The national initiative by NIOSH to prevent fire fighter fatalities and injuries will result in substantial new information which will be of importance to fire fighters, fire departments, State fire marshals, researchers, and others interested in the protection of fire fighters. It is imperative that this and existing information are readily accessible to those who can intervene in the workplace and use it for the development of recommendations and guidelines to prevent fire fighter injuries and deaths.

C2.5 Hazards and Fires Involving Oxygen Regulators—Washenitz FC

Over the past 5 years, there have been over 16 reports of aluminum regulators used with oxygen cylinders burning or exploding. These incidents caused severe burns to over 11 emergency medical service providers, health care workers, and patients. Many of the incidents occurred during emergency medical use or during routine equipment checks. The NIOSH Fire Fighter Fatality Investigation and Prevention Program has investigated 3 incidents concerning fire fighters who had been severely burned by oxygen regulator fires. In the course of these investigations, NIOSH sought outside expertise in and outside the federal government, and learned of previous cases. Evidence suggests that aluminum in these regulators was a major factor in both the ignition and severity of the fires, although there were likely other contributing factors. Recommendations to minimize the occurrence of future incidents were made in reports summarizing these investigations. Additionally, NIOSH and the FDA jointly released a Public Health Advisory alerting fire departments, safety officers, biomedical engineers, nursing homes, emergency transportation services, rescue squads, state EMS systems, hospital administrators, home health care agencies, and risk managers of the hazards that may exist with aluminum regulators. NIOSH is currently involved in a project with the National Aeronautics and Space Administration (NASA) to develop a positive ignition test. The test is being developed and proposed to the American Society for Testing Materials as a possible standard, which would require that all regulators be tested before distribution to consumers. A training video is also being developed by the FDA and NIOSH concerning the hazards involved with oxygen systems. The video will demonstrate the safe handling of oxygen systems and will be disseminated to emergency medical service and health care providers.

C2.6 Oxygen Regulators Testing and Standards—Stoltzfus J

Investigation of recent medical oxygen regulator fires indicates that promoted ignition of vulnerable regulators has occurred with increasing frequency, resulting in catastrophic burnout and injury to equipment operators. In February 1999, the National Institute for Occupational Safety and Health and the Food and Drug Administration issued a joint public health advisory regarding explosions and fires in oxygen regulators used in medical and emergency applications. In response, the ASTM Committee G-4, along with several oxygen equipment manufacturers, is developing a standard entitled, "*Standard Test Method for Evaluating the Ignition Sensitivity and Fault Tolerance of Oxygen Regulators Used for Medical and Emergency Applications*." The intent of this provisional standard is to develop a test method that will fairly evaluate the ignition sensitivity and fault tolerance of oxygen regulators used in medical and emergency applications.

The most recent draft of the standard was sent to the Committee G-4 Test Methods subcommittee for ballot in July. The results of the ballot will be discussed at the Fall 2000 committee meeting in Paris, France in September. It is hoped that agreement can be reached regarding all the important issues related to the standard so that it can be released as a provisional standard after the September meeting. The standard is being treated as a provisional standard. This status will allow the test method to be developed and validated so that it can be upgraded to a full consensus standard as soon as possible. Meanwhile, manufacturers who need a tool to evaluate new regulator designs can use the test method.

The standard provides an evaluation tool for determining the fault tolerance of oxygen regulators. A fault tolerant regulator is defined as 1) having a low probability of ignition as evaluated by rapid pressurization testing and 2) having a low consequence of ignition as evaluated by forced ignition testing. The rapid pressurization test is performed according to International Standards Organization 10524, Section 11.8.1, which is similar to Compressed Gas Association E-4. In this test, the regulator is repeatedly subjected to rapid pressurization with oxygen. The heat from the compression of gas in the regulator is the ignition source. The method determines the resistance to ignition by the pressure surge that occurs each time the upstream valve is opened.

The consequence of ignition is evaluated by burning an ignition pill at the inlet of the regulator. The ignition pill, which is designed to simulate the burning of possible contaminants or components that are typically found in medical and emergency oxygen systems, is ignited by the heat of compression from the same system used in the rapid pressurization test. A regulator is considered fault tolerant when consumption of the ignition pill has occurred without external breach of any pressurized regulator component or ejection of molten or burning metal or ejection of any internal parts from the regulator.

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ABSTRACTS

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