



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: June 8, 2000

In reply refer to: A-00-55

Ms. Carol B. Hallett
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The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the safety recommendation in this letter. The Safety Board is vitally interested in this recommendation because it is designed to prevent accidents and save lives.

This recommendation addresses the adequacy of emergency response guidelines, procedures, and training for responding to a hydrogen peroxide spill and the adequacy of air carrier procedures for responding to hazardous material spills. The recommendation is derived from the Safety Board's investigation of the October 28, 1998, spill of hydrogen peroxide in a cargo compartment on Northwest Airlines (Northwest) flight 957 while it was en route from Orlando, Florida, to Memphis, Tennessee, and is consistent with the evidence we found and the analysis we performed. As a result of this investigation, the Safety Board has issued ten safety recommendations, one of which is addressed to the Air Transport Association. Information supporting the recommendation is discussed below. The Safety Board would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendation.

On the morning of October 28, 1998, 2 gallons of a 35-percent hydrogen peroxide solution in water, an oxidizer¹ with corrosive properties, spilled in a cargo compartment of Northwest flight 957, a passenger-carrying airplane en route from Orlando to Memphis. The solution leaked from two undeclared 1-gallon plastic bottles that had split. The bottles were in an ice chest that belonged to a passenger on the flight. The leaking hydrogen peroxide contaminated three mail sacks and an undetermined number of bags.

¹ The Department of Transportation defines an oxidizer as "a material that may, generally by yielding oxygen, cause or enhance the combustion of other materials."

The leak was not discovered until cargo handlers in Memphis began to unload the baggage on flight 957. Thinking that the spilled liquid was water, the cargo handlers ignored it and transferred some of the baggage to other Northwest passenger-carrying flights, including flight 7, which then departed for Seattle, Washington. When flight 7 arrived in Seattle, two bags in a cargo compartment were smoldering, including one that had come from flight 957.

As a result of the spill, several people required treatment. In Memphis, 11 employees were treated at the airport's first aid station because their hands had been exposed to the hydrogen peroxide, and 2 more employees went to a local clinic, where they were treated and released. In Seattle, the employee who removed the smoldering bags from the cargo compartment was exposed to fumes. He went to a hospital for treatment and was released. None of the injuries were serious. Northwest estimated that the total cost of the damage to and the downtime on the aircraft and of the damage to the baggage was more than \$40,000.

The National Transportation Safety Board determines that the probable cause of the release of undeclared hazardous material aboard Northwest Airlines flight 957 was the passenger's failure to properly package and identify the hazardous material and inadequate inquiries from the Northwest Airlines agent about the contents of the cooler offered by the passenger. Contributing to the consequences of the incident were inadequate carrier procedures for handling a hazardous materials cargo spill.

The passenger who had checked the ice chest at Orlando was a nurse. She had bought the hydrogen peroxide containers several years earlier and stored them unopened at an assisted care facility for the elderly in Fort Pierce, Florida, that she had once owned. Before her trip on flight 957, she had packed the two plastic bottles of hydrogen peroxide in a plastic ice chest with some sand and a bag of rolls.

She arrived at the airport at 0600 eastern standard time (EST); the flight was scheduled to depart at 0630 EST. She attempted to check seven items, including the ice chest, at Northwest's roadside skycap service. According to the skycap, he had been reluctant to check the bags because Northwest allows a passenger to have only two items checked without paying additional fees. He had told her that the fees must be paid at the ticket counter inside the terminal, but she explained that she was late and persuaded him to check all seven of her items. She tipped him \$20 dollars and rushed off.²

The skycap said that he had asked the woman whether the ice chest contained dry ice, a hazardous material with special limitations in air transportation.³ She did not declare that there were any hazardous materials in her baggage⁴ and later told investigators that she was not aware that hydrogen peroxide was a hazardous material. She checked in with Northwest at the gate and

² Northwest management indicated that the skycap was a Northwest employee and was authorized to collect the fees for extra baggage. Northwest took disciplinary action against the skycap.

³ Northwest hazardous materials training specifically addresses questioning passengers about hazardous materials in ice chests.

