

Contents

- I Introduction..... 1**
- II Background 3**
 - A Antifreeze Solutions 3
 - B Flammability of Liquids 6
 - C Sprinkler Droplet Sizes and Distributions 9
 - D Phase I Testing 10
- III Phase II Test Plan and Setup 13**
 - A Scope A: Fire Tests for Spray Ignition Using Sprinklers 13
 - B Scope B: Room Fire Tests of Sprinkler Effectiveness 20
- IV Phase II Test Results 23**
 - A Scope A – Spray Ignition..... 23
 - 1 Sprinkler 25
 - 2 Antifreeze Solution 26
 - 3 Sprinkler Height..... 28
 - 4 Temperature of Antifreeze Solution 29
 - B Scope B – Room Fire Tests..... 29
 - 1 Temperature 3 inches Below Ceiling 30
 - 2 Temperature at 5'-3" Above Floor 30
 - 3 Temperature ¼-inch Behind Ceiling Surface 32
 - 4 Number of Sprinkler Activated..... 33
 - 5 Scope B Summary 34
- V Analysis 37**
 - A Observations 37
 - B Classification based on Solution Heat of Combustion..... 39
- VI Future Research and Recommendations 41**
 - A Investigate the use of Antifreeze Solutions
in Sprinkler Systems with Non-Residential Sprinklers 41
 - B Characterize Droplet Size Distributions from Sprinklers 42

- C Develop a Small or Medium Scale Screening
 Test for Antifreeze Solutions 42
- D Develop a Listing Standard for Solutions Introduced
 into Sprinkler Systems 42
- VII Summary** 45
- References** 47