| 9 | 22.3 | 29.7 | 124 | 0.286 | 0.820 | 24.4 | 16.9 | 69.4 |
| 10 | 20.4 | 27.2 | 123 | 0.284 | 0.821 | 22.3 | 16.0 | 71.6 |
| 11 | 21.8 | 29.1 | 130 | 0.300 | 0.812 | 23.6 | 15.8 | 66.9 |
| 12 | 23.2 | 30.9 | 166 | 0.383 | 0.767 | 23.7 | 16.3 | 68.7 |
| 13 | 20.9 | 27.9 | 153 | 0.353 | 0.783 | 21.8 | 16.5 | 75.6 |
| 14 | 22.4 | 29.9 | 171 | 0.395 | 0.761 | 22.7 | 14.8 | 65.2 |
| 15 | 23.6 | 31.5 | 165 | 0.381 | 0.768 | 24.2 | 16.6 | 68.7 |
| 16 | 21.1 | 28.1 | 160 | 0.370 | 0.774 | 21.8 | 15.9 | 72.9 |
| 17 | 16.9 | 22.5 | 153 | 0.353 | 0.783 | 17.6 | 14.2 | 80.5 |
| 18 | 20.9 | 27.9 | 137 | 0.316 | 0.803 | 22.4 | 16.5 | 73.6 |
| 19 | 20.8 | 27.7 | 169 | 0.390 | 0.763 | 21.2 | 14.4 | 68.0 |
| 20 | 21.7 | 28.9 | 177 | 0.409 | 0.753 | 21.8 | 12.2 | 56.0 |
| 21 | 20.6 | 27.5 | 193 | 0.446 | 0.734 | 20.2 | 11.8 | 58.3 |
| 22 | 21 | 28.0 | 191 | 0.441 | 0.737 | 20.6 | 9.0 | 43.6 |
| 23 | 19.9 | 26.5 | 207 | 0.478 | 0.718 | 19.1 | 13.8 | 72.4 |
| 24 | 23 | 30.7 | 179 | 0.413 | 0.751 | 23.0 | 10.4 | 45.1 |
| 25 | 20.3 | 27.1 | 234 | 0.540 | 0.688 | 18.6 | 11.5 | 61.8 |
| 26 | 20.1 | 26.8 | 167 | 0.386 | 0.765 | 20.5 | 13.6 | 66.1 |
| 27 | 23 | 30.7 | 246 | 0.568 | 0.675 | 20.7 | 14.1 | 68.3 |
| 28 | 25.6 | 34.1 | 155 | 0.358 | 0.780 | 26.6 | 14.3 | 53.8 |
| 29 | 21 | 28.0 | 173 | 0.400 | 0.758 | 21.2 | 13.8 | 65.0 |
| 30 | 20.2 | 26.9 | 226 | 0.522 | 0.696 | 18.8 | 9.9 | 52.6 |
| 31 | 22.9 | 30.5 | 137 | 0.316 | 0.803 | 24.5 | 15.8 | 64.3 |
| 32 | 20.3 | 27.1 | 155 | 0.358 | 0.780 | 21.1 | 11.4 | 53.9 |
| 33 | 22.5 | 30.0 | 148 | 0.342 | 0.789 | 23.7 | 13.0 | 55.0 |
| 34 | 20.2 | 26.9 | 159 | 0.367 | 0.775 | 20.9 | 12.9 | 62.0 |
| 35 | 21.2 | 28.3 | 143 | 0.330 | 0.795 | 22.5 | 13.2 | 58.6 |
| 30 | 20.5 | 27.3 | 153 | 0.353 | 0.783 | 21.4 | 10.5 | 48.9 |
| 37 20 | 21.0 | 20.0 | 149 | 0.544 | 0.788 | 22.7 | 15.5 | 08.3 |
| 20 | 20.7 | 27.0 | 200 | 0.589 | 0.005 | 10.4 | 0.0 12.0 | 40.7 |
| 39 | 19.5 | 20.0 | 208 | 0.460 | 0.717 | 10.0 21 E | 13.0 | 69.8 |
| 40 | 10.0 | 29.0 | 201 | 0.404 | 0.723 | 21.5 | 15.1 | 76.0 |
| 41 | 19.9 | 20.5 | 152 | 0.331 | 0.764 | 20.8 | 12.0 | 70.5 |
| 42 | 21.2 | 20.5 | 160 | 0.365 | 0.787 | 21.7 | 12.0 | 20 5 |
| 45 | 15.0 | 20.4 | 150 | 0.340 | 0.787 | 20.8 | 0.2 | 39.5 72.0 |
| 44 | 17.4 | 25.2 | 172 | 0.346 | 0.767 | 10.2 | 15.5 | 72.9 |
| 45 | 19.0 | 20.4 | 1/5 | 0.400 | 0.758 | 20.0 | 10.5 | 01.4 |
| 40 | 20.2 | 24.0 | 155 | 0.555 | 0.783 | 17.4 | 17.0 | 72.6 |
| /12 | 20.5 | 27.1 | 202 | 0.005 | 0.037 | 16 0 | 1/ 2 | 845 |
| 40 | 10.1 | 20.0 | 200 | 0.005 | 0.031 | 20.5 | 10.2 | 50 5 |
| 49 50 | 16 7 | 20.5 | 302 | 0.365 | 0.767 | 12 7 | 10.2 | 30.5 81 2 |
| 50 | 17 1 | 22.3 | 1/17 | 0.704 | 0.014 | 19.7 | 11 1 | 61.2 |
| 57 | 21 | 22.0 | 260 | 0.528 | 0.757 | 19.2 | 11.2 | 62.0 |
| 52 | 10.6 | 20.0 | 185 | 0.021 | 0.050 | 10.2 | 12.2 | 71.0 |
| | 20.7 | 20.1 | 171 | 0.727 | Avg Voluo | 21.4 | 12.6 | 65.0 |
| Std Dev | 1.7 | 2.3 | 46 | | Std Dev | 2.4 | 2.3 | 10.9 |

