CLAIMS:

1. An infusion system comprising:

a frame that carries a beta detector, a gamma detector, and a controller communicatively coupled to the beta detector and the gamma detector,

wherein the frame is further configured to receive a strontium-rubidium radioisotope generator that generates a radioactive eluate via elution,

the beta detector is positioned to measure beta emissions emitted from the radioactive eluate,

the gamma detector is positioned to measure gamma emissions emitted from the radioactive eluate, and

the controller is configured to determine an activity of the radioactive eluate based on the beta emissions measured by the beta detector, determine an activity of the radioactive eluate based on the gamma emissions measured by the gamma detector, characterised in that the controller is further configured to ~~and~~ calibrate the infusion system based on comparison of the activity of the radioactive eluate measured by the beta detector to the activity of the radioactive eluate measured by the gamma detector.

2. The infusion system of claim 1, wherein the controller is configured to determine ~~of~~ an activity of rubidium in the radioactive eluate based on the beta emissions measured by the beta detector and also determine the activity of rubidium in the radioactive eluate based on the gamma emissions measured by the gamma detector.

3. The infusion system of either of claims 1 or 2, wherein the controller is configured to calibrate the infusion system by at least storing calibration information used by the controller to determine a cumulative activity delivered by the infusion system based on beta emissions measured by the beta detector.

4. The infusion system of claim 3, wherein the controller is configured to reference the calibration information to adjust one or more of the beta emissions measured by the

beta detector, information corresponding to a flow rate of the radioactive eluate whose beta emissions are measured by the beta detector, information corresponding to a volume of the radioactive eluate whose beta emissions are measured by the beta detector, and combinations thereof.

5. The infusion system of any one of the foregoing claims, wherein the controller is configured to calibrate the infusion system by calibrating the beta detector.

6. The infusion system of any one of the foregoing claims, wherein the controller is configured to calibrate the infusion system by at least storing a calibration parameter generated based on the comparison in a non-transitory computer readable memory associated with the controller.

~~7. The infusion system of claim 6, wherein the controller is configured to reference the calibration parameter to convert a measurement signal from the beta detector into an activity measurement during a patient infusion procedure.~~

~~8~~7. The infusion system of any one of the foregoing claims, wherein the controller is configured to determine at least one of a difference between the activity of the radioactive eluate measured by the beta detector and the activity of the radioactive eluate measured by the gamma detector and a ratio of the activity of the radioactive eluate measured by the beta detector to the activity of the radioactive eluate measured by the gamma detector.

~~9. The infusion system of claim 8, wherein the controller is configured to calibrate the infusion system by at least storing the determined difference or determined ratio, or parameter derived therefrom, in a non-transitory computer readable memory associated with the controller.~~

~~10~~8. The infusion system of any one of the foregoing claims, wherein the gamma detector is positioned to measure the gamma emissions emitted from a static portion of the radioactive eluate.

~~11~~9. The infusion system of any one of the foregoing claims, further comprising an infusion tubing line configured to receive the radioactive eluate, either directly or indirectly, from the strontium-rubidium radioisotope generator, when the strontium-rubidium radioisotope generator is received by the frame, and an eluate-receiving container in fluid communication with the infusion tubing line to receive a portion of the radioactive eluate, thereby providing a static portion of the radioactive eluate,

wherein the beta detector is positioned to measure the beta emissions emitted from the radioactive eluate flowing through the infusion tubing line; and

the gamma detector is positioned to measure the gamma emissions emitted from the static portion of the radioactive eluate in the eluate-receiving container.

~~12. The infusion system of claim 11, further comprising an eluate-receiving container in fluid communication with the infusion tubing line to receive a portion of the radioactive eluate, thereby providing a static portion of the radioactive eluate.~~

~~13. The infusion system of claim 12,~~

~~wherein the beta detector is positioned to measure the beta emissions emitted from the radioactive eluate flowing through the infusion tubing line; and~~

~~the gamma detector is positioned to measure the gamma emissions emitted from the static portion of the radioactive eluate in the eluate-receiving container.~~

~~14. The infusion system of any one of claims 11-13, wherein the eluate-receiving container comprises a vial.~~

~~15. The infusion system of any one of the foregoing claims, further comprising a waste container.~~

160. The infusion system of any one of the foregoing claims, further comprising the strontium-rubidium radioisotope generator received by the frame, wherein the strontium-rubidium radioisotope generator is configured to generate the radioactive eluate containing rubidium-82 via elution of a column containing strontium-82.

