Yog H-493

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 11, 1987

In reply refer to: H-87-17 and I-87-1 through -3

Honorable Caspar Weinberger
Secretary
U.S. Department of Defense
The Pentagon
Washington, D.C. 20310

About 3:30 a.m., c.d.t., on August 4, 1985, a tractor-semitrailer operated by Explosives Transports, Inc., and loaded with 10 MK 84 2,000-pound general purpose bombs, collided with an automobile on Interstate 40 near Checotah, Oklahoma. The automobile fuel tank ruptured and spilled gasoline which quickly ignited. Both vehicles were engulfed in flames. Subsequent explosions from the bombs destroyed the vehicles and left a crater 27 feet deep and 35 feet wide in the roadway. Three hundred and seventy-one residences were damaged. Other buildings, including a school located 734 feet from the accident site, suffered substantial damage. Total damages were estimated at $5 million. Forty-nine persons reported to a hospital emergency room for treatment of injuries, most after breathing smoke and gases from burning tritonal. No one was fatally injured. 1/

Public exposure to munitions shipments has doubled in the past 7 years, increasing from 23,456 shipments in 1980 to 47,593 in 1986. During the same period, Department of Defense (DOD) Class A and Class B explosive shipments have been involved in 49 highway accidents in 25 States. Following the investigation of an accident involving the overturn of a tractor-semitrailer transporting torpedoes in Denver, Colorado, 2/ the Safety Board concluded that the DOD munitions transportation safety program was inadequate. The Safety Board found that the DOD did not conduct its own safety audits or surveys of motor carriers. The Safety Board concluded that the DOD relied essentially upon illusory programs to ensure the safety of its shipments; it relied on the Federal Highway Administration (FHWA) motor carrier safety ratings.

As a result of its investigation of the accident in Denver, the Safety Board recommended that the DOD:

1/ For more detailed information, read Hazardous Materials Special Investigation Report--"Collision Between a Tractor-Semitrailer Transporting Bombs and an Automobile, Resulting in Fire and Explosions, Checotah, Oklahoma, August 4, 1985" (NTSB/SIR-87/01).

2/ Hazardous Materials Accident Report--"Overturn of a Tractor-Semitrailer Transporting Torpedoes, Denver, Colorado, August 1, 1984" (NTSB/HZM-85/02).

I-85-25

Establish Department of Defense safety requirements for the safe transportation of explosive and other high-hazard Department of Defense shipments which motor carriers must meet, in addition to U.S. Department of Transportation requirements.

I-85-26

Establish a safety evaluation program to monitor motor carrier compliance with Department of Defense safety requirements for explosive and other high-hazard Department of Defense shipments.

During the investigation of the Checotah accident, the Safety Board found that, again, the DOD essentially had relied upon the FHWA motor carrier safety ratings to determine the carrier's safety fitness. Although Explosives Transports, Inc., had been assigned a satisfactory safety rating by the FHWA at the time of the accident, the FHWA had not performed a safety audit on the carrier since 1973, 12 years before the accident. An FHWA safety audit conducted on the carrier about 3 weeks after the Checotah accident resulted in an unsatisfactory safety rating and the preparation of an enforcement case for multiple safety violations, including inadequate driver qualification files, false entries on drivers' records of duty, inadequate records of vehicle maintenance, failure to require motor vehicles containing Class A explosives to be attended, and transportation and storage of a prohibited combination of hazardous materials.

If the DOD had conducted a safety audit on Explosives Transports, Inc., before the Checotah accident, it should have been able to identify the same safety deficiencies that were identified by the FHWA in a postaccident audit. In addition, the DOD should have been able to determine that the carrier did not meet safety requirements contained in an agreement with the DOD, such as evidence of an active safety and security training and evaluation program for its drivers, the use of drivers with a minimum of at least 1 year of general commodities driving experience (using similar equipment) before transporting explosives shipments, and the use of drivers who are trained and competent in the movement of explosives and who understand pertinent instructions and procedures.

