SP-20

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

I-83 for

ISSUED: August 12, 1985

Forwarded to:

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Administrator
Research and Special Programs
Administration
U.S. Department of Transportation
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

I-85-19 and -20

About 11:50 a.m., P.s.t., on January 19, 1985, a tractor with two tank trailers, operated by Cal Tank Lines, struck the concrete median barrier of the southbound lanes of Interstate 680 on the Benicia-Martinez bridge in Benicia, California. The trailers, carrying molten sulfur, overturned into the northbound lanes. One trailer was destroyed by ensuing fires, and the other was breached in several places. The molten sulfur splashed onto vehicles traveling in the northbound lanes as well as onto the roadway and its shoulders. The sulfur was ignited by an undetermined source and burned for approximately 3 hours. The driver of the truck and the driver of one of the vehicles in the northbound lanes died, and 26 persons were taken to local hospitals; 3 persons were admitted. Persons were evacuated from the area near the accident site, and the roadway was closed for 15 hours.

Firefighters reported that when they arrived, visibility was extremely poor due to a heavy white smoke. In their haste to attend to the injured, and because bystanders appeared to be suffering no ill effects from the smoke, the initial responders carried out rescue operations without donning any protective breathing apparatus. These firefighters later were treated for breathing difficulties related to vapors from the burning material. When the fire chief arrived, he tried to identify the cargo by looking for placards, but there were none on the trailers. After the injured had been sent to the hospital, the firefighters turned their attention to dealing with the material spilled from the trailers. Firefighters, now in chemical protective suits, attempted to plug the holes in one of the trailers using wooden plugs, but they were unsuccessful because the molten material ignited the plugs. At the same time, other firefighters were hesitant to apply extinguishants to the burning material on the ground since they did not know what the material was.

About 1:15 p.m., two firefighters approached the cab of the truck and found a waybill and other papers on the ground outside the tractor. Using information from these papers, the carrier was contacted, and at 1:30 p.m. the material was identified as molten sulfur. By that time, several additional persons had been sent to the hospital suffering from either contact burns due to the molten sulfur or inhalation of its combustion products. Even after the firefighters learned the identity of the material, they had difficulty finding information on how to handle the emergency and how to treat those injured in the emergency response guidebooks they had available. Ultimately, the fire chief finally was able to find limited information on handling molten sulfur in the U.S. Department of Transportation's (DOT) 1984 Emergency Response Guidebook.

The molten sulfur was a causal factor in the two deaths and in most of the injuries involved in this accident. When firefighters arrived, the truck driver was alive, but trapped in the cab of his truck. Firefighters attempted to extricate the driver but were forced to retreat due to the heat from the burning sulfur. Sometime after 11:30 p.m., the driver's body was removed from the cab of the truck. The coroner's report listed the cause of the driver's death as "inhalation of fire and smoke with asphyxiation." The other fatality was splashed by molten sulfur as the tanks climbed the barrier. He died 3 days later of thermal burns. Many of those injured as a result of this accident suffered irritation of the mucous membranes. Sulfur dioxide, a combustion product of sulfur, produces this effect.

Approximately 6 million long tons of molten sulfur are shipped domestically by highway and rail each year. Sulfur, in a molten state, is not listed as a regulated hazardous material within Title 49 of the Code of Federal Regulations (49 CFR) nor does the Research and Special Programs Administration consider it to be a regulated material. 1/ The U.S. Coast Guard, however, lists it as a Grade E combustible liquid. Sulfur, in a solid, powdered, or cake form, is listed within 49 CFR as a hazardous material, specifically an ORM 2/ substance.

From the packaging requirements set forth in the regulations for powdered or cake sulfur, the hazards posed by sulfur during transportation apparently are viewed by the DOT as being related to the form in which it is transported, and not to any inherent properties of sulfur. The packaging described in 49 CFR 173.1080 appears to be designed to protect against dust hazards. However, when sulfur is transported in the molten state, i.e., as liquid, it presents hazards to public safety and health, as demonstrated by this accident, which the regulations in 49 CFR do not address. Materials transported at elevated temperatures present unique hazards to the public, especially when transported by highway. Molten materials have high potential for endangering public safety and health when released during accidents.

1/ Molten sulfur is listed in the Optional Hazardous Materials table in 49 CFR 172.102.

