INTRODUCTION

Special Problems in Fire Protection Engineering

Building fires, because of the number of such structures that exist, the vast size of their aggregated occupancy populations, and the frequency and consequences of fires which occur in them, properly receive first attention from the fire safety community. However, all man-made structures are vulnerable to fire and the uniqueness of each particular (non-building) environment, and the fire hazards associated with them, make their protection the most challenging that fire safety professionals encounter. These structures are also significant in terms of their monetary value and because the potential for loss of life from fire may be extreme.

In this volume, the chapter by A. Michael Birk discusses engulfing fires in tanker trucks. The author uses TANKCAR to model the effects of fusible plug type temperature sensitive pressure relief valves and presents simulation results for different numbers of fusible plugs and for a fixed number of plugs to different melting temperatures. The temperature pressure relief valves (TPRV) simulation results are compared with experimental data and simulation results for an uninsulated tank filled with propane exposed to fire.

In their chapter on practical solutions for new fire protection problems, Kerwin and Forsythe discuss a general engineering approach to the modification of a bus facility to accommodate vehicles fueled by natural gas. Their second chapter, *Background on Facilities Modification for Natural Gas Fueled Bus Use,* reviews the analysis and requirements proposed for a typical natural gas bus facility. As a follow-up consideration, Sforza and Fox discuss the characteristics of compressed natural gas (CNG) and flammable plumes that may result from its leakage into the surrounding environment. The authors also propose an experimental setup to verify future theoretical analysis of gas leaks and to provide a source of data for those using CNG.

Smith and Kashiwagi in their chapter on *Expert Systems Applied to Spacecraft Fire Safety,* discuss the development of an expert system to manage fire safety in aircraft and in particular, NASA Space Station "Freedom." The authors present the unique fire safety problems and strategies for dealing with them. The chapter is of special interest in light of what has been learned about fires in low gravity

environments and a number of fire events which have occurred on spacecraft since its writing.

Fernandez, Jacobs, Kauffman, Keating, and Sizemore discuss a decision analysis approach to assessment of community fire risk. The study was performed for accreditation under the National Fire Service Accreditation Program developed by the International Association of Fire Chiefs. The results of the study provide a model and risk assessment tool for fire science practitioners.

Ali and O'Connor present a case study on the calculation of axial forces generated in restrained pin-ended steel columns subjected to high temperatures. This chapter investigates the effect of the shortening of column height as the axially loaded pin ended element starts to lose its stability and deforms laterally.

Corbett's chapter on fire protection in large stadia (*The Alamodome in San Antonio*) discusses fire protection features incorporated in the design of the structure. Shortcomings of existing codes and standards necessitated the use of design fires to examine how the stadium and its occupants might respond to a particular fire scenario. The chapter also describes the fire testing of suppression and smoke management systems.

A systemic approach to fire safety in an offshore platform is presented in the chapter by Reyes, Beard, and Clark. The authors critique prescriptive and goal-setting approaches in addressing fire risks in this type of structure and describe a systems management procedure for analyzing fire safety issues.

Zhang, Fan, Shields, and Silcock, in two separate chapters, describe salt water techniques for simulation of fire smoke movement in an atrium building and smoke and induced air movement in a room-corridor building. In the atrium study, buoyant plume and circulation patterns were observed and circulation mechanisms were analyzed. In the room-corridor study, the occurrence of stratified smoke and air layers in the corridor were verified. The effects of position and heat release rate of the fire source on the smoke layer and the induced air layer are discussed.