On July 21, 1986, the DOD advised the Safety Board that it had initiated action to develop and implement a program to evaluate and monitor carriers which transport DOD explosives and sensitive shipments. It said that the program was scheduled to be funded in fiscal year (FY) 1988 and that it would involve actual visits to carrier terminals and home offices. DOD also said that roadside inspections would be performed, that audits would be conducted similar to those of the FHWA to ensure compliance with FHWA and DOD regulations, and that serious shortfalls in carrier safety compliance would be a basis for immediate non-use of the carrier. Also, the DOD advised the Board that specific DOD training requirements, as well as training aids, are being developed to help drivers better understand the characteristics of the explosives they transport and their responsibilities in the event of an emergency situation. In addition, the Safety and Security Committee of the Munitions Carriers Conference has been working with the DOD's Military Traffic Management Command (MTMC) to establish safety training standards for drivers who transport Class A and Class B explosives. As a result of the DOD's response, the Safety Board placed Safety Recommendations I-85-25 and -26 in an "Open--Acceptable Action" status. However, the Checotah accident points out the need for the DOD to make this program a high priority for funding and to move expeditiously toward achieving its early implementation.

Although the accident truckdriver was properly licensed to drive the combination vehicle at the time of the accident, he had not attended any formal driver training program and, except for the 2 months he had been employed by Explosives Transports, Inc., he had accumulated no significant tractor-semitrailer driving experience in the previous 4 years. While the DOD agreement with munitions carriers requires that drivers have a minimum of at least 1 year of general commodities driving experience before transporting explosives shipments, there is no requirement that the driving experience be recent or that it be without serious traffic violations.

Further, the Safety Board could find no evidence of an adequate safety training and evaluation program for the drivers. Explosives Transports, Inc., provided extremely limited indoctrination training to its new drivers in the form of a brief lecture from the safety officer that addressed basic operational information and emergency procedures. No other safety meetings or instruction was provided to the drivers.

Previous Safety Board accident investigations have identified experience and training as causal factors. Following the investigation of an accident involving 18 surface-to-air missiles near Los Banos, California, on December 2, 1982, and numerous other accidents 3/ involving trucks transporting hazardous materials where driver error or deficiency was found to be a causal factor, the Safety Board concluded:

> . . . if employee's driver license records and levels of operational experience were reviewed more carefully and more stringent standards were established for licensing and employment, the number of truck accidents involving hazardous materials resulting from errors by drivers could be decreased.

In its investigation of the Denver accident involving torpedoes, the Safety Board found that driver inexperience was the major factor. The accident report of that investigation noted several comments to an FHWA advanced notice of proposed rulemaking that included driver qualification requirements. Respondents to the proposed rulemaking commented on a need to require truckdrivers to meet more stringent qualification criteria before allowing them to transport hazardous materials. For example, the Minnesota State Patrol recommended that all operators of vehicles transporting hazardous materials have at least 2 to 3 years of verifiable experience operating similar vehicles under all weather conditions. The Engineering and Safety Service of the American Insurance Service Group, Inc., which represents a large segment of the property and casualty insurance industry, recommended that drivers transporting certain hazardous materials have 5 years of experience operating other equipment, have not more than three moving violations in the past 3 years, and have not more than one DOT-reportable accident in the past 2 years.

In a special study of railroad/highway grade crossing accidents involving trucks transporting hazardous materials, 4/ the Safety Board found that some carriers are selective in hiring drivers for hazardous materials trucks. One carrier identified in the report will not consider for employment any driver without at least 2 years of accident-free driving on semitrailer units.

3/ Safety Recommendation Letter H-83-31 through -33 and -38 to the American Association of Motor Vehicle Administrators, July 8, 1983.

4/ Special Study—"Railroad/Highway Grade Crossing Accidents Involving Trucks Transporting Bulk Hazardous Materials" (NTSB/HZM-81-2).

In its safety study on training, licensing, and qualification standards for drivers of heavy trucks, 5/ the Safety Board said that "drivers transporting hazardous materials need specialized knowledge. They must know the properties of their cargo and the rules of the road concerning transportation of those materials. In the event of a mishap, they will be among the first persons at the scene, so they must be familiar with emergency response procedures." The Safety Board also said that a driver should "have to demonstrate proficiency in handling hazardous materials trucks, as well as mastery of the knowledge related to hazardous materials transport." The DOD should implement procedures to assure that drivers transporting its explosives shipments have demonstrated this specialized knowledge.

