Testimony of

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— On —

Examining the Federal Role in Improving School Bus Safety
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An Independent Federal Agency

Good morning, Chairwoman Norton, Ranking Member Davis, Chairman DeFazio, Ranking Member Graves, and Members of the Subcommittee. Thank you for inviting the National Transportation Safety Board (NTSB) to testify before you today regarding our investigations and safety recommendations on school bus safety.

In 1967, Congress established the NTSB as an independent agency within the United States Department of Transportation (USDOT) with a clearly defined mission to promote a higher level of safety in the transportation system. In 1974, Congress reestablished the NTSB as a separate entity outside of the USDOT, reasoning that "no federal agency can properly perform such (investigatory) functions unless it is totally separate and independent from any other . . . agency of the United States."[1] Because the USDOT has broad operational and regulatory responsibilities that affect the safety, adequacy, and efficiency of the transportation system, and transportation accidents may suggest deficiencies in that system, the NTSB's independence was deemed necessary for proper oversight.

The NTSB is charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—highway, rail, marine, and pipeline. We determine the probable cause of the accidents we investigate, and we issue recommendations to federal, state, and local agencies, and other entities, aimed at improving safety, preventing future accidents and injuries, and saving lives. The NTSB is not a regulatory agency—we do not promulgate operating standards and do not certificate organizations and individuals. The goal of our work is to foster safety improvements, through safety alerts, reports, and formal safety recommendations, for the traveling public.

School bus travel is one of the safest forms of transportation in the United States. Every day, nearly 600,000 buses carry more than 25 million students to and from school and activities. Children are safer traveling in school buses than in any other vehicle.[2]

The NTSB has a long history of investigating school bus crashes and making recommendations to improve the safety of the system. However, we continue to investigate school bus crashes that result in preventable fatalities and injuries. In 2018, we completed a special investigation report regarding selective issues in school bus transportation safety following crashes in Baltimore, Maryland, and Chattanooga, Tennessee.[3] We also recently completed the investigation of a December 12, 2017, school bus fire in Oakland, Iowa.[4] We have made recommendations regarding improving occupant protection, enhancing driver oversight, and increasing pedestrian safety, as well as emphasizing the need for crash-prevention technologies, fire-resistant materials, and fire suppression systems on school buses.

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[1] Independent Safety Board Act of 1974 § 302, Pub. L. 93-633, 88 Stat. 2166–2173 (1975).

[2] See the NHTSA road safety webpage on school bus safety, accessed July 10, 2019.

[3] NTSB. *Selective Issues in School Bus Transportation Safety: Crashes in Baltimore, Maryland, and Chattanooga, Tennessee.* NTSB/SIR-18/02. Washington, DC: NTSB.

[4] NTSB. *School Bus Run-Off-Road and Fire*. NTSB/HAR-19/01. Washington, DC: NTSB.

Lap/Shoulder Belts on School Buses

School buses are one of the safest modes of transportation because of their robust design and unique operating environment. School buses are designed with a passive form of occupant protection, termed "compartmentalization," which requires no action by the passenger and functions by forming a compartment fore and aft of the bus occupant. Compartmentalization is designed to contain passengers within their seating compartments during frontal and rear-impact collisions, while the seatback is designed to absorb impact energy and reduce occupant injury. A key aspect of this occupant protection system is that passengers remain within the compartment prior to and during an impact so that they benefit from the energy-absorbing seat design. However, for many years, we have recommended enhancements to school bus occupant protection systems, particularly to address side-impact collisions and rollovers in which compartmentalization is incomplete and provides insufficient protection for occupants.