⁴ A search of her other baggage in Seattle revealed other undeclared hazardous materials, including small arms ammunition, an aerosol can of lubricant (a flammable gas), and a tube of gun oil (a combustible liquid).

left Orlando on flight 957. There were no reports of incidents or injuries at the Orlando airport involving her baggage.

After flight 957 arrived in Memphis, two Northwest ramp employees entered the cargo compartments, between 0730 and 0745 central standard time, and began transferring the baggage to other aircraft in the morning bank of flights.⁵ Both employees noted wet baggage and a clear liquid on the floor. They assumed the liquid was water that had leaked from the ice chest or from a shipment of tropical fish.⁶

About 10 minutes after the baggage was unloaded, the employees who had handled the wet baggage and mail sacks began to complain that their hands were tingling and turning white. By then, some of the baggage had been transferred to other airplanes, and some had been returned to passengers. The ice chest and several bags had been loaded onto flight 7.

Because employees were complaining about their hands, Northwest contacted the airport's fire station, and it responded to the site. Northwest also contacted the airport's post office, which sent a postal employee to pick up the wet mail sacks. A ramp employee retrieved the ice chest from flight 7. When he was told that the ice chest probably contained a hazardous material, he left to seek medical attention. After he left, the pilot of flight 7 noticed that there was a cluster of emergency responders and Northwest employees near the airplane. The pilot asked them about the nature of the emergency. They told him that the ice chest might contain a hazardous material. The pilot asked whether the ice chest had been on flight 7. Not knowing that the chest had been on flight 7, several Northwest employees told the pilot that it had not. Thinking that his airplane was not affected by the incident, the pilot of flight 7 departed as scheduled.

The emergency responders did an on-site examination and found that each bottle had split open and that the hydrogen peroxide had leaked from the bottles and the ice chest. Each bottle had a label that said "Vero Chemical Distributors, Inc.," and had generic warnings about flammable materials. The words "Hydrogen Peroxide" were handwritten in an upper corner of each label. When the responders questioned the passenger who had checked the ice chest, she told them that the bottles had contained a 35-percent solution of hydrogen peroxide.

During the emergency, the fire station responders used the *North American Emergency Response Guide* and a material safety data sheet⁷ about hydrogen peroxide as references. Northwest stated that it also contacted the Minnesota Poison Control Center.⁸ (While there is no record of the information provided by the center, a previous employee indicated that, given the nature of the center,

⁵ Memphis is one of Northwest's hub airports. Northwest has 3 daily banks of about 40 flights; the planes are at the airport for only 1 to 2 hours.

⁶ According to the ramp employees, it is common to discover ice chests leaking due to melting ice. Also, live fish are shipped in plastic bags inside fiberboard boxes, and the bags occasionally break, spilling the water from the box.

⁷ A material safety data sheet is developed by the producer of a chemical product and contains general information about it, including a description of its chemical and physical properties, a description of the health and environmental hazards it poses, and guidelines for responding to its release.

⁸ At the time of the incident, the Minnesota Poison Control Center was under contract to Northwest to provide hazardous materials information.

its information would have focused on the medical hazards, including the fact that hydrogen peroxide can damage skin.) The information gathered described some of the hazards posed by hydrogen peroxide, but much of it did not point out that hydrogen peroxide that has dried on certain materials is a fire hazard. A fire station responder stated that the responders were concerned about the danger of fire from materials exposed to the oxidizing properties of hydrogen peroxide and had warned the Northwest employees.

Hydrogen peroxide is a very powerful oxidizing agent that can oxidize all organic compounds and a wide range of inorganic ones. It is not flammable, but it can readily cause other materials to burn. Natural materials like wood, paper, cotton, and leather are very susceptible to fire when exposed to hydrogen peroxide. These reactions are enhanced when the material contains dirt, especially metallic compounds of copper, silver, or mild steel.⁹ If a hydrogen peroxide solution is allowed to evaporate, the water evaporates more quickly than the hydrogen peroxide does, causing the solution to become more concentrated. As a hydrogen peroxide solution becomes more concentrated and is exposed to organic materials and dirt or metallic compounds, the hydrogen peroxide begins to decompose. This decomposition results in an exothermic reaction¹⁰ and the release of oxygen, which will support combustion.

