What we claim is:

1. A treatment system comprising:

a wet air oxidation unit for receiving a heated waste material comprising a spent carbon material and a scale forming contaminant and discharging a first treated material comprising a regenerated carbon material;

a scale reducing heat exchanger in fluid communication with the wet air oxidation unit for receiving the first treated material from the wet air oxidation unit and for discharging a second treated material comprising regenerated carbon and having a reduced temperature relative to the first treated material; and

a second heat exchanger in fluid communication with the scale reducing heat exchanger for receiving the second treated material, the second heat exchanger further arranged to receive a source waste material comprising the spent carbon material and the scale forming contaminant and discharge the heated waste material for delivery to the wet air oxidation unit;

wherein the heated waste material comprises an increased temperature relative to the source waste material due to heat exchange with the second treated material.

2. The system of claim 1, wherein the second treated material comprises a temperature less than a solubility temperature limit of the scale forming contaminant at a given concentration of the scale forming contaminant.

3. The system of claim 2, wherein the scale reducing heat exchanger is effective to reduce a temperature of the first treated material such that the second treated material comprises a temperature of from about 100° C to about 185° C.

4. The system of claim 1, wherein the scale forming contaminant comprises a member selected from the group consisting of aluminum, calcium, carbonate, iron, magnesium, phosphorus, sulfate, and combinations thereof

5. The system of claim 4, wherein the scale forming contaminant comprises calcium.

6. The system of claim 5, wherein the scale forming contaminant comprises calcium sulfate.

7. The system of claim 1, wherein the second heat exchanger (114) comprises a shell and tube heat exchanger.

8. The system of claim 1, wherein the system further comprises a fluid source in fluid communication with the scale reducing heat exchanger to deliver an amount of a fluid to the scale reducing heat exchanger effective to control an extent of temperature reduction for the first treated material.

9. The system of claim 8, further comprising a fluid flow controller in communication with the fluid source and effective to regulate the amount of the fluid delivered to the scale reducing heat exchanger.

10. The system of claim 1, wherein the source waste material is from a powdered activated carbon treatment (PACT) system or a granular activated carbon (GAC) system.

11. A treatment process comprising:

reducing a temperature of a regenerated carbon material exiting a wet air regeneration unit in a first heat exchanger;

delivering the reduced temperature regenerated carbon material from the first heat exchanger to a second heat exchanger, wherein the second heat exchanger heats a spent carbon material comprising spent carbon and a scale forming contaminant with heat from the regenerated carbon material to generate a heated spent carbon material; and

delivering the heated spent material to the wet air regeneration unit for regeneration of the heated spent material.

12. The process of claim 11, wherein the temperature is reduced to a temperature less than a solubility temperature limit of the scale forming contaminant at a given concentration of the scale forming contaminant.

13. The process of claim 12, wherein the temperature is reduced to a temperature of about 100° C to about 185° C.

14. The process of claim 11, wherein the regenerated carbon material further comprises an oxygen depleted gas mixture, wherein the oxygen depleted gas mixture is also utilized to heat the spent carbon material.

15. The process of claim 11, wherein the scale forming contaminant comprises a member selected from the group consisting of aluminum, calcium, carbonate, iron, magnesium, phosphorus, sulfate, and combinations thereof

16. The process of claim 15, wherein the scale forming contaminant comprises calcium sulfate.

17. The process of claim 11, further comprising:

additionally reducing a temperature of a material exiting the second heat exchanger with a third heat exchanger.

18. The process of claim 11, wherein the reducing is done via regulating a fluid flowing through the first heat exchanger via a fluid flow controller.

CLAIMS

The invention claimed is:

1. A treatment system (100) comprising:

a wet air oxidation unit (104) for receiving a heated waste material (106) comprising a scale-forming contaminant and discharging a first treated material (108);

a scale reducing heat exchanger (110) in fluid communication with the wet air oxidation unit (104) for receiving the first treated material (108) from the wet air oxidation unit (104) and for discharging a second treated material (112) having a reduced temperature relative to the first treated material (108); and

a second heat exchanger (114) in fluid communication with the scale reducing heat exchanger (110) for receiving the second treated material (112) having the reduced temperature, the second heat exchanger (114) further arranged to receive a source waste material (116) and discharging the heated waste material (106) for delivery to the wet air oxidation unit (104);

wherein the heated waste material (106) comprises an increased temperature relative to the source waste material (116) due to heat exchange with the second treated material (112).