In 1999, we released a special investigation report regarding bus crashworthiness.[5] In this report, we issued two recommendations requesting that the National Highway Traffic Safety Administration (NHTSA) develop performance standards for school bus occupant protection systems that account for frontal, side-, and rear-impact collisions and rollovers, then require that newly manufactured school buses install systems to retain passengers within the seating compartments throughout the crash sequence for all accident scenarios.[6]

In 2008, NHTSA published a final rule (with an effective date of October 21, 2011) that upgraded the school bus occupant protection requirements of various Federal Motor Vehicle Safety Standards (FMVSSs), including the requirement for lap and shoulder belts (rather than lap-only belts) for all passenger seating positions on school buses with a gross vehicle weight rating (GVWR) equal to or less than 10,000 pounds; and the establishment of performance standards for seat belts voluntarily installed by states or school districts on school buses with a GVWR greater than 10,000 pounds (these vehicles are referred to as "large school buses").[7]

Now that there is a federal regulation defining performance standards for large school bus passenger lap/shoulder belts, school bus and seat manufacturers are designing large school buses with this safety improvement. In addition, design improvements—such as flexible seating systems—have reduced the impediments to equipping large school buses with this key safety feature. States and local school districts that have required or installed lap/shoulder belts in large school buses report additional improvements beyond occupant protection, including reduced driver distraction and improved student behavior. However, to date, there is no federal requirement for large school buses to be equipped with lap/shoulder belts, and most states do not require them.

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[5] NTSB. *Bus Crashworthiness*. NTSB/SIR-99/04. Washington, DC: NTSB.

[6] NTSB Safety Recommendations H-99-45 and -46.

[7] (a) See Title 49 *Code of Federal Regulations* (*CFR*) Part 571, "Federal Motor Vehicle Safety Standards, Seating Systems, Occupant Crash Protection, Seat Belt Assembly Anchorages, School Bus Passenger Seating and Crash Protection, Final Rule." (b) The final rule developed performance standards for both lap belts and lap/shoulder belts on large school buses if the belts were voluntarily installed. The rule requires higher seatbacks for all school buses, but does not require that passenger lap or lap/shoulder belts be installed in large school buses.

For large school buses, NHTSA has continued to maintain that compartmentalization, rather than lap/shoulder belts, is the best way to provide crash protection.[8]

In February 2012, a school bus transporting students to Chesterfield Elementary School in Chesterfield, New Jersey, was struck at an intersection by a Mack roll-off truck with a fully loaded dump container, resulting in 1 bus passenger fatality, 5 serious passenger injuries, and 11 minor passenger injuries. After being struck by the truck, the bus rotated nearly 180 degrees and subsequently struck a traffic beacon support pole. The fatally and severely injured passengers were seated in the back half of the school bus, in the area of higher impact forces and accelerations. The bus was equipped with lap belts, but some students on the school bus wore them improperly or not at all.

Although compartmentalization makes school buses extremely safe, precrash, lateral, and rollover motions still expose unbelted passengers to injury-producing components within the vehicle, intrusion, movement out of the seating compartment, and ejection. Lap belts can be beneficial in some circumstances, but injuries may still result from upper-body flailing. As a result of our investigation of the Chesterfield crash, we concluded that, in severe side-impact crashes, properly worn lap/shoulder belts reduce injuries related to upper-body flailing that are commonly seen with lap-only belts and, therefore, provide the best protection for school bus passengers. Further, better student, parent, and school district education and training may increase the use and proper fit of passenger seat belts in school buses. Thus, we recommended that school districts provide improved information to parents and students regarding the importance of properly using seat belts on school buses.

Another large school bus crash that we investigated demonstrated the safety benefit of lap/shoulder belts in protecting bus passengers. On November 27, 2017, a school bus in Helena, Montana, was struck at an intersection by a pickup truck towing a trailer.[9] Following the collision, the school bus departed the roadway, struck an electrical equipment box, and overturned 90 degrees onto its right side. The bus was occupied by the driver, an adult aide, and two student passengers. All of the bus passengers were wearing lap/shoulder belts, and there were only minor injuries as a result of the crash. We concluded that the passenger lap/shoulder belts mitigated injuries in this side-impact and rollover crash.

In the Chattanooga, Tennessee, bus crash that occurred on November 21, 2016, 6 students died and more than 20 others were injured when the bus struck a utility pole, rolled onto its right side, and collided with a tree. The Chattanooga school bus passengers were at risk due to the precrash vehicle motions that threw them from their seating compartments prior to the bus striking the utility pole. This rendered compartmentalization ineffective during the rollover sequence. Therefore, we have recommended that each state that has not already done so require that passenger lap/shoulder belts be installed in all new large school buses to provide the best protection for all their occupants.[10]

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[8] See the NHTSA road safety webpage on school bus safety, accessed July 10, 2019.