2/ Other Regulated Material--a material that may pose an unreasonable risk to property or health and safety or property when transported in commerce and does not meet any of the definitions of any other hazard class.

In the Safety Board's review of the DOT hazard classification, it appears that molten sulfur and perhaps other molten materials should be classified as flammable solids. DOT regulations (49 CFR 173.150) define a flammable solid as any "solid material other than one classed as an explosive, which under conditions normally incident to transportation, is liable to cause fires through friction, retained heat from manufacturing or processing (emphasis added), or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious transportation hazard." Beyond this general statement, the regulations provide no tests, criteria, or other basis for identifying those materials which should be classed as a flammable solid.

According to the United Nations (UN) Recommendations of the Committee of Experts on the Transportation of Dangerous Goods, a flammable solid is a material that is readily combustible or may cause or contribute to fire through friction. Molten sulfur is considered to be a flammable solid by the UN. When the DOT was questioned by the Safety Board about the inclusion of molten sulfur in its guidebook, it responded that molten sulfur was included because it is listed by the UN; however, there are other materials included in the UN recommendations that are not listed in the DOT guidebook. The Safety Board could not determine the criteria used by the DOT to select materials for inclusion in its guidebook. Since the DOT contends that molten sulfur does not pose unreasonable hazards to public safety and health, the Board does not understand why molten sulfur was listed in the guidebook when similar materials were not.

On May 7, 1981, the DOT issued an advance notice of proposed rulemaking, Docket HM-178 "Definition of a Flammable Solid." This rulemaking posed the question whether liquid sulfur and other molten materials should be considered flammable solids under one of the proposed subdivisions. While none of the commenters agreed that liquid sulfur should be classified as a flammable solid, a few did suggest that molten materials be regulated in some manner--either grouped with the ORM materials or classed separately. To support their opinion that molten sulfur should not be regulated as a flammable solid, those commenting in opposition submitted accident histories which indicated the numbers of accidents and injuries that had occurred involving shipments of sulfur were very limited.

Although accident histories of a material may accelerate the need for a determination, the Safety Board believes that a material's accident history is not the sole determinant. Indeed, the hazards posed by a particular quantity and form of a material within each transportation environment should be the primary bases for this regulatory decision. The DOT has recognized this fact regarding certain materials and transportation modes, and the Safety Board urges the DOT to apply this concept to all materials in transportation which are subject to its regulatory authority.

The comments in Docket HM-178 are not limited to reasons why molten sulfur should not be a flammable solid. Many of those commenting applauded the DOT's effort to provide a precise definition of a flammable solid. As the DOT itself pointed out in the preamble to the notice, "The present definition of flammable solid is so vague that many shippers are unable to determine if certain of their materials fall within the definition of this hazard class." Nevertheless, a recent Federal Register notice, 50 FR 17599, April 29, 1985, listed Docket HM-178 as a nonpriority docket with the next scheduled action as undetermined.

Lack of a clear and precise definition has allowed shippers to classify and then package their materials based on economic incentives rather than on safety considerations. The Safety Board believes that precise definitions of all classes of materials should be promulgated which include adequate criteria and required testing so that shippers are guided in the proper hazard classification of the materials.

While the temperature at which molten sulfur is transported is not sufficient to ignite most combustibles, its elevated temperature presents a hazard nevertheless, as this accident involving the deaths of 2 persons and injury to 26 others and substantial property damage demonstrated. The Safety Board is concerned that there may be other unregulated molten materials in the transportation system which also might cause severe casualties involving persons, damage to property, and major disruption to communities.

Therefore, the National Transportation Safety Board recommends that the Research and Special Programs Administration:

> Regulate molten sulfur and, as appropriate, other molten materials, as hazardous materials, prescribe packaging and handling standards, and incorporate information relating to the hazards of these materials into warning devices and publications available to emergency responders and others involved in the transportation of molten materials. (Class II, Priority Action) (I-85-19)
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> Classify as priority action on the proposed rulemaking in Docket HM-178 regarding the definition of a flammable solid, and establish a timetable for its completion. Include in the final rule test requirements and clear, objective criteria for shippers to identify those materials included in this hazard class. (Class II, Priority Action) (I-85-20)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

By: Jim Burnett
Chairman