CLAIMS

1. A delivery assembly, comprising:

a console including a vial containment region;

a vial engagement mechanism extending from the console within the vial containment region, wherein the engagement mechanism is configured to engage a vial assembly;

a sled assembly removably couplable to the console at the vial containment region; and

a safety shield removably couplable to the console over the vial containment region such that the vial engagement mechanism and the sled assembly are encapsulated within the safety shield when the safety shield is coupled thereto;

wherein the sled assembly, the vial assembly, and the safety shield are configured to inhibit radioactive emissions from within the vial containment region.

2. The delivery assembly of claim 1, wherein the vial assembly comprises:

a vial body formed of a material that inhibits radioactive emissions from within the vial body;

a locking feature coupled to the vial body and configured to securely engage the vial assembly to the sled assembly when the vial body is received therein; and

a plunger slidably translatable relative to the locking feature and through the vial body in response to the vial engagement mechanism engaging the vial assembly.

3. The delivery assembly of claim 2, wherein the plunger includes an engagement head having a pair of resilient arms that are sized and shaped to interlock with a pair of lever arms of the vial engagement mechanism.

4. The delivery assembly of claim 2, wherein the vial assembly comprises a septum disposed within a distal end of the vial body that is configured to seal the vial body.

5. The delivery assembly of any preceding claim, wherein the console comprises an interface display and one or more of a dosimeter, a linear encoder, an optical sensor, a linear displacement sensor, a flow sensor, an ultrasonic sensor, a magnetic encoder, a laser distance

sensor, an inductance sensor, a radial encoder, a volumetric sensor, a radiation sensor, and a mechanical transducer.

6. The delivery assembly of claim 5, wherein the interface display is communicatively coupled to one or more of the dosimeter, linear encoder, optical sensor, linear displacement sensor, flow sensor, ultrasonic sensor, magnetic encoder, laser distance sensor, inductance sensor, radial encoder, volumetric sensor, radiation sensor, and mechanical transducers.

7. The delivery assembly of any preceding claim, wherein the vial engagement mechanism is disposed within the vial containment region and proximate to the sled assembly when the sled assembly is coupled to the console.

8. The delivery assembly of claim 7, further comprising a delivery handle coupled to the vial engagement mechanism and configured to move the vial engagement mechanism within the vial containment region.

9. The delivery assembly of claim 8, wherein the delivery handle is configured to move the vial assembly relative to the sled assembly in response to actuating the delivery handle.

10. The delivery assembly of any preceding claim, wherein the sled assembly comprises a locking system and a vial chamber, wherein the locking system forms an aperture sized and shaped to receive the vial assembly therethrough and into the vial chamber.

11. The delivery assembly of claim 10, wherein the locking system comprises annular projections extending laterally into the aperture, wherein the annular projections are sized and shaped to engage a locking feature of the vial assembly when the vial assembly is received through the aperture and into the vial chamber.

12. The delivery assembly of claim 10, wherein the vial chamber is encapsulated in a protective shield that is formed of a material that inhibits radioactive emissions from within the vial chamber.

13. The delivery assembly of claim 10, wherein the sled assembly comprises a needle extending within the vial chamber, the needle being configured to puncture a septum of the vial assembly when the vial assembly is received within the vial chamber through the aperture.

14. The delivery assembly of claim 13, wherein sled assembly further comprises a manifold fluidically coupled to the needle such that the manifold is in fluidic communication with the vial chamber via the needle.

15. The delivery assembly of claim 14, wherein the sled assembly comprises one or more ports that are in fluid communication with the vial chamber through the manifold, wherein one or more delivery lines are operable to couple to the manifold via the one or more ports.

16. The delivery assembly of any preceding claim, wherein the sled assembly, the vial assembly, and the safety shield are formed of materials that inhibit radioactive emissions from within the vial containment region.

17. The delivery assembly of claim 2, wherein the plunger includes an engagement head having a bottom surface that is sized and shaped to interlock with a pair of lever arms of the vial engagement mechanism.

18. The delivery assembly of claim 17, wherein the vial assembly further includes a pair of flexible wings rotatably coupled to the plunger such that the pair of flexible wings are configured to flexibly deform in response to translation of the plunger outwardly from the vial body.

19. The delivery assembly of claim 18, wherein the pair of flexible wings are configured to form an engagement surface that is sized and shaped to interlock with the pair of lever arms in response to a deformation of the pair of flexible wings as the plunger translates outwardly from the vial body.

20. The delivery assembly of claim 2, wherein the plunger includes an upper engagement head and a lower engagement head positioned relatively beneath the upper engagement head along a longitudinal length of the plunger.

21. The delivery assembly of claim 20, wherein the upper engagement head includes a bottom surface that is sized and shaped to interlock with a pair of lever arms of the vial engagement mechanism in response to an upward translation of the vial engagement mechanism.

22. The delivery assembly of claim 21, wherein the lower engagement head includes a top surface that is sized and shaped to interlock with the pair of lever arms of the vial engagement mechanism in response to a downward translation of the vial engagement mechanism.

23. The delivery assembly of claim 22, wherein the plunger further includes at least a curved track and a linear track disposed along an exterior surface of the plunger, wherein the curved track and the linear track are sized and shaped to slidably receive a fixed pin of the vial body therein.

24. The delivery assembly of claim 23, wherein the curved track extends around the exterior surface of the plunger and the linear track extends along the exterior surface and parallel to a longitudinal length of the plunger.

25. The delivery assembly of claim 24, wherein the plunger is configured to rotate within and translate outwardly from the vial body in response to the pair of lever arms interlocking with the bottom surface of the upper engagement head when the vial engagement mechanism translates upward due to the fixed pin being received within the curved track.

26. The delivery assembly of claim 24, wherein the plunger is configured to translate into the vial body at a fixed orientation relative thereto in response to the pair of lever arms interlocking with the top surface of the lower engagement head when the vial engagement mechanism translates downward due to the fixed pin being received within the linear track.

27. The delivery assembly of any preceding claim, wherein the vial assembly comprises an inner chamber and a floating septum movably disposed therein.

28. The delivery assembly of claim 27, wherein the floating septum is configured to translate within the vial body in response to the inner chamber receiving fluid medium therein.

29. The delivery assembly of claim 28, wherein the floating septum engages a needle of the sled assembly positioned at a bottom end of the inner chamber as the floating septum translates within the vial body and the fluid medium within the inner chamber increases.

30. The delivery assembly of any preceding claim, wherein the vial engagement mechanism is coupled to an electrical system such that translation of the vial engagement mechanism within the vial containment region is electrically-driven.

31. The delivery assembly of any preceding claim, wherein the sled assembly includes a battery that is configured to supply power to the sled assembly and the console in response to the sled assembly coupling with the console at the vial containment region.

32. The delivery assembly of claim 31, wherein the sled assembly includes a battery status indicator communicatively coupled to the battery and configured to display data indicative of a charge of the battery.

33. The delivery assembly of any preceding claim, wherein the sled assembly is configured to maintain fluid leaks of therapeutic particles therein such that the sled assembly is operable to inhibit radioactive emissions and fluid leaks from the therapeutic particles stored therein.