CLAIMS

1. A system for concentrating per- and polyfluoroalkyl substances (PFAS), the system comprising:

a regenerant solution line coupled to a vessel configured to introduce a regenerant solution to the vessel to remove PFAS from an anion exchange resin within the vessel thereby regenerating the anion exchange resin and generating a spent regenerant solution comprising the removed PFAS and the regenerant solution;

a separation and recovery subsystem configured to separate and concentrate the removed PFAS to produce a concentrated PFAS solution; and

a super-loading recovery subsystem configured to receive the concentrated PFAS solution and separate and further concentrate the removed PFAS by adsorbing the concentrated PFAS onto an adsorptive media to produce a PFAS waste product and a solution substantially without PFAS.

2. The system of claim 1 in which the regenerant solution includes a salt, a solvent, and water.

3. The system of claim 1 in which the regenerant solution includes a base, a solvent, and water.

4. The system of claim 2 in which the solvent includes an alcohol.

5. The system of claim 3 in which the solvent includes an alcohol.

6. The system of claim 1 in which the anion exchange resin includes a macroporous, strong base, anion exchange resin.

7. The system of claim 1 in which the separation and recovery subsystem includes one or more of:

an evaporation subsystem, a distillation subsystem and/or a membrane separation subsystem.

8. The system of claim 1 in which the separation and recovery subsystem includes a solvent purification subsystem configured to remove carryover PFAS from the separation and recovery subsystem and to provide a purified, reclaimed solvent capable of reuse.

9. The system of claim 8 in which the solvent purification subsystem includes an additional vessel including an anion exchange resin therein.

10. The system of claim 2 in which the super-loading recovery subsystem is configured to produce the PFAS waste product and a solution of concentrated salt and water capable of reuse.

11. The system of claim 3 in which the super-loading recovery subsystem is configured to produce the PFAS waste product and a solution of concentrated base and water capable of reuse.

12. The system of claim 1 in which the super-loading recovery subsystem includes an anionic exchange resin housed in another vessel.

13. A method for concentrating per- and polyfluoroalkyl substances (PFAS), the method comprising:

introducing a regenerant solution to an anion exchange resin to remove PFAS from the anion exchange resin thereby regenerating the anion exchange resin and generating a spent regenerant solution comprising removed PFAS and the regenerant solution;

separating and concentrating the removed PFAS to produce a concentrated PFAS solution; and

subjecting the concentrated PFAS solution to a super-loading recovery process to separate and further concentrate the removed PFAS by adsorbing concentrated PFAS onto an adsorptive media to produce a PFAS waste product and a solution substantially without PFAS.

14. The method of claim 13 in which the regenerant solution includes a salt, a solvent, and water.

15. The method of claim 13 in which the regenerant solution includes a base, a solvent, and water.

16. The system of claim 14 in which the solvent includes an alcohol.

17. The system of claim 15 in which the solvent includes an alcohol.

18. The method of claim 13 in which the anion exchange resin includes a macro-porous, strong base, anion exchange resin.

19. The method of claim 13 in which the separating and concentrating includes one or more of evaporation, distillation and/or membrane separation.

20. The method of claim 13 in which the separating and concentrating includes removing carryover PFAS and providing a purified reclaimed solvent capable of reuse.

21. The method of claim 14 in which the super-loading recovery process includes providing the PFAS waste product and a solution of concentrated salt and water capable of reuse.

22. The method of claim 15 in which the super-loading recovery process includes providing the PFAS waste product and a solution of concentrated base and water capable of reuse.