1711. The infusion system of any one of the foregoing claims, further comprising:

an eluant reservoir containing an eluant;

a pump coupled to the eluant reservoir via an eluant line;

an eluate-receiving container carried by the frame;

a waste container carried by the frame; and

an infusion tubing circuit that includes an infusion tubing line, an eluate line, a waste line, and one or more valves, wherein the infusion tubing line is in fluid communication with the eluate line via the one or more valves and the waste line is in fluid communication with the eluate line via the one or more valves,

wherein the beta detector is positioned to measure the beta emissions from the radioactive eluate flowing through the eluate line, and the gamma detector is configured to measure the gamma emissions from a static portion of the radioactive eluate in the eluate-receiving container and received from the infusion tubing line.

1812. The infusion system of claim 1711, wherein

the controller is communicatively coupled to the one or more valves and configured to control flow from the eluate line to a select one of the infusion tubing line and the waste line; and

the controller is further configured during a calibration process to:

control the pump to pump the eluant through the strontium-rubidium radioisotope generator and generate the radioactive eluate,

determine the activity of the radioactive eluate based on the beta emissions measured via the beta detector while the radioactive eluate is directed to the waste container,

upon the radioactive activity of the radioactive eluate reaching a threshold level of rubidium activity, control the one or more valves to place the infusion tubing line in fluid communication with the eluate line,

further control the pump to fill the eluate-receiving container with the radioactive eluate,

determine the activity of the radioactive eluate based on the beta emissions measured via the beta detector while the radioactive eluate is directed to the eluate-receiving container, and

determine the activity of the radioactive eluate in the eluate-receiving container based on the gamma emissions measured by the gamma detector.

~~19. The infusion system of claim 18, wherein the one or more valves comprise a multi-way divergence valve.~~

~~20~~13. The infusion system of ~~either of claims 18 or 19~~claim 12, wherein the controller is communicatively coupled to the one or more valves and is configured to control flow from the eluate line to a select one of the infusion tubing line and the waste line via the one or more valves; and

the controller is further configured to:

control the pump to pump the eluant through the strontium-rubidium radioisotope generator and generate the radioactive eluate flowing through the eluate line to the waste line and the waste container,

control the beta detector to measure the beta emissions from the radioactive eluate flowing through the eluate line to the waste line and determine therefrom the activity of the radioactive eluate;

upon the activity of the radioactive eluate reaching a threshold level, control the one or more valves to place the infusion tubing line in fluid communication with the eluate line,

control the beta detector to measure the beta emissions from the radioactive eluate flowing through the eluate line to the eluate-receiving container via

the infusion tubing line and determine therefrom an accumulated rubidium radioactive dose supplied to the eluate-receiving container,

upon determining that the accumulated rubidium radioactive dose has reached a QC threshold level, control the pump to cease pumping the eluant through the strontium-rubidium radioisotope generator,

control the gamma detector to measure the gamma emissions from the radioactive eluate in the eluate-receiving container and determine therefrom a rubidium calibration activity, and

calculate a calibration parameter based on the accumulated rubidium radioactive dose supplied to the eluate-receiving container and the rubidium calibration activity.

~~21. The infusion system of claim 20, wherein the QC threshold level is between 5 mCi to 75 mCi of rubidium, preferably between 10 mCi to 60 mCi of rubidium, between 15 mCi to 50 mCi of rubidium, or between 20 mCi to 40 mCi of rubidium, such as about 30 mCi of rubidium.~~

~~22~~14. The infusion system of ~~either of claims 20 or 21~~claim 13, wherein the controller is configured to calculate the calibration parameter by at least dividing the accumulated rubidium radioactive dose supplied to the eluate-receiving container by the rubidium calibration activity.

