

- 6. Truckdriver's use of the opposing lane for purposes other than passing was contrary to Virginia law.
- 7. The Virginia policy for signing and marking of sharp curves on mountainous highways is contrary to the FHWA Manual on Uniform Traffic Control Devices and had not been explained to the public.
- 7. Had the truckdriver been on the route he had been told to follow, the accident probably would not have occurred. No conclusion could be reached as to why the incorrect route was followed.
- 8. The evasive action taken by the truckdriver, i.e., turning to the right, back toward the northbound lane, to avoid the oncoming southbound car and then steering to the left to avoid the rock embankment, produced a centrifugal force. The lateral surge of the cargo, the centrifugal force, the instability of the truck which resulted from tractor-trailer misalignment, and a shifting center of gravity were sufficient to overturn the

CFR 177, did not adequately inform the bystanders who were injured of the threat to their safety.

- 13. The use of an odorizer in the propane cargo to warn the public of hazards was not effective in this spill.
- 14. The vapor cloud ignited at the truck.
- 15. The failure of the States which issued driver's licenses to this driver to comply with all the provisions of Highway Safety Program Standard No. 5 enabled the truckdriver to obtain driver's licenses which should not have been issued.
- 16. If the truckdriver's complete motor-vehicle driver record had been known by his employer, he probably would not have been hired as a truckdriver.
- 17. The trailer rear spring dislocation occurred during the vehicle overturn and did not contribute to the accident.

### V. PROBABLE CAUSE

The National Transportation Safety Board determines that the cause of the overturn was the driving of the tractor-semitrailer on the wrong side of the road, and a subsequent evasive steering action which exceeded the limited capability of the truck to resist overturn. Contributing factors included a misleading traffic-control sign, an inadequate road-marking system, and the high center of gravity of the truck. The cause of the burn fatalities and injuries were rupture of the tank at a point susceptible to rupture and the inadequacy of the required placards as a means of warning bystanders of the nature and range of the hazard.

- 9. Truckdriver returned to the right lane well before his vehicle could have struck the oncoming southbound automobile.
- 10. The center-of-gravity height of the truck lowered the vehicle's overturn stability and limited its maneuverability to a degree which was difficult for the truckdriver to gauge. The calculated stability factor in the range of .5 to .6 g permitted the truck to be overturned by steering maneuvers substantially less severe than needed to produce overturning or skidding in most highway vehicles.
- 11. The design and fabrication of the MC 331 trailer performed well in this accident with one exception. The location and design of the manway cover assembly in the front hemispherical tank-head allowed the assembly to transmit impact loadings which caused failures in the head and shell materials.
- 12. The regulatory warnings displayed on the tank, which met the requirements of 49

### VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

- 1. The Hazardous Materials Regulations Board of the Department of Transportation and

MAR 73

the Tank Truck Technical Council consider the desirability of amending 49 CFR 178.337-6 (Closure for manhole) to require that all manhole assemblies in MC 331 pressure vessels manufactured after a specified date be located in the upper quadrant of the rear hemispherical head to minimize the possibility of manhole-assembly collision with other vehicles or objects. (Recommendation No. H-73-20)

2. The Office of Hazardous Materials study the warning system deficiencies demonstrated in this accident. The proposal for a Hazardous Material Information System issued by OHM on June 6, 1972 should be carefully reviewed to insure that warnings of impending danger and advice are given in an understandable manner to the general public as well as to emergency personnel. The capability of the system to warn those at a distance should be equal to the range of the hazard and should not rely on the physical condition of the driver. The system should function under all weather conditions and the range of warning should be specified by regulation. (Recommendation No. H-73-21) This recommendation was previously published in the Board's report NTSB-HAR-72-5, *Automobile/Truck Collision Followed by Fire and Explosion of Dynamite Cargo, U.S. Highway 78 near Waco, Georgia, on June 4, 1971.*
3. The Bureau of Motor Carrier Safety (Federal Highway Administration) revise the Motor Carrier Safety Regulation contained in 49 CFR 397.9 as follows:
  - a. Part (a) be revised to require the safest feasible route with strict compliance by the driver;
  - b. Part (b) be revised to include, in addition to Class A and Class B explosives, all bulk hazardous materials that can disperse or react with violent, abrupt, incapacitating or lethal effects; and to require that a driver preparing a written route plan when he begins a trip at a location other than the carrier's terminal,

mail a copy of the written route plan to the carrier before departure. (Recommendation No. H-73-22)

4. The National Highway Traffic Safety Administration expedite its proposed rule-making on Highway Safety Standard No. 5 (Driver licensing), and expand the standard to require that each State, before issuing a new or renewal driver's license, check with the National Driver Register to determine whether the applicant's right to drive is under suspension or revocation in any jurisdiction. (Recommendation No. H-73-23)
5. The Bureau of Motor Carrier Safety (Federal Highway Administration), in cooperation with the Tank Truck Technical Council, investigate the overturn stability problem created by liquid cargo surging in tank-truck combinations. The ultimate objective of such an investigation should be the promulgation of Federal regulations to specifically limit the effects of surge. (Recommendation No. H-73-24)
6. The National Highway Traffic Safety Administration modify the work statement of the National Driver Register study being conducted by the Safety Management Institute, to assure that specific consideration is given to the accessibility to the Register by employers or prospective employers of persons who are required, as a condition of employment or retention, to possess a valid motor-vehicle driver's license. (Recommendation No. H-73-25)
7. The Federal Highway Administration (FHWA) review the policies of the Commonwealth of Virginia relative to compliance with the standards in the FHWA Manual on Uniform Traffic Control Devices which concern the signing and marking of highways in mountainous areas. (Recommendation No. H-73-26)
8. The Commonwealth of Virginia review its policies of signing and marking highways in mountainous areas for conformity with the FHWA Manual on Uniform Traffic Control Devices. (Recommendation No. H-73-27)

9. The National Highway Traffic Safety Administration amend its proposed revision of Highway Safety Program Standard No. 5, Driver Licensing, to add the provisions of Chapter 6, Article I, Section 6-106(c) of the Uniform Vehicle Code, Revised 1968, and require that whenever an application is received from a person previously licensed in another jurisdiction, a copy of such driver's record be obtained from such other jurisdiction, thus determining, before issuing or renewing any motor vehicle driver's license, if the applicant had an

accident or traffic-violation record which might preclude the issuance of a motor vehicle driver's license in the inquiring State. (Recommendation No. H-73-28)

10. The several States adopt and fully implement the provisions of Chapter 6, Article I, Section 6-101 (c) of the Uniform Vehicle Code, Revised 1968, which sets forth the "one license concept" of driver licensing, to assure that each licensed motor-vehicle driver holds only one valid driver's license. (Recommendation No. H-73-29)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED  
Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ ISABEL A. BURGESS  
Member

/s/ WILLIAM R. HALEY  
Member

Louis M. Thayer, Member, filed the attached statement, concurring and dissenting.

May 24, 1973.