Table S10. Spreadsheet showing data for initial wet chemistry At-211 isolation runs after decay and bismuth attenuation corrections *.

* The attenuation correction was made by dividing the At-211 target reading by 0.75. That approach gives approximately the same number as multiplying the At-211 target reading by an attenuation factor of 1.33.

| | At-211 in Target | At-211 Attenuat. | Isolation Time | Fraction of | Decay | At-211 | Isolated At-211 | Corr. % Recovery |
|-----------|------------------|------------------|----------------|-------------|--------|--------------|-----------------|---------------------|
| Run # | mCi | Corr. (mCi) | in minutes | Half-life | Factor | after decay | mCi | (attenuat. & decay) |
| 1 | 19.1 | 25.5 | 235 | 0.543 | 0.687 | 17.5 | 15.1 | 86.1 |
| 2 | 19.2 | 25.6 | 240 | 0.554 | 0.681 | 17.4 | 14.7 | 84.4 |
| 3 | 21.0 | 28.0 | 190 | 0.439 | 0.738 | 20.7 | 17.3 | 83.9 |
| 4 | 19.9 | 26.5 | 253 | 0.584 | 0.667 | 17.7 | 13.7 | 77.6 |
| 5 | 17.7 | 23.6 | 335 | 0.774 | 0.585 | 13.8 | 13.5 | 97.5 |
| 6 | 17.5 | 23.3 | 149 | 0.344 | 0.788 | 18.4 | 15.0 | 81.6 |
| 7 | 17.5 | 23.3 | 207 | 0.478 | 0.718 | 16.8 | 7.4 | 44.2 |
| 8 | 18.4 | 24.5 | 150 | 0.346 | 0.787 | 19.3 | 17.8 | 92.2 |
| 9 | 18.8 | 25.1 | 149 | 0.344 | 0.788 | 19.7 | 16.0 | 81.0 |
| 10 | 20.0 | 26.7 | 262 | 0.605 | 0.657 | 17.5 | 13.2 | 75.3 |
| 11 | 19.7 | 26.3 | 163 | 0.376 | 0.770 | 20.2 | 14.9 | 73.6 |
| 12 | 19.2 | 25.6 | 209 | 0.483 | 0.716 | 18.3 | 15.3 | 83.3 |
| 13 | 20.7 | 27.6 | 176 | 0.406 | 0.755 | 20.8 | 15.5 | 74.4 |
| 14 | 19.0 | 25.3 | 253 | 0.584 | 0.667 | 16.9 | 16.0 | 94.7 |
| 15 | 21.3 | 28.4 | 255 | 0.589 | 0.665 | 18.9 | 17.9 | 94.8 |
| 16 | 20.2 | 26.9 | 245 | 0.566 | 0.676 | 18.2 | 14.3 | 78.6 |
| 17 | 18.7 | 24.9 | 139 | 0.321 | 0.801 | 20.0 | 15.6 | 78.2 |
| 18 | 20.3 | 27.1 | 155 | 0.358 | 0.780 | 21.1 | 16.1 | 76.2 |
| 19 | 18.8 | 25.1 | 149 | 0.344 | 0.788 | 19.7 | 13.8 | 69.9 |
| 20 | 18.2 | 24.3 | 119 | 0.275 | 0.827 | 20.1 | 16.4 | 81.8 |
| 21 | 20.0 | 26.7 | 136 | 0.314 | 0.804 | 21.5 | 16.3 | 75.8 |
| 22 | 19.3 | 25.7 | 124 | 0.286 | 0.820 | 21.1 | 15.9 | 75.2 |
| 23 | 18.5 | 24.7 | 130 | 0.300 | 0.812 | 20.0 | 15.8 | 78.6 |
| 24 | 23.2 | 30.9 | 172 | 0.397 | 0.759 | 23.5 | 13.6 | 57.9 |
| 25 | 20.0 | 26.7 | 119 | 0.275 | 0.827 | 22.0 | 18.7 | 84.8 |
| 26 | 20.2 | 26.9 | 116 | 0.268 | 0.831 | 22.4 | 18.9 | 84.5 |
| 27 | 19.9 | 26.5 | 118 | 0.273 | 0.828 | 22.0 | 18.8 | 85.6 |