[9] NTSB. *Intersection Collision and Rollover Involving School Bus and Pickup Truck*. NTSB/HAB-19/02. Washington, DC: NTSB.

[10] NTSB Safety Recommendations H-18-9 and -10.

Fire Protection on School Buses

We have investigated several bus fires and identified safety issues regarding flammability, fire suppression, and emergency evacuation.

In 1988, a school bus operating as a church activity bus was struck head-on by a pickup truck on Interstate 71 near Carrollton, Kentucky.[11] The bus's fuel tank was punctured during the collision and a fire ensued, engulfing the bus. The bus driver and 26 passengers were fatally injured, 34 bus passengers sustained minor to serious injuries, and 6 passengers were uninjured. During our investigation, we identified safety issues with, among other things, the federal safety standards used in school bus manufacture, the flammability and toxicity of school bus seating materials, and emergency egress on school buses.

All school buses in the United States are required to meet FMVSS 302 (flammability of interior materials), established by NHTSA, specifying the fire-resistance requirements for materials used in the occupant compartments of motor vehicles.[12] Since its adoption in 1971, FMVSS 302 has remained essentially the same. All 27 fatalities in the Carrollton crash resulted from smoke injuries, not from the collision with the pickup truck. Thirty years later, we are still addressing the adequacy of FMVSS 302 to prevent the rapid spread of fire and smoke inside school buses.

FMVSS 302 is intended to reduce deaths and injuries caused by vehicle fires; however, flammability testing under FMVSS 302 is performed using a small-scale fire to represent a fire originating in the passenger compartment from sources such as matches or cigarettes. The test does not represent the most common causes of school bus fires, most of which begin in the engine and can ignite after a crash. The current standard for school buses remains less stringent than the flammability standards applied in other modes of transportation under USDOT safety oversight, such as aviation and rail, and is clearly outdated.

Following our investigation of the April 2014 collision and postcrash fire involving a truck-tractor double trailer and a motorcoach that occurred on Interstate 5 in Orland, California, we recommended that NHTSA revise FMVSS 302 to adopt the more rigorous performance standards for interior flammability and smoke emissions characteristics already in use for commercial aviation and rail passenger transportation.[13] In 2017, NHTSA publicly announced it was pursuing a research effort, titled *Test Procedures for Evaluating Flammability of Interior Materials*, and that final results were expected to be published in June 2018; however, no results have yet been published, more than a year after the deadline.

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[11] NTSB. *Pickup Truck/Church Activity Bus Head-on Collision and Fire*. NTSB/HAR-89/01. Washington, DC: NTSB.

[12] The standard (49 *CFR* 571.302) specifies a horizontal burn rate of not more than 102 millimeters per minute within 13 millimeters of the passenger compartment air space.

[13] (a) NTSB. *Truck-Tractor Double Trailer Median Crossover Collision With Motorcoach and Postcrash Fire on Interstate 5*. NTSB/HAR-15/01. Washington, DC: NTSB. (b) NTSB Safety Recommendation H-15-12.

The Oakland, Iowa, bus fire occurred when a school bus backing out of a driveway got stuck in a drainage ditch. While the driver was attempting to drive the bus forward and back onto the road, a fire ignited in the engine compartment and spread into and through the bus's passenger compartment. The driver and 16-year-old passenger sustained thermal injuries and died in the fire as a result of smoke and soot inhalation.

The Oakland school bus was not equipped with an automatic fire suppression system (AFSS). Typically, such systems deliver a fire suppressant inside a vehicle's engine compartment when a fire sensor is activated. An AFSS uses either thermal sensors to detect heat or optical sensors to detect flame on specific ignition points or flammable agents on or near the engine block. Following detection, the system alerts the driver and automatically releases a water mist or chemical (powder) suppressant. The systems can be installed during or just after new manufacture, or retrofitted into buses already in service. No national standards exist for AFSS installation or performance; however, specifications have been defined for AFSS testing as well as voluntary performance certification, both in the United States and internationally.

