Claims

1. A method of controlling a cold water spray system in an exhaust ventilation system, the exhaust ventilation system including an exhaust hood and the cold water spray system, the cold water spray system including a plurality of cold water spray nozzles, the method comprising:

determining a demand load of a cooking appliance that generates cooking effluent in a vicinity of the exhaust hood;

determining a temperature of water in the cold water spray system; and

controlling the cold water spray system in response to at least one of the determined appliance demand load and the determined temperature of water in the cold water spray system to maintain a low temperature of water in the cold water spray system below a predetermined temperature threshold, thereby enabling efficient removal of contaminants from the exhaust hood by the cold water spray system, wherein the controlling includes draining water from the cold water spray system when the determined temperature of water in the cold water spray system exceeds a first predetermined out-of-bounds temperature threshold.

2. The method of claim 1, wherein the controlling further includes:

attempting to recover a predefined temperature of the water by flowing the water through a heat exchanger and then, upon a failure to recover the predefined temperature, draining the water to a drain and replacing it with replacement water.

3. The method of claim 1 or 2, wherein the controlling includes draining water from a storage tank of the cold water spray system.

4. The method of any one of claims 1 to 3, wherein the first predetermined out-of-bounds temperature threshold is between 80 degrees Fahrenheit (27 °C) and 90 degrees Fahrenheit (32 °C).

5. The method of any one of claims 1 to 3, wherein the controlling includes circulating water from the cold water spray system to a heat exchanger when the determined temperature of water in the cold water spray system exceeds a second predetermined out-of- bounds temperature threshold lower than the first predetermined out-of-bounds threshold, and does not exceed the first predetermined out-of-bounds temperature threshold.

6. The method of any one of claims 1 to 3, wherein when the determined temperature of water in the cold water spray system exceeds a second predetermined out-of- bounds temperature threshold lower than the first predetermined out-of-bounds temperature threshold and does not exceed the first predetermined out-of-bounds temperature threshold, the controlling includes:

spraying water through the spray nozzles;

collecting a portion of the water in a collection element of the exhaust hood; and

draining the collected portion of the water from the cold water spray system.

7. The method of any one of claims 5 or 6, wherein the first predetermined out-of-bounds temperature threshold is 90 degrees Fahrenheit (32 °C), and the second predetermined out-of-bounds temperature threshold is 80 degrees Fahrenheit (27 °C).

8. The method of claim 1, comprising determining a temperature of the cooking effluent;

wherein the controlling includes draining water from the cold water spray system when the determined temperature of water in the cold water spray system exceeds the determined cooking effluent temperature minus a first predetermined temperature difference;

wherein the first predetermined temperature difference is a temperature difference of the water below the cooking effluent temperature.

9. The method of claim 8, wherein when the determined temperature of water in the cold water spray system exceeds the determined cooking effluent temperature minus a second predetermined temperature difference, and does not exceed the determined cooking effluent temperature minus the first predetermined temperature difference, the controlling includes:

spraying water through the spray nozzles;

collecting a portion of the water in a collection element of the exhaust hood; and

draining the collected portion of the water from the cold water spray system;

wherein the first predetermined temperature difference is less than the second predetermined temperature difference.

10. The method of claim 9, wherein the first predetermined temperature difference is 10 degrees Fahrenheit (5.6 °C), and the second predetermined temperature difference is 15 degrees Fahrenheit (8.3 °C).

11. The method of any one of claims 1 to 10, wherein the controlling includes circulating water from a water storage tank of the cold water spray system through a heat exchanger to reduce the temperature of the water, and returning the water to the storage tank.

12. The method of any one of claims 1 to 11, wherein the controlling includes spraying water through the cold water spray nozzles based on the determined appliance demand load and the determined temperature of water in the cold water spray loop.

13. The method of claim 12, comprising:

determining the appliance demand load responsive to a cooking effluent temperature proximal the exhaust hood; and

controlling the cold water spray system to maintain a predetermined temperature difference between the cooking effluent temperature and the temperature of the water in the cold water spray system, wherein the temperature of the water in the cold water spray system is lower than the cooking effluent temperature.

14. The method of claim 13, wherein the predetermined temperature difference is between 15 degrees Fahrenheit (8.3 °C) and 25 degrees Fahrenheit (14 °C).

15. The method of claim 14, wherein the predetermined temperature difference is 20 degrees Fahrenheit (11 °C).

16. The method of any one of claims 1 to 15, comprising controlling an amount of water sprayed through the cold water spray nozzles responsive to the appliance demand load.

17. The method of any one of claims 1 to 16, comprising spraying water from a storage tank of the cold water spray system through one or more of the plurality of cold water spray nozzles during a predetermined time period to wash the exhaust hood.

18. The method of any one of claims 1 to 17, wherein the controlling comprises:

spraying water through the spray nozzles;

collecting a portion of the water in a collection element of the exhaust hood; and directing the collected portion of the water through a water preheater of a hot water heater.

19. The method of claim 18, comprising returning the collected water to a storage tank of the cold water spray system after it passes through the water preheater.

20. The method of any one of claims 1 to 19, wherein the controlling comprises:

spraying water through the spray nozzles;

collecting a portion of water in a collection element of the exhaust hood;

detecting a water quality of the collected portion;

responsive to a detected out-of-bounds water quality, implementing at least two water quality recovery schemes, each including one of filtering and transferring heat out of the collected water; and

draining the collected water from the cold water spray system and replacing the collected water if the at least two quality recovery schemes fail to recover the water quality.

21. The method of any one of claims 1 to 20, wherein the method further comprises controlling the cold water spray system based on a fire safety signal representing one or more of a temperature of the cooking effluent and an indicator of the presence of one or more of fire, smoke, and sparks; the controlling including:

receiving the fire safety signal, the fire safety signal including one or more of a high limit exhaust temperature signal and an optical sensor signal; and

spraying water through one or more of the plurality of cold water spray nozzles when the received fire safety signal indicates one or more of:

the temperature of the cooking effluent exceeds a predetermined threshold cooking effluent temperature, and

the presence of one or more of fire, smoke, and sparks.

22. The method of claim 21, wherein the fire safety signal includes an indication of a fluctuating temperature in a predefined frequency band, based on a power spectral density from a band-pass filtered temperature signal, such that a predefined power of the temperature signal within a frequency range indicates a fire.

23. The method of claim 21, wherein the fire safety signal includes a conditioned temperature signal including at least one of a combination of effluent stream temperature with radiant temperature, optical characteristics including color and luminance, and frequency characteristics thereof.