# Performance Comparison of Classified Wetting Agents

Shawn Oke

Albemarle Fire Department, Albemarle, North Carolina

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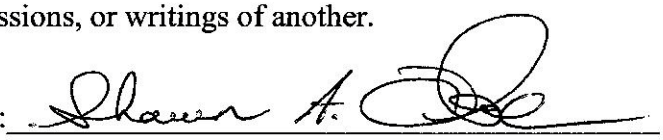
Signed: 

## Abstract

The problem is performance data on Classified wetting agents from an independent testing source isn't readily available. This lack of data prevents users of wetting agents from understanding how these agents perform according to the National Fire Protection Association (NFPA) standard on wetting agents, NFPA 18.

The purpose of this research was to utilize performance data from independent testing sources to compare wetting agent performance.

Research was conducted utilizing the evaluative research method. The following research questions were examined: a) How did each brand of Classified wetting agent perform on the NFPA 18 wood crib test?, b) How did each brand of Classified wetting agent perform on the NFPA 18 deep-seated fire test?, c) How did each brand of Classified wetting agent perform on the NFPA 18 wood fiber board test?, and d) How did each brand of Classified wetting agent perform on the NFPA 18 Class B fire test?

The primary research tool was the internet. Data was collected and reviewed on wetting agents currently classified by independent testing agencies as complying with NFPA 18.

The results of this research showed many manufacturer recommended usage concentrations differ than concentration levels tested by Underwriter Laboratories (UL). Changes to the 2011 edition of NFPA 18 prevents users of Classified wetting agents from obtaining testing data related to compliance with NFPA 18. Sufficient data was not produced to clearly determine the best performing wetting agent currently Classified by UL.

There are three recommendations from this research. 1) UL performance data in relation to compliance with NFPA 18 should be made available to potential users, 2) All Classified wetting agents should be tested to the same edition of NFPA 18, and 3) Copies of original UL

documentation showing the performance of the Classified wetting agent should be obtained prior to using the product.

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## Introduction

The problem is performance data on Classified wetting agents from an independent testing source isn't readily available. This lack of information prevents the users of wetting agents from understanding how the product they are using performs according to the NFPA standard on wetting agents, NFPA 18.

The purpose of this research was to utilize performance data from independent testing sources to compare wetting agent performance.

In order to determine what independently tested wetting agent performed the best the evaluative research method was utilized. There were four research questions which guided the research. Those questions were: a) How did each brand of Classified wetting agent perform on the NFPA 18 wood crib test?, b) How did each brand of Classified wetting agent perform on the NFPA 18 deep-seated fire test?, c) How did each brand of Classified wetting agent perform on the NFPA 18 wood fiber board penetration test?, and d) How did each brand of Classified wetting agent perform on the NFPA 18 Class B fire extinguishment test?

## Background and Significance

The Albemarle Fire Department has utilized a wetting agent concentrate in its extinguishment of Class A and Class B fires for the past several years. The use of wetting agent concentrates by the Albemarle Fire Department has increased over time as the effectiveness of these agents has become more apparent. The increased use of these agents has increased the knowledge and abilities of department members in the arena of wetting agents. This increased knowledge has driven department members to search to determine if the wetting agent concentrate in use at the Albemarle Fire Department is the most efficient and effective agent available to the fire service.

When the Albemarle Fire Department made the decision to utilize a wetting agent the agent chosen was based on limited field testing by a small number of department members. This field testing determined the agent chosen performed consistent with the manufacturer's recommendations and NFPA 18 as determined by independent testing conducted by Underwriters Laboratories (UL).

As time has progressed and the knowledge of wetting agents by members of the Albemarle Fire Department has increased, the need to determine if the limited field testing conducted in the department's wetting agent selection process resulted in the best performing agent being chosen. The utilization of one product for both Class A and Class B fires makes the importance of choosing the best performing product even more vital.

The use of a proven wetting agent by the Albemarle Fire Department has become a priority for the department. The department's experience with the wetting agent currently being utilized has shown faster fire knockdown, less off gassing by involved fuels and quicker overhaul. The ability to have one agent on the apparatus that has the capability to extinguish both Class A and Class B fires gives the department more versatility in operations. A Class B fire is a rare occurrence in the Albemarle Fire Department so using a product for all fires reduces the chances for operational errors due to inexperience with the extinguishing agent being utilized. This reliance on wetting agents requires the department to assure themselves that they have chosen the best performing product.

Conducting an online search for data on UL Listed wetting agents revealed manufacturer recommendations that were inconsistent with the concentration levels tested by UL for NFPA 18 compliance. Some manufacturers recommended concentration application rates that differed

within the same website. These differences clearly demonstrated the need to conduct research to determine the best performing wetting agent using data from an independent testing source.

Determining the best performing classified wetting agent will assist the Albemarle Fire Department in achieving the United States Fire Administration (USFA) Operational Objectives. The results of this research will allow the Albemarle Fire Department to "Improve the fire and emergency services' capability for response to and recovery from all hazards" (United States Fire Administration, 2012).