| 28 | 21.6 | 28.8 | 122 | 0.282 | 0.823 | 23.7 | 14.4 | 60.8 |
| 29 | 20.0 | 26.7 | 126 | 0.291 | 0.817 | 21.8 | 17.8 | 81.7 |
| 30 | 17.6 | 23.5 | 115 | 0.266 | 0.832 | 19.5 | 15.1 | 77.3 |
| 31 | 19.0 | 25.3 | 121 | 0.279 | 0.824 | 20.9 | 17.4 | 83.4 |
| 32 | 19.0 | 25.4 | 119 | 0.275 | 0.827 | 21.0 | 18.0 | 86.0 |
| 33 | 21.0 | 28.0 | 126 | 0.291 | 0.817 | 22.9 | 19.3 | 84.3 |
| 34 | 26.0 | 34.7 | 123 | 0.284 | 0.821 | 28.5 | 26.5 | 93.1 |
| 35 | 12.4 | 16.5 | 119 | 0.275 | 0.827 | 13.7 | 14.0 | 102.2 |
| 36 | 18.0 | 24.0 | 132 | 0.305 | 0.810 | 19.4 | 15.6 | 80.4 |
| 37 | 18.1 | 24.1 | 132 | 0.305 | 0.810 | 19.5 | 17.3 | 88 5 |
| 38 | 17.7 | 23.6 | 124 | 0.286 | 0.820 | 19.5 | 9.6 | 49.4 |
| 39 | 18.9 | 25.0 | 110 | 0.254 | 0.839 | 21.1 | 17.4 | 82.1 |
| 40 | 20.4 | 23.2 | 127 | 0.293 | 0.816 | 22.1 | 19.3 | 87.0 |
| 40 | 20.4 | 31.1 | 143 | 0.330 | 0.795 | 24.2 | 17.8 | 72.2 |
| 41 | 19.1 | 25.5 | 179 | 0.350 | 0.755 | 20.7 | 15.4 | 74.5 |
| 43 | 20.1 | 26.8 | 118 | 0.258 | 0.828 | 20.7 | 12.4 | 55.2 |
| 45 | 19.8 | 26.0 | 125 | 0.275 | 0.819 | 21.6 | 18.2 | 84.2 |
| 44 | 19.6 | 20.4 | 121 | 0.285 | 0.813 | 21.0 | 15.2 | 78.6 |
| 45 | 18.0 | 24.0 | 1/12 | 0.303 | 0.789 | 10.0 | 14.0 | 75.0 |
| 40 | 21 7 | 29.2 | 127 | 0.342 | 0.703 | 22.2 | 16.9 | 72.8 |
| 47 | 21.7 | 20.5 | 122 | 0.310 | 0.803 | 25.2 | 17.9 | 72.8 67.1 |
| 40 | 24.5 | 26 Q | 1/2 | 0.204 | 0.821 | 20.0 | 1/.9 | 65.2 |
| 45 | 15 9 | 20.5 | 116 | 0.320 | 0.757 | 21.J 17 E | 14.0 | 0J.Z 81 E |
| 50 | 20.2 | 21.1 | 175 | 0.200 | 0.051 | 17.5 | 14.5 | 61.0 |
| 51 | 20.2 | 20.9 | 123 | 0.289 | 0.820 | 22.0 | 14.0 | 64.0 |
| 52 | 21.0 | 20.0 | 124 | 0.280 | 0.820 | 23.0 | 14.7 | 04.U 70.C |
| 22 | 20.1 | 20.8 | 132 | 0.351 | 0.784 | 21.0 | 177 | /9.0 91 E |
| 54 | 19.9 | 20.5 | 125 | 0.289 | 0.819 | 21./ | 11.7 | 01.0 01.7 |
| 55 | 10.0 | 24.8 | 123 | 0.567 | 0.775 | 19.2 | 15./ | 01./ |
| Avg value | 79.0 | 20.1 | 102 | | | 20.4 | 10.9 | /ð.3 11 3 |
| Stu Dev | 2.0 | 2.7 | 50 | | | 2.0 | 2.7 | 11.2 |

Table S11. Spreadsheet showing data for recent "optimized" wet chemistry At-211 isolation runs after decay and bismuth attenuation corrections *.

*The attenuation correction was made by dividing the At-211 target reading by 0.75. That approach gives approximately the same number as multiplying the At-211 target reading by an attenuation factor of 1.33.

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