~~23. The infusion system of any one of claims 20-22, wherein the controller is further configured to store the calibration parameter, or a parameter derived therefrom, in a non-transitory computer readable memory associated with the controller.~~

~~24. The infusion system of any one of claims 20-23, wherein the controller is configured to control the gamma detector to measure the gamma emissions from the radioactive eluate in the eluate-receiving container after the eluate-receiving container has completed filling.~~

~~25. The infusion system of any one of claims 20-24, wherein the controller is configured to determine the rubidium calibration activity at one or more of a 511 keV energy and a 776 keV energy line of a gamma spectrum.~~

~~26. The infusion system of any one of the foregoing claims, further comprising a touchscreen, wherein the controller is configured to initiate recalibration of the beta detector in response to a user input received through the touchscreen.~~

~~27. The infusion system of any one of the foregoing claims, wherein the controller is further configured to store the activity of the radioactive eluate determined by the beta detector and the gamma detector in a non-transitory computer-readable medium.~~

~~28. The infusion system of any one of the foregoing claims, further comprising an external port that the non-transitory computer-readable medium is insertable into and removable from to place the non-transitory computer-readable medium in communication with the controller.~~

~~29. The infusion system of any one of the foregoing claims, wherein the controller is further configured to print out the activity of the radioactive eluate determined by the beta detector and the gamma detector in a human-readable medium.~~

~~30. The infusion system of any one of the foregoing claims, wherein the controller is further configured to transmit the activity of the radioactive eluate determined by the beta detector and the gamma detector to an offsite location that monitors the operation of the strontium-rubidium radioisotope generator.~~

~~31. The infusion system of any one of the foregoing claims, further comprising radioactive shielding surrounding the beta detector, the gamma detector, and the strontium-rubidium radioisotope generator, when the strontium-rubidium radioisotope~~

generator is received by the frame, the radioactive shielding providing a barrier effective to reduce radiation emitted by the strontium-rubidium radioisotope generator and the radioactive eluate below a limit allowable for operating personnel.

32. The infusion system of claim 31, wherein the radioactive shielding comprises a shielding assembly having a plurality of compartments, including a compartment containing the beta detector, a compartment containing the gamma detector, and a compartment containing the strontium-rubidium radioisotope generator.

33. The infusion system of either of claims 31 or 32, wherein the frame carries the beta detector and the gamma detector and also receives the strontium-rubidium radioisotope generator by supporting the shielding assembly which, in turn, is configured to contain the beta detector, the gamma detector, and the strontium-rubidium radioisotope generator.

34. The infusion system of any one of claims 31–33, wherein the controller is carried by the frame outside of the radioactive shielding.

35. The infusion system of any one of claims 31–34, further comprising a cabinet structure housing at least the beta detector, the gamma detector, and the strontium-rubidium radioisotope generator, when the strontium-rubidium radioisotope generator is received by the frame.

36. The infusion system of any one of the foregoing claims, wherein the gamma detector comprises a solid state gamma detector coupled to a multi-channel analyzer and the beta detector comprises a scintillator and photomultiplier.

37. The infusion system of any one of the foregoing claims, wherein the gamma detector does not have an ion chamber.

~~38. The infusion system of any one of the foregoing claims, wherein the gamma detector is a CadmiumZincTelluride (CZT) gamma detector.~~

~~39. The infusion system of any one of the foregoing claims, wherein the frame is mounted on wheels so as to be movable.~~

~~40~~15. A method comprising:

pumping an eluant through a strontium-rubidium radioisotope generator of an infusion system and thereby generating a radioactive eluate via elution;

conveying the radioactive eluate across a beta detector and measuring beta emissions emitted from the radioactive eluate generated by the radioisotope generator and flowing through an eluate line and determining therefrom an activity of the radioactive eluate;

receiving the radioactive eluate conveyed across the beta detector in an eluate-receiving container positioned adjacent a gamma detector;

measuring gamma emissions emitted from the radioactive eluate received by the eluate-receiving container and determining therefrom an activity of the radioactive eluate in the eluate-receiving container; and characterised by

calibrating the infusion system based on comparison of the activity of the radioactive eluate measured by the beta detector to the activity of the radioactive eluate measured by the gamma detector.

~~41~~16. The method of claim ~~40~~15, wherein:

measuring beta emissions emitted from the radioactive eluate generated by the radioisotope generator and determining therefrom the activity of the radioactive eluate comprises determining an activity of rubidium in the radioactive eluate, and

measuring gamma emissions emitted from the radioactive eluate received by the eluate-receiving container and determining therefrom the activity of the radioactive eluate comprises determining the activity of rubidium in the radioactive eluate.