The initial reaction of the baggage handlers to the clear water-like liquid in the cargo compartment of flight 957 was not unreasonable, given Northwest's indication that there are frequent spills of water from ice chests and tropical fish shipments. However, the Safety Board concludes that hydrogen peroxide presents a serious hazard to air transportation because it can be mistaken for water and can cause a fire if it is allowed to dry on cargo or baggage. Therefore, the Safety Board has recommended that the Federal Aviation Administration (FAA) develop, with the assistance of the North American Hydrogen Peroxide Safety Producers Committee, and distribute to carriers guidance about the difficulty of identifying a hydrogen peroxide spill and about the danger of allowing hydrogen peroxide to dry on organic materials (including paper, fabric, cotton, and leather), which may result in a fire. The Safety Board has also recommended that the North American Hydrogen Peroxide Safety Producers Committee assist the FAA in developing this guidance.

In the time between the discovery of the spill and the identification of the hazardous material, an undetermined number of bags potentially contaminated with hydrogen peroxide were transferred to 13 other Northwest aircraft for flights that departed Memphis, including flight 7 to Seattle. Northwest began making calls to Northwest management at all of its destination airports, initially focussing on airports receiving flights that had baggage transferred from flight 957. Callers provided information that focused on the injuries to the Memphis ground crew, first aid, and the need to use protective gloves when handling the baggage, and not on the fire hazard. It was recommended that people unloading the airplane check for wet baggage and, if it was discovered, condemn and replace it. A call was also made to Northwest's Systems Operations Control, which telexed information on the spill and a warning about potentially contaminated baggage to all Northwest operations offices, station managers, maintenance managers, and control centers. No similar warnings were sent to the pilots of the airplanes containing potentially contaminated baggage.

⁹ Mild steel is a carbon steel with a maximum of about 0.25 percent carbon.

¹⁰ A chemical reaction that results in the generation and release of heat.

Before flight 7 landed in Seattle, the Northwest employees there knew that the airplane might be carrying contaminated baggage, and the baggage handlers, as Memphis had suggested, were protecting their hands with rubber gloves. However, no one in Seattle had independently researched the hazards posed by hydrogen peroxide, and the Northwest telephone call from Memphis had not mentioned fire hazards. Consequently, no one in Seattle was prepared for the possibility of a fire. The Northwest employees in Seattle had told the local emergency responders about the Memphis spill but had not asked any responders to stand by when flight 7 arrived in case there was a fire.

The baggage handlers reported that when they opened the cargo compartments of flight 7, they found smoke, but no flames, coming from the area of two adjacent suitcases. One handler said the smoke was “like someone blowing on a good cigar.” The handlers backed away, and an equipment service employee without any protective equipment climbed into the compartment and retrieved the smoldering suitcases. Northwest called the fire department, which drowned the suitcases with water. A short time later, the equipment service employee became nauseated and was taken to a local hospital, where he was treated and released.

The Safety Board concludes that Northwest personnel in Memphis did not adequately address the nature of the emergency and allowed potentially contaminated baggage to be transferred to other aircraft. Once the employees’ hands began to sting and turn white, Northwest should have immediately isolated all baggage, instead of returning it to passengers or transferring it to other airplanes; and the baggage should have remained in isolation until the nature of the spilled material was determined. Had Northwest done so, the incident in Seattle would have been prevented. Therefore, the Safety Board has recommended that Northwest amend its emergency response procedures and training to include the importance of isolating baggage and cargo that have been involved with a hazardous materials spill until it can be determined which items have been contaminated and what measures are necessary to prevent further contamination of baggage and aircraft or other hazards (such as fire or poisoning).

Because the danger of this type of incident is not limited to Northwest, the Safety Board has recommended that the FAA issue guidance to air carriers about the need to isolate baggage and cargo that have been involved with a hazardous materials spill until it can be determined which items have been contaminated and what measures are necessary to prevent further contamination of baggage and aircraft or other hazards (such as fire or poisoning). The Safety Board has also recommended that the FAA require principal operations inspectors to review and amend, as necessary, air carrier manuals to ensure that air carrier procedures are consistent with the FAA’s new guidance.