In 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) instructed NHTSA to research motorcoach fires and ways to prevent them.[14] This requirement, while directed at motorcoach fire safety, has helped pave the way for the testing fire suppression systems that have been shown to prevent or mitigate the spread of fire into a passenger compartment and are now widely available and already installed in some school buses. If the Oakland school bus had been equipped with such a system, the system likely would have slowed or stopped the growth and spread of the fire and its progression into the passenger compartment. As a result of this investigation, we have recommended that NHTSA require all new school buses to be equipped with fire suppression systems that, at a minimum, address engine fires.[15] Further, we have recommended that the USDOT require in-service school buses to be equipped with fire suppression systems that, at a minimum, address engine fires.[16] Absent such requirements, we recommended that school bus manufacturers install fire suppression systems that, at a minimum, address engine fires as standard equipment on all newly manufactured school buses.[17]

We also found during the Oakland investigation that small penetrations through the firewall protecting the interior of the bus from the engine compartment were not blocked with fire-resistant material. More importantly, the firewall did not prevent the spread of fire from the engine compartment because the engine block's penetration into the passenger compartment was covered only in fiberglass cowling, which provided no fire protection or containment and acted as fuel load. This resulted in a firewall gap and a direct pathway for the fire to enter the passenger area. We concluded that the lack of a complete firewall between the school bus engine compartment and the passenger compartment led to the rapid spread of superheated gases, smoke, and fire into

[14] Section 32704(a) of MAP-21, Public Law 112-141 (July 6, 2012), directs the secretary of the USDOT to "conduct research and testing to determine the most prevalent causes of motorcoach fires and the best methods to prevent such fires and to mitigate the effect of such fires, both inside and outside the motorcoach." Research and testing were to include automatic fire suppression systems.

[15] NTSB Safety Recommendation H-19-4.

[16] NTSB Safety Recommendation H-19-3.

[17] NTSB Safety Recommendation H-19-11.

the passenger compartment; and the interior components of the bus were flammable when exposed to ignition sources greater than those used in tests under FMVSS 302 and in fire block tests.

Even without a fire suppression system, if the Oakland school bus had been equipped with a complete firewall or with fire-resistant materials between the engine and the passenger compartment, the spread of fire and smoke into the bus's interior would have been reduced or slowed. As a result, the occupants would have been exposed to less smoke and heated gas, and they would have had more time to evacuate the bus, which might have prevented their fatal injuries. As a result of this investigation, we recommended that NHTSA develop standards and that school bus manufacturers ensure that, for newly manufactured school buses—especially those with engines that extend beyond the firewall—no hazardous quantity of gas or flame can pass through the firewall from the engine compartment to the passenger compartment.[18]

The Oakland, Iowa, fire, along with other school bus fires reported nationally and as shown in school bus fire demonstrations, illustrates that once a school bus compartment is breached (even when an exterior fire enters the bus), a fire spreads quickly, and smoke, toxic gases, and heat make the interior untenable for occupants. On April 16, 2018, as a training exercise, the Stafford County (Virginia) Public Schools and the Stafford County Fire and Rescue Department held a school bus fire demonstration. The fire department placed a hay bale in front of a school bus and ignited it; the bus was fully engulfed in flames within 3 minutes.[19] That demonstration led to another on October 27, 2018, in Kansas City, Kansas, in which the National Association for Pupil Transportation partnered with the Lee Summit Fire Department to show the time it takes for flames to engulf a school bus and demonstrated realistic evacuation scenarios. A bale of hay was set on fire inside the open front door of one bus; by the 3-minute mark, the bus was filled with smoke and temperatures had reached 900°F to 1,000°F.[20]

Two critical components of school bus safety are emergency training for school bus drivers and passengers, and emergency drills involving both drivers and students. Proper response in an emergency depends on the quality of training, the types of drills (which should supplement classroom instruction), and the frequency of refresher training and drills.

School Bus Driver Oversight

Although the specific safety issues differed, the Baltimore, Chattanooga, and Oakland crashes shared one common factor: poor driver oversight by the school districts and contracted motor carriers, which resulted in unsafe school bus operations. In each case, the drivers continued to operate school buses unsafely with no remedial action being taken, even in the face of known driver safety issues.