2. The system of claim 1, wherein the second treated material (112) comprises a temperature less than a solubility temperature limit of the scale-forming contaminant at a given concentration of the scale forming contaminant.

3. The system in any of claims 1 to 2, wherein the scale reducing heat exchanger (110) is effective to reduce a temperature of the first treated material (108) such that the second treated material (112) comprises a temperature of from about 100° C to about 185° C.

4. The system in any of claims 1 to 3, wherein the scale-forming contaminant comprises a member selected from the group consisting of aluminum, calcium, carbonate, iron, magnesium, phosphorus, sulfate, and combinations thereof

5. The system of claim 4, wherein the scale-forming contaminant comprises calcium.

6. The system of claim 5, wherein the scale-forming contaminant is in the form of calcium sulfate.

7. The system in any of claims 1 to 6, further comprising a third heat exchanger (132) in fluid communication with the second heat exchanger (114) for receiving a third treated material (130) from the second heat exchanger (114) and discharging a fourth treated material (134) having a further reduced temperature relative to the third treated material (130) upon exit from the third heat exchanger (132).

8. The system in any of claims 1 to 7, wherein the second heat exchanger (114) comprises a shell and tube heat exchanger.

9. The system in any of claims 1 to 8, wherein the system (100) further comprises a fluid source (118) in fluid communication with the scale reducing heat exchanger (110) to deliver an amount of a fluid (120) to the scale reducing heat exchanger (110) effective to control an extent of temperature reduction for the first treated material (108).

10. The system of claim 9, further comprising a fluid flow controller (121) in communication with the fluid source (118) and effective to regulate the amount of the fluid (120) delivered to the scale reducing heat exchanger (110).

11. The system in any of claims 1 to 10, wherein the source waste material (116) is delivered from at least one of a powdered activated carbon treatment (PACT) system or a granular activated carbon (GAC) system.

12. The system in any of claims 1 to 11, wherein the treated material (108) comprises a regenerated carbon material and an oxygen depleted gas mixture.

13. The system in any of claims 1 to 11, wherein the heated source material (106) and the source waste material (116) comprise a spent carbon material.

14. A treatment process comprising:

reducing a temperature of a treated material (108) fed from a wet air oxidation unit (104) in a first heat exchanger (110) prior to delivery of the treated material (108) to a second heat exchanger (114) which heats a source waste material (116) comprising a scale forming contaminant therein with heat from the first treated material (108) to form a heated waste material (106) comprising the scale forming contaminant.

15. The process of claim 14, wherein the temperature is reduced to a temperature less than a solubility temperature limit of the scale forming contaminant at a given concentration of the scale forming contaminant.

16. The process in any one of claims 14 to 15, wherein the temperature is reduced to a temperature of about 100° C to about 185° C.

17. The process in any one of claims 14 to 16, wherein the scale forming contaminant comprises a member selected from the group consisting of aluminum, calcium, carbonate, iron, magnesium, phosphorus, sulfate, and combinations thereof

18. The process of claim 17, wherein the scale forming contaminant comprises calcium sulfate.

19. The process in any one of claims 14 to 18, further comprising:

additionally reducing a temperature of a second treated material (112) exiting from the second heat exchanger (114) via a third heat exchanger (132).

20. The process in any of claims 14 to 19, wherein the reducing is done via regulating a fluid (120) flowing through the first heat exchanger (110) via a fluid flow controller (121).

21. The process in any of claims 14 to 20, wherein the treated material (108) comprises a regenerated carbon material and an oxygen depleted gas mixture.

22. The process in any of claims 14 to 21, wherein the heated source material (106) and the source waste material (116) comprise a spent carbon material.

23. A treatment process comprising:

reducing a temperature of a regenerated carbon material (108) exiting a wet air regeneration unit (104) in a first heat exchanger (110);

delivering the regenerated carbon material (108) from the first heat exchanger (110) to a second heat exchanger (114), wherein the second heat exchanger (114) heats a spent carbon material (116) comprising spent carbon and a scale forming contaminant with heat from the regenerated carbon material (108) to generate a heated spent carbon material (106); and

delivering the heated spent material (106) to the wet air regeneration unit (104) for regeneration of the heated spent material (106).

24. The process of claim 23, wherein the regenerated carbon material (108) further comprises an oxygen depleted gas mixture, wherein the oxygen depleted gas mixture is also utilized to heat the spent carbon material (116).