The Memphis incident did not have severe consequences; however, on February 3, 1988, American Airlines flight 132, a McDonnell Douglas DC-9-83, had an in-flight fire while en route to Tennessee from Texas.¹¹ The fire eventually breached the cargo compartment, and the passenger cabin floor over the middle cargo compartment was charred. The investigation determined that the fire had been caused by an undeclared and improperly packaged shipment of

¹¹ National Transportation Safety Board. 1988. *In-flight Fire, McDonnell Douglas DC-9-83, N569AA, Nashville Metropolitan Airport, Nashville, Tennessee, February 3, 1988*, Hazardous Materials Incident Report NTSB/HZM-88/02. Washington, D.C.

hydrogen peroxide. Further, according to the incident data base of the Research and Special Programs Administration, from 1995 through 1999, there were nine incidents involving hydrogen peroxide in air transportation.

The Safety Board concludes that given the potential for tragedy, Northwest failed to adequately alert aircraft flight crews. Several aircraft had departed before the emergency responders were able to determine what material had spilled. It is vitally important that the aircraft flight crew be notified in flight if any baggage on their airplane has been determined to have been involved in a hazardous materials spill. The flight crew should also be told how to prevent or mitigate an incident involving those materials. Therefore, the Safety Board has recommended that Northwest amend its emergency response procedures and training to include notification of pilots in flight when baggage and cargo that are believed to have been involved in a hazardous materials spill have been placed on their aircraft; notifying the pilots includes clearly identifying the hazards posed by the material involved in the spill and the procedures that the pilots should take.

Further, because the danger of this type of incident is not limited to Northwest, the Safety Board has recommended that the FAA issue guidance to air carriers about the need to notify pilots in flight when baggage and cargo that are believed to have been involved in a hazardous materials spill have been placed on their aircraft; notifying the pilots includes clearly identifying the hazards posed by the material involved in the spill and the procedures that the pilots should take. The Safety Board has recommended that the FAA then require principal operations inspectors to review and amend, as necessary, air carrier manuals to ensure that air carrier procedures are consistent with this guidance.

Given the potential that contaminated baggage and cargo have to cause a tragedy and given your organization's unique position in the industry, the Safety Board believes that the Air Transport Association should inform its members about the Memphis incident and make them aware of the following: the difficulty of identifying a hydrogen peroxide spill; the danger of allowing hydrogen peroxide to dry on organic materials; the need to isolate baggage and cargo that have been involved with a hazardous materials spill until it can be determined which items have been contaminated and what measures are necessary to prevent further contamination of baggage and aircraft or other hazards (such as fire or poisoning); and the need to notify pilots in flight when baggage and cargo that are believed to have been involved in a hazardous materials spill have been placed on their aircraft (such notification includes informing the pilots clearly about the hazards presented by the material involved in the spill and the procedures that the pilots should take).

The FAA has initiated action against the passenger for violating the Hazardous Materials Regulations.¹²

As a result of this investigation, the National Transportation Safety Board recommends that the Air Transport Association:

¹² Title 49 *Code of Federal Regulations* Subchapter "C."

Inform your members about the Memphis incident and make them aware of the following: the difficulty of identifying a hydrogen peroxide spill; the danger of allowing hydrogen peroxide to dry on organic materials; the need to isolate baggage and cargo that have been involved with a hazardous materials spill until it can be determined which items have been contaminated and what measures are necessary to prevent further contamination of baggage and aircraft or other hazards (such as fire or poisoning); and the need to notify pilots in flight when baggage and cargo that are believed to have been involved in a hazardous materials spill have been placed on their aircraft (such notification includes informing the pilots clearly about the hazards presented by the material involved in the spill and the procedures that the pilots should take). (A-00-55)

The Safety Board also issued safety recommendations to the Federal Aviation Administration, the U.S. Postal Service, the Hydrogen Peroxide Safety Producers Committee, and Northwest Airlines, Inc. In your response to the recommendation in this letter, please refer to Safety Recommendation A-00-55. If you need additional information, you may call (202) 314-6170.

Chairman HALL and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By: Jim Hall
Chairman