[18] NTSB Safety Recommendations H-19-5 and -12.

[19] School Bus Fleet. *School Bus Fire Demo Highlights Need for Preparedness*. June 19, 2018.

[20] School Bus Fleet. *School Bus Fire Demo Shows Importance of Evacuation Training*. October 27, 2018.

In the Chattanooga crash, the bus driver was speeding as he transported students from the school to their drop-off locations. While driving, he answered a cell phone call, which was still active when he lost control of the bus and departed the roadway. We concluded that the Chattanooga school bus driver's speeding, combined with his cell phone use while driving, led to the crash. At the time of the crash, the driver had about 5 months of school bus driving experience, during which he had accumulated numerous complaints about his driving performance. However, investigators found no record of disciplinary or corrective training in the driver's file. The day of the crash was not the first time the bus driver had exhibited unsafe driving maneuvers. Shortly after the beginning of the 2016 school year, he began reporting student disciplinary problems to Hamilton County Department of Education (HCDE) school staff. As the school year progressed, the problems between the driver and the students continued, and the driver sent even more discipline referrals to school administrators, who told him he should not be submitting so many. About a week later, the HCDE and Durham School Services (Durham), the contract carrier for the school district, received the first complaint that the driver was intentionally trying to make students fall.

After the crash, our investigators found e-mails and letters from parents and students about the bus driver's performance in the months leading to the crash, which provided insight into how the driver dealt with student behavioral issues during this period. Student passengers who normally rode this bus told our investigators that when there was excessive noise or when some students refused to sit down, the driver would slam on the brakes or swerve, causing them to fall. No action was taken to relieve the driver of duty, nor were definitive steps taken to resolve the safety complaints. We concluded that Durham had no systematic method for recording, tracking, or investigating complaints of driver behavior, and that it was deficient in driver oversight. Following this crash, the state of Tennessee enacted a law establishing a program to monitor and oversee transportation services for local education authorities, school districts, and charter schools.

We also have a long history of investigating crashes in which drivers who failed to report their medical conditions were issued medical certificates and were subsequently involved in fatal crashes in which their medical condition contributed to the event.

On November 1, 2016, a Baltimore City school bus struck a private auto and a Maryland Transit Administration (MTA) bus, killing four MTA passengers and both bus drivers. Medical records from the school bus driver's primary care physician document the driver's history of seizures dating back to his childhood. Additionally, the driver experienced several incapacitating medical events while on duty as a school bus driver, including three incidents in the previous 5 years. We determined that the Baltimore school bus driver was likely incapacitated by a seizure due to his long-standing seizure disorder, which resulted in the collisions with the car and transit bus.

Maryland Motor Vehicle Administration (MVA) records showed that the Baltimore school bus driver had repeated license revocations and suspensions over several decades. He fraudulently obtained his driver's license by providing documents with different name spellings or birth dates to circumvent the MVA verification system. We concluded that the Baltimore school bus driver understood his diagnosis of epilepsy and intentionally hid this disqualifying medical condition and his use of treatment medications during his medical examinations to prevent being denied certification. Further, although Baltimore City Public Schools (BCPS) was responsible for driver oversight, it failed to address multiple deficiencies and to identify the bus driver as high risk. Similarly, the MVA verification system failed to prevent the Baltimore school bus driver from obtaining a driver's license through fraudulent means.

The Federal Motor Carrier Safety Administration establishes regulations for commercial driver licensing, including licensing school bus drivers employed either by a local school district directly or by a contracted motor carrier that provides student transportation services. A person who operates a commercial vehicle in commerce must be medically certified as physically qualified to operate the vehicle. The Baltimore crash might have been prevented had a coworker or a BCPS employee reported the driver to the MVA. We concluded that school districts and their contracted student transportation service providers would benefit from awareness training on federal and state commercial driver fitness regulations and on the avenues available to report drivers with medical conditions that may make it unsafe to operate a school bus.