Additionally, as a result of the Denver accident investigation, the Safety Board concluded that the DOD should evaluate highway routes selected by motor carriers to transport explosive shipments to ensure that motor carriers use the most direct routes consistent with public safety. The DOD also had previously recognized a need to minimize transit time. In its study, entitled "The Safe Transportation of Munitions (STROM)," issued June 1981, the DOD concluded that transit time is the factor that most influences public exposure (to the risks of munitions transportation) and that in-transit exposure is not now considered, but is reducible by minimizing transit time.

In the Checotah accident, however, the Safety Board found that Class A and Class B explosives shipments transported by Explosives Transports, Inc., for the DOD regularly experienced unnecessarily long transit times. Not only were munitions often transported over indirect routes for hundreds of unnecessary miles, but shipments regularly were held at carrier terminals for several days while in-transit. The accumulation of multiple in-transit shipments of Class A and Class B explosives at the carrier's terminal in Oklahoma City also unnecessarily exposed the public in that area to significantly increased risks.

The DOD currently requires that carriers maintain a record of chain-of-custody (DD Form 1907—Signature and Talley Record) for most munitions shipments that track the movement of a shipment from origin to destination. The DOD should use the information available on these completed documents, in conjunction with other carrier records, to verify the accuracy of the information, to identify shipments that are not moving expeditiously between points of origin and destination, and to take effective action to correct problems identified.

As the shipper of many unique, highly dangerous explosives developed to meet its specific needs, the DOD is best capable of determining the hazards to public safety posed by the transportation of its shipments. Consequently, the DOD should use this information for controlling routing of truckload and less-than-truckload shipments to minimize the time and extent of public exposure. Clearly, the DOD should establish a process for controlling the routing of its shipments not just for highway, but for rail and other transportation systems.

For its highway transportation of explosives, the DOD should expect assistance from the FHWA, the Research and Special Programs Administration, and the States for establishing an acceptable nationwide system for the routing of hazardous materials. Until this nationwide system is established, the DOD must provide overall routing direction for the carriers it uses. However, even the establishment of a nationwide

5/ Safety Study—"Training, Licensing, and Qualification Standards for Drivers of Heavy Trucks" (NTSB/SS-86/02).

system will not relieve the DOD of its routing responsibilities. It still will be necessary for the DOD to exercise control over the selection of specific routes from among those approved by the States for the transportation of shipments that present unique or widespread threats to public safety.

As demonstrated in the Checotah accident, the principal threats to the safe transportation of general purpose bombs and other Class A and Class B explosive munitions are fire and heat. During fast cook-off tests conducted by the DOD on general purpose bombs similar to those involved in the Checotah accident, the bombs deflagrated in about 4 minutes. Fast cook-off tests conducted on other munitions, including rockets, air-launched missiles, mines, and torpedoes, have demonstrated that major hazards also exist when those munitions are subjected to fire conditions for very short periods of time.

The Safety Board has investigated two other recent munitions accidents where the release of vehicle fuel increased risks of cook-off reactions.

- On August 1, 1984, a tractor-semitrailer transporting Navy torpedoes overturned at the intersection of two major interstate highways near downtown Denver, Colorado. After arriving at the accident scene, the fire department stopped a leak in the vehicle's fuel tank. In its report, the Safety Board found that while no fire resulted during the accident a sufficient volume of diesel fuel was present to have produced temperatures necessary for deflagration of the warheads.

- On May 10, 1985, a truck-trailer transporting munitions struck a parked vehicle on Interstate 65 near Bonnieville, Kentucky, resulting in a fiery accident. A fuel tank on the truck was torn open and an estimated 30 gallons of gasoline poured onto the ground and ignited. Class A explosives (C-4 plastic explosives) transported in a dromedary on the truck ignited and burned intensely. Although the trailer contained additional Class A and Class B explosive munitions, the fire department chose to deluge it with water rather than withdraw. Fortunately for the fire department, the explosives on the trailer did not explode.