~~42~~17. The method of either of claims ~~40~~ 15 or ~~41~~16, wherein calibrating the infusion system comprises storing calibration information used to determine a cumulative activity delivered by the infusion system based on beta emission measured by the beta detector.

~~43~~18. The method of claim ~~42~~17, further comprising referencing the calibration information to adjust one or more of the beta emissions measured by the beta detector, information corresponding to a flow rate of the radioactive eluate whose beta emissions are measured by the beta detector, information corresponding to a volume of the radioactive eluate whose beta emissions are measured by the beta detector, and combinations thereof.

~~44~~19. The method of any one of claims ~~40–43~~15-18, wherein calibrating the infusion system is performed by calibrating the beta detector, and calibrating the beta detector comprises determining at least one of a difference between the activity of the radioactive eluate measured by the beta detector and the activity of the radioactive eluate measured by the gamma detector and a ratio of the activity of the radioactive eluate measured by the beta detector to the activity of the radioactive eluate measured by the gamma detector.

~~45. The method of any one of claims 40–44, further comprising storing a calibration parameter generated based on the comparison in a non-transitory computer readable memory.~~

~~46. The method of claim 45, further comprising~~

~~pumping the eluant through the strontium-rubidium radioisotope generator during a patient infusion and thereby generating the radioactive eluate via elution,~~

~~conveying the radioactive eluate across the beta detector and generating a measurement signal, and~~

~~converting the measurement signal into an activity measurement with reference to the calibration parameter.~~

~~47. The method of any one of claims 40–46, wherein calibrating the beta detector comprises determining at least one of a difference between the activity of the radioactive eluate measured by the beta detector and the activity of the radioactive eluate measured by the gamma detector and a ratio of the activity of the radioactive eluate measured by the beta detector to the activity of the radioactive eluate measured by the gamma detector.~~

~~48. The method of any one of claims 40–47, wherein the radioactive eluate received by the eluate-receiving container provides a static portion of the radioactive eluate from which the gamma emissions are measured.~~

~~49. The method of any one of claims 40–48, wherein conveying the radioactive eluate across the beta detector comprises conveying the radioactive eluate through tubing positioned in front of the beta detector and in fluid communication with a waste container until the activity of the radioactive eluate exceeds a threshold and then diverting the flow of the radioactive eluate to the eluate-receiving container.~~

~~5~~20. The method of any one of claims ~~40~~15–~~49~~19, wherein:

conveying the radioactive eluate across the beta detector comprises conveying the radioactive eluate through tubing positioned in front of the beta detector and in fluid communication with a waste container until the activity of the radioactive eluate exceeds a threshold and then diverting the flow of an radioactive eluate to the eluate-receiving container;

measuring the beta emissions emitted from the radioactive eluate generated by the radioisotope generator comprises measuring the beta emissions from the radioactive eluate flowing through the eluate line to the eluate-receiving container and determining

therefrom an accumulated rubidium radioactive dose supplied to the eluate-receiving container; and

measuring the gamma emissions emitted from the radioactive eluate received by the eluate-receiving container comprises measuring the gamma emissions emitted from the radioactive eluate in the eluate-receiving container and determining therefrom a rubidium calibration activity; and

calculating a calibration parameter based on the accumulated rubidium radioactive dose supplied to the eluate-receiving container and the rubidium calibration activity.

~~51. The method of claim 50, wherein the threshold ranges from 5 mCi to 75 mCi.~~

~~52. The method of either of claims 50 or 51, wherein measuring the gamma emissions emitted from the radioactive eluate in the eluate-receiving container comprises measuring the gamma emissions emitted from the radioactive eluate in the eluate-receiving container after the eluate-receiving container has completed filling.~~

~~53. The method of any one of claims 40–52, wherein the gamma detector comprises a solid state gamma detector and the beta detector comprises a scintillator and photomultiplier.~~

~~54. The method of any one of claims 40–53, wherein the gamma detector does not have an ion chamber.~~

~~55. The method of any one of claims 40–54, wherein pumping the eluant through the strontium-rubidium radioisotope generator comprises pumping saline at a rate ranging from 5 ml/min to 100 ml/min.~~