In the Oakland crash, the driver was found qualified for a commercial driver's license during an examination on March 6, 2017, and he held a medical certificate valid for 2 years. However, after the examination, the driver's degenerative spinal condition worsened, resulting in his inability to walk without a cane or a walker. The driver understood his diagnosis of degenerative disc disease, had seen a specialist, and was scheduled for back surgery 2 days after the crash. The school district was also aware of the driver's condition and that he was scheduled for surgery. When a school district, as an intrastate motor carrier, identifies a physical impairment that could affect a driver's ability to operate a school bus and could lead to a crash or result in the driver's inability to safely render assistance—such as an inability to walk without a cane or move quickly in an emergency—the district should require the driver (even if he or she has a medical certificate) to demonstrate physical ability or provide a doctor's clearance for duty. Although school bus drivers undergo federally required medical examinations and can be medically certified for 2 years, their physical condition may change during the interval between examinations and render the driver incapable of performing critical emergency duties. As a result of the Oakland investigation, we recommended that states revise their school bus driver requirements so that all drivers must pass a physical performance test on hiring and at least annually, and also whenever their physical condition changes in a manner that could affect their ability to physically perform school bus driver duties, including helping passengers evacuate a bus in an emergency.[21]

School Bus Route and Stop Safety

Following our investigation of a 2016 collision in which a 7-year old was fatally struck by a pickup truck while crossing the roadway to board his school bus in Thief River Falls, Minnesota, we recommended that NHTSA assess, and if necessary, update, its guidelines on pupil transportation safety to specifically address pedestrian issues related to conspicuity and route selection.[22]

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[21] NTSB Safety Recommendation H-19-6.

[22] (a) NTSB. *Fatal Pedestrian Collision with Minivan Thief River Falls*. NTSB/HAB-18/17. Washington, DC: NTSB. (b) NTSB Safety Recommendation H-18-50.

We are continuing to investigate collisions involving school bus passenger loading and unloading. On October 30, 2018, three children were killed and one seriously injured in Rochester, Indiana, when they were struck by a pickup truck while they were crossing the roadway to board their bus to school.[23] The school bus had its warning lights on and the driver had deployed the stop arm, but the pickup truck driver did not stop on the 55-mph roadway. In addition to the Rochester crash, we are also investigating two other crashes—one in Hartsfield, Georgia, and one in Baldwyn, Mississippi—involving school bus passenger loading and unloading where drivers did not stop for stopped school buses with their warning lights on and stop arms deployed, and struck children crossing the roadway. These two crashes resulted in the deaths of two children and serious injury to another child.

Our investigations continue to focus on school districts' student transportation policies, bus route planning and development, and safety issues related to school bus loading and unloading on high-speed roadways.

Crash Prevention Technology

We have advocated for collision avoidance systems in commercial motor vehicles, including buses, for more than 20 years. Collision avoidance technology mitigates or prevents crashes by detecting moving, stopped, or stationary vehicles ahead. When appropriate, vehicles equipped with automatic emergency braking systems apply brakes to prevent or mitigate a collision.

NHTSA issued a final rule, effective in August 2015, requiring electronic stability control systems on most truck-tractors and over-the-road buses weighing more than 26,000 pounds; however, the requirement does not apply to school buses. Even without this requirement, though, some school bus manufacturers are beginning to voluntarily install these systems in school buses. Our crash investigations and industry research have shown that collision avoidance systems significantly help prevent or mitigate the severity of crashes and reduce the frequency of rear-end or loss-of-control crashes, such as the one that occurred in Baltimore. In support of this effort, last year we recommended that NHTSA require, and that all school bus manufacturers install, collision avoidance systems with automatic emergency braking as standard equipment in all newly manufactured school buses.[24]

Conclusion

Although school buses are extremely safe, more needs to be done to ensure that our most vulnerable road users—our children—arrive at school and home again safely. Our investigations have shown that improved occupant protection, driver oversight, pedestrian safety, fire protection, and collision avoidance technologies are needed to prevent crashes, deaths, and injuries on the nation's roadways. Thank you for this opportunity to discuss our recommendations for improving school bus safety. I would be pleased to answer any questions you might have.

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[23] NTSB. *Crash between Pickup Truck and Children Boarding a School Bus*. NTSB/HWY19MH003 (preliminary). Washington, DC: NTSB.

[24] NTSB Safety Recommendations H-18-8 and -19.