The DOD's STROM report concluded that its programs to protect munitions from fire focused on the shipboard environment rather than the transportation environment. This appears to continue to be the focus today. The general purpose bombs involved in the Checotah accident were manufactured for the U.S. Air Force and were not covered with a thermal protective coating or any other thermal shielding to increase the cook-off time in a transportation fire environment. Similar, general purpose bombs manufactured for shipboard use by the U.S. Navy, however, are currently covered with a thermal protective coating. Also, while the U.S. Navy proposes to use in the future a new explosive filler in its general purpose bombs that will react less violently when exposed to fire, no comparable change was found for use by the other military services. Furthermore, a summary report of fast cook-off characteristics of air-launched, in-service weapons prepared by the Naval Air System Command's Pacific Missile Test Center in June 1985 recommended that some weapons be provided thermal protection to delay time to cook off when used aboard carriers. Although the firefighting needs of the U.S. Navy for thermally protected munitions to improve combat ship survivabiltiy are valid, the DOD

also has a responsibility to minimize the risk of quick cook-off reactions when munitions are transported, not for firefighting purposes but rather to provide critical time for evacuations.

Thermal protective coatings on munitions are not intended to prevent cook-off reactions but instead to delay any explosion for a short period of time. Therefore, the application of thermal protective coating on the bombs involved in the Checotah accident probably would not have prevented the explosions. However, although the persons involved in the accident were able to leave the immediate accident scene before the most violent explosion, the first cook-off reaction occurred only 15 minutes after the accident and while accident vehicle occupants and emergency response personnel were still nearby. Although the Checotah accident did not occur in a heavily populated area, a school building was located only 734 feet away from the accident site. Had the accident occurred while school was in session, the consequences could have been deadly without adequate time for evacuation actions. Under other accident conditions, the initial cook-off reaction could have been sooner and more violent. The need for adequate time to remove victims from accident sites or to evacuate nearby populated areas is critical. This essential time can be provided by the use of thermal protective coatings or thermal shields/barriers, such as insulated packages, insulated trailers, or insulated rail cars for munitions shipments.

The STROM report concluded that the days of minor incidents are gone and that should an explosion occur today, "things could get serious fast." Yet, the DOD has rejected the use of thermal insulation and fire-sensor-suppression systems as economically impractical in the transportation environment. The DOD's movement toward the use of cook-off-resistant explosives to reduce the fire danger to munitions onboard ships will benefit transportations needs. However, widespread use of explosive fillers in munitions that react less violently in a fire and the modification of weapon designs to meet those goals are many years away. Even then, military services that do not have operational needs to extend cook-off times may not make use of the changes. The DOD cannot ignore the need for thermal protection of munitions shipments in the transportation environment. Instead, the DOD should identify those munitions shipments which pose the greatest threat to public safety in transportation accidents involving fire and should provide thermal protection for those shipments, particularly when the munitions are transported by highway vehicles where munitions may be exposed to the hazard of vehicle fuel fires.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the U.S. Department of Defense:

> Establish more stringent criteria for the selection and continued use of truckdrivers for transporting explosives shipments by increasing the minimum years of recent truck driving experience and establishing minimum training requirements. Also, develop and include criteria for disqualifying drivers based on specific safety violations on driving records, accident experience, and violations of Department of Defense safety requirements. (Class II, Priority Action) (H-87-17)
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> Implement a program to route expeditiously Class A and Class B explosives shipments over the most direct routes available consistent with public safety and with any unique safeguards required for specific shipments. (Class II, Priority Action) (I-87-1)

Provide thermal protection for those explosives shipments which pose the greatest fragment and overpressure hazards in highway transportation accidents involving fire to allow reasonable time for the evacuation of nearby persons. (Class II, Priority Action) (I-87-2)

Notify the Federal Highway Administration of any safety audit of a munitions carrier which results in the assignment of a safety evaluation other than satisfactory. (Class II, Priority Action) (I-87-3)

Also, the Safety Board issued Safety Recommendations I-87-4 and -5 to the Research and Special Programs Administration.

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER and NALL, Members, concurred in these recommendations.

By: Jim Burnett
Chairman