3.1 Findings

1. The captain and the first officer of American Airlines flight 1420 were properly certificated and qualified under Federal and company requirements. No evidence indicated any preexisting medical or behavioral conditions that might have adversely affected the flight crew's performance during the accident flight.
2. The accident airplane was properly certified, equipped, and maintained in accordance with Federal regulations and approved company procedures. No evidence indicated preexisting engine, system, or structural failures.
3. During the descent into the terminal area, the flight crewmembers could have reasonably believed that they could reach the airport before the thunderstorm.
4. Because the first officer was able to maintain visual contact with the runway as the airplane was vectored for the final approach course, both flight crewmembers might still have believed that flight 1420 could arrive at the airport before the thunderstorm.
5. When the second windshear alert was received, the flight crew should have recognized that the approach to runway 4R should not continue because the maximum crosswind component for conducting the landing had been exceeded.
6. Because of the flight crew's failure to adequately prepare for the approach and the rapidly deteriorating weather conditions, the likelihood of safely completing the approach was decreasing, and the need to take a different course of action was progressively increasing; as a result, the flight crew should have abandoned the approach.
7. Dynamic or reverted rubber hydroplaning did not occur during the accident airplane's landing rollout.
8. The autospoiler system operated properly, and the spoilers did not automatically deploy because the spoiler handle was not armed by either pilot before landing.
9. A high level of operational redundancy should exist to ensure that spoiler arming has been completed before landing.
10. The flight crew failed to verify that the spoilers had automatically deployed after landing, and the captain failed to manually extend the spoilers when they did not deploy.
11. Because spoiler deployment is critical for optimal landing performance, procedures to ensure that the spoilers have deployed after touchdown should be a required part of all air carriers' landing operations.
12. The lack of spoiler deployment led directly to the flight crew's problems in stopping the airplane within the remaining available runway length and maintaining directional control of the airplane on the runway.
13. The use of reverse thrust at levels greater than 1.3 engine pressure ratio significantly reduced the effectiveness of the airplane's rudder and vertical stabilizer and resulted in further directional control problems on the runway.
14. The maximum reverse thrust for MD-80 landings on wet or slippery runways should be 1.3 engine pressure ratio, except when directional control can be sacrificed for a marginal increase in deceleration.
15. Automatic brake systems reduce pilot workload during landings in wet, slippery, or high crosswind conditions.
16. The lack of spoiler deployment was the single most important factor in the flight

crew's inability to stop the accident airplane within the available runway length.
17. The flight crewmembers' performance during the accident flight was degraded, as evidenced by their operational errors and impaired decision-making.
18. The flight crewmembers' focus on expediting the landing because of the impending weather contributed to their degraded performance.
19. Aircraft penetration of thunderstorms occurs industry-wide.
20. The flight crew's degraded performance was consistent with known effects of fatigue.
21. The local controller provided appropriate, pertinent, and timely weather information to the flight crew regarding the conditions on approach to and at the airport.
22. If near-real-time color weather radar showing precipitation intensity were available, it would provide air traffic controllers with improved representation of weather conditions in their areas of responsibility.
23. The ability of flight dispatchers to provide timely and accurate weather support would be enhanced if they had access to Terminal Doppler Weather Radar information at airports where it is available and Weather Systems Processor information when the system becomes available.
24. Center Weather Service Units should be staffed at all times when any significant weather is predicted to affect their areas of operation, even if the weather is predicted to occur before or after normal operating hours.
25. The Automated Surface Observing System lockout period can prevent the relay of critical weather information to flight crews.
26. Runway visual range data should be directly reported to automated weather systems.
27. The current 2-hour runway visual range archiving capability is inadequate to ensure that data can be preserved for future use.
28. If detailed information on the Low Level Windshear Alert System were contained in the Federal Aviation Administration's Aeronautical Information Manual, pilots could have a better understanding of the system.
29. Part of the delay in locating the flight 1420 wreckage was preventable, and several minutes in the emergency response time might have been saved if the Aircraft Rescue and Fire Fighting units had proceeded directly to the departure end of runway 4R.
30. Aircraft Rescue and Fire Fighting (ARFF) units may not be staffed at a level that enables ARFF personnel, upon arrival at an accident scene, to conduct exterior firefighting activities, an interior fire suppression attack, and a rescue mission.
31. A crash detection and location technology would help expedite the arrival of emergency responders at an accident scene, thus maximizing the possibility for saving lives and reducing the severity of injuries.
32. A timely postaccident interagency emergency response critique that identifies deficiencies that need corrective action and successes that should be repeated in similar circumstances would be beneficial for all parties involved in an aviation accident response.
33. The development of recent technologies to convert nonfrangible structures to frangible ones would provide a safety benefit to airport facilities.
34. American Airlines has insufficient guidance to assist its pilots in performing a stabilized approach and recognizing when an approach has become unstabilized.
35. Because a stabilized approach is a critical part of safe flight operations, it is

imperative that air carriers have specific stabilized approach criteria.
36. Effective Federal Aviation Administration oversight of American Airlines' MD-80 training and line operations has not occurred.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable causes of this accident were the flight crew's failure to discontinue the approach when severe thunderstorms and their associated hazards to flight operations had moved into the airport area and the crew's failure to ensure that the spoilers had extended after touchdown. Contributing to the accident were the flight crew's (1) impaired performance resulting from fatigue and the situational stress associated with the intent to land under the circumstances, (2) continuation of the approach to a landing when the company's maximum crosswind component was exceeded, and (3) use of reverse thrust greater than 1.3 engine pressure ratio after landing.