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In this accident, the primary hazard from oxygen, under the present scheme of regulations, was its reactivity as an oxidizer, not its status as a compressed gas.

19. The classification of oxygen as a compressed gas under the regulations contributed to the preponderance of effort devoted to control of this lesser hazard, rather than the apparent primary hazard of oxidizing tendency.

20. The lack of Federal regulatory specifications, gaps in voluntary standards, and inadequate technical exchanges among the regulators handicapped the local governmental regulatory agency in the exercise of its safety responsibilities to residents within its jurisdiction in this accident.

Probable Cause:

The National Transportation Safety Board determines that the probable cause of this accident was the abrupt oxidation, without warning, during conditions normally incident to transportation, of one or more reactant materials inside the cargo tank, which triggered an intense heat-producing reaction between the aluminum of the cargo tank and the oxygen cargo; the resultant rapid rise in pressure and weakening of the tank wall led to the explosive rupture of the tank and the resultant fatalities, injuries, and property damage.

V. RECOMMENDATIONS

The Safety Board recommends that:

1. The Hazardous Materials Regulations Board of the Department of Transportation, and the Administrations represented thereon, examine the available accident history of oxygen and, in the absence of conclusive evidence to the contrary, initiate rulemaking proceedings to reclassify oxygen as an oxidizing material, according to its principal hazard as detected in this accident; and further consider whether 49 CFR 173.2 should be excepted to permit oxygen to be classified as an oxidizing material and com-

pressed gas when shipped under pressure per 49 CFR 173.300.

2. The Department of Transportation, with the participation of the vehicle manufacturers and operators, conduct a complete restudy of existing cargo tanks used for transportation of oxygen, under suspended or outstanding Special Permits, to assure that the hazards identified in this accident are not present, are removed, or are adequately controlled and monitored prior to authorizing continued use of such vehicles in (or conversion to) oxygen transportation. 44

3. The Hazardous Materials Regulations Board of the Department of Transportation, and the Administrations represented thereon, establish more rigorous requirements to be met by petitioners for or recipients of future Special Permits for new hazardous materials containers, such requirements to include a systematic analysis for and consideration of the risks and the hazards introduced during the manufacture and operation of the equipment over its life cycle, a plan for the monitoring or control of the hazards detected, and a periodic reporting plan which will permit an assessment of the success of these efforts. 45

4. The Department of Transportation promulgate regulations encompassing cargo tank requirements for oxygen at the earliest feasible date, taking into account the findings in this investigation and the data which will have to be developed through additional research as a result of these findings; and that these regulations incorporate a rationale for evaluating materials of construction for this service, which will utilize the findings and suggested supporting research data in this accident. 46

5. The Compressed Gas Association, Inc., sponsor the accelerated development of quantified, enforceable industry cleanliness standards or specifications for oxygen cargo tanks, applicable over the life cycle of the equipment, and the research for and development of comparative rankings for the relative susceptibility of alternative materials of construction to initiation and 47

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spreading of induced reactions with oxygen in cargo tanks transporting oxygen.

6. The Compressed Gas Association, Inc., the American Society of Mechanical Engineers, and such other trade or professional organizations as may have an active role in the promulgation and issuance of voluntary standards utilized in connection with cargo tanks for transport vehicles, review and reappraise the scope of the hazards they address to insure that the full range of identifiable hazards is addressed by these stand-

ards, either singly or in combination with each other.

7. The Department of Transportation make a determination of the need for a program which provides for mutually supportive technical exchanges to enhance the effectiveness of hazardous materials regulatory functions, between Federal and State or local agencies having statutory responsibility for the safe transportation and delivery of these materials, and, if warranted, institute such a program.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED

Chairman

/s/ OSCAR M. LAUREL

Member

/s/ FRANCIS H. McADAMS

Member

/s/ LOUIS M. THAYER

Member

/s/ ISABEL A. BURGESS

Member

May 12, 1971