3. The improvement of claim **2**, whereby said software outputs a cooling water adjustment signal to said actuator when the sensed approach to adiabatic saturation temperature is greater than the predetermined setpoint to increase a volume of cooling water sprayed into said reactor vessel.

4. The improvement of claim **3**, further comprising a dry lime feed for injecting dry lime to said reactor vessel as a sorbent.

5. The improvement of claim **2**, whereby the CFB further comprises a water return line for returning cooling water that is not injected into said reactor vessel to a water source, said actuator controls water flow in said water return line, and said cooling water adjustment signal opens said actuator when the sensed approach to adiabatic saturation temperature is less than the predetermined setpoint to decrease a volume of cooling water sprayed into said reactor vessel.

6. The improvement of claim **5**, whereby said cooling water adjustment signal closes said actuator when the sensed approach to adiabatic saturation temperature is greater than the predetermined setpoint to increase a volume of cooling water sprayed into said reactor vessel.

7. The improvement of claim **2**, further comprising a dry lime feed for injecting dry lime to said reactor vessel as a sorbent.

8. The improvement of claim **1**, wherein said flue gas produced during the combustion of a sulfur-bearing fossil fuel includes calcium products converted in situ into $Ca(OH)_2$.

9. The improvement of claim **1**, wherein said temperature monitor comprises an environmentally-hardened moisture analyzer for monitoring relative humidity at said probe.

10. A system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber having a reactor vessel, a dry circulating fluidized bed of dry lime sorbent, fuel ash and by-products in said reactor vessel, an inlet to said reactor vessel, and an exhaust exit, said CFB scrubber having a water spray near the inlet, the system comprising:

an actuated control valve for adjusting an amount of cooling water sprayed into said CFB scrubber;

a moisture analyzer having a probe installed downstream of said CFB scrubber exhaust exit for sensing humidity of the flue gas,

a temperature monitor for monitoring temperature of said flue gas;

a programmable or distributed controller with memory in communication with said actuated control valve and with said moisture analyzer and temperature monitor;

software resident in said memory for determining an approach to adiabatic saturation temperature at said probe based on said sensed humidity and temperature, said software being preprogrammed with a pre-determined approach to adiabatic saturation temperature setpoint and operative to control said actuated control valve to adjust an amount of cooling water sprayed in the water spray inlet when the outlet gas approach to adiabatic saturation temperature differs from a pre-determined setpoint.

11. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **10**, wherein said software is operative to decrease an amount of cooling water sprayed in the scrubber vessel when the outlet gas approach to adiabatic saturation temperature falls below said pre-determined temperature setpoint.

12. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **11**, wherein said software is operative to increase an amount of cooling water sprayed in the scrubber vessel when the outlet gas approach to adiabatic saturation temperature rises above said pre-determined temperature setpoint.

13. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **11**, wherein said pre-determined approach to adiabatic saturation temperature setpoint is a pre-determined range above an adiabatic saturation temperature of the CFB scrubber exhaust.

14. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **13**, wherein said pre-determined approach to adiabatic saturation temperature setpoint is within 20-60° F. of an adiabatic saturation temperature of the CFB scrubber exhaust.

15. The system for automated control of claim **11**, whereby the CFB further comprises a water return line from the water spray inlet for returning cooling water that is not injected into said reactor vessel to a water source, said actuated control valve is operative to open said actuated control valve when the sensed approach to adiabatic saturation temperature is less than the predetermined setpoint to decrease a volume of cooling water sprayed into said reactor vessel.

16. The system for automated control of claim **15**, whereby said actuated control valve is operative to close said actuated control valve when the sensed approach to adiabatic saturation temperature is greater than the predetermined setpoint to increase a volume of cooling water sprayed into said reactor vessel.

17. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **10**, wherein said moisture analyzer probe is installed in said CFB scrubber exhaust exit.

18. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **10**, further comprising a particulate collector downstream of said CFB scrubber exhaust exit, and said temperature sensor probe is installed downstream of said particulate collector.

19. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **10**, wherein an operating temperature of the CFB scrubber is maintained within a pre-determined range of approach temperatures to the adiabatic saturation temperature (ATS).

20. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **19**, wherein 99% $SO_2$ removal efficiency is realized.

21. The system for automated control of an operating temperature of a circulating fluidized bed (CFB) scrubber according to claim **19**, wherein said temperature sensor comprises an environmentally-hardened moisture analyzer for monitoring relative humidity at said probe.

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