The research conducted on this project directly relates to Unit 1, *Introduction* of the National Fire Academy Executive Analysis of Fire Service Operations in Emergency Management class. This chapter discussed the command functions of the incident command system which include assuring the proper resources are acquired for incident operations (United States Department of Homeland Security, 2012). This research could assist the Logistics Section Chief with assuring the best performing wetting agent is provided for incident operations.

## Literature Review

There is virtually no information, other than from manufacturers, available regarding the performance of wetting agents on Class A or Class B fires. Although these agents have been utilized by the fire service for years there has been little research conducted on their performance. This lack of information puts the department utilizing a wetting agent at the mercy of the sales person.

In order to understand wetting agents it is important to understand the definition of a wetting agent and a wetting agent solution. According to the official NFPA definition a wetting agent is, "A concentrate that when added to water reduces the surface tension and increases its

ability to penetrate and spread". The official NFPA definition of a wetting agent solution is, "Water to which a wetting agent has been added" (NFPA 18, 2010, p. 18-6).

In addition to a lack of performance information on wetting agents, it is even difficult to trace the history of wetting agents in the fire service. There is some mention in William Clark's book *Fire Fighting/Principles & Practices* of wetting agents following the advent of protein based mechanical foam in the 1940s. These early wetting agents had advantages over foams that were available during this time period. Wetting agents worked better with the dry chemicals that were being utilized during this time period. Wetting agents would penetrate porous surfaces better than other products available. The wetting agents of this period also had a shelf life which was better than the protein foams available during this time (William Clark, 1974/1987, p. 27-28).

Wetting agents have been under NFPA guidance for over sixty years. According to NFPA, the first standard developed by their agency that provided direction regarding wetting agents was officially adopted in 1951. The committee first charged by NFPA to oversee wetting agents was the Committee on Wetting Agents. In 1959 the standard on wetting agents was transferred to the Committee on Foam. The standard underwent some minor changes in the 1972 and 1979 revision cycles. The wetting agent standard then sat nearly idle for the next sixteen years. The 1995 revision of NFPA 18 contained minor changes in an effort to make the standard more user friendly. The 2006 edition of NFPA 18 saw extensive revisions including the addition of methods for testing wetting agents. The current edition of NFPA 18, which went into effect in August 2011, also saw major revisions to several sections (NFPA 18, 2010, p. 18-1).

The fire extinguishment testing standards for NFPA compliant wetting agents weren't defined until the 2006 edition of NFPA 18. The 1995 edition of NFPA 18 only provided broad

directions regarding the fire extinguishment tests that needed to be successfully completed to be NFPA 18 compliant. The Class A fire extinguishment test was not defined at all in the 1995 edition of NFPA 18. There was a notation in the appendix regarding the Class A fire extinguishment test which stated that acceptable evaluation tests have not been developed (NFPA 18, 1995, p. 18-9). The only guidance provided by the standard in regards to the Class B fire extinguishment test was noted in section 2-1.2.2 which stated "Evaluation tests by a testing laboratory shall be followed for acceptance of a wetting agent for application to Class B fires" (NFPA 18, 1995, p. 18-6).

The 2006 edition of NFPA 18 created a chapter devoted to the requirements and test methods for wetting agents and wetting agent solutions, Chapter Five. This chapter detailed the requirements for products desiring to comply with NFPA 18 which included Class A and Class B fire extinguishment tests. This chapter also provided potential users the ability to see "the information developed in response to the requirements of this chapter" (NFPA 18, 2005, p. 18-6).

There are two sections within NFPA 18, 2006 edition, which detail the requirements for fire extinguishment testing. The first section details the three Class A fire extinguishment tests. The second section details the Class B fire extinguishment test. The three tests for Class A fire extinguishment are: Wood Crib Test, Deep-Seated Fire Test and the Wood Fiber Board Penetration. These tests attempt to measure the ability of the wetting agent to extinguish a 3A wood crib fire, extinguish a deep-seated cotton fire while exhibiting less runoff than water and extinguish a wood fiber board fire while exhibiting less runoff and weight loss than water. The deep-seated cotton and wood fiber board tests are performed three times with plain water and

three times with a wetting agent solution prepared at the manufacturer's recommended concentrations (NFPA 18, 2005, p. 18-9).

The Class B fire extinguishment test is designed to comply with the requirements of UL 711. This test utilizes a two inches deep layer of heptane fuel and four inches of water in a fifty square foot (20B) burn pan. A ten gallons per minute (gpm) nozzle is utilized and must extinguish the fire without extending the nozzle over the burn pan after a one minute free burn of the heptane fuel. The fire must be extinguished within five minutes after the one minute free burn. This test must be successfully completed in two consecutive burns (NFPA 18, 2005, p. 18-9). The tests in the 2006 edition of NFPA 18 were the first outlined tests by NFPA to give users the ability to see measurable performance of wetting agents meeting the NFPA 18 standard.

One major revision to the 2011 edition of NFPA 18, which effected this research, was the moving of the Class A and Class B extinguishment tests from Chapter Five to Chapter Six and Chapter Seven (NFPA 18, 2010, p. 18-10). This change was significant as it removed the fire extinguishment tests from the section of the standard which required manufacturer's to release information "developed in response to the requirements of this chapter" to potential users (NFPA 18, 2010, p. 18-7).

In 1998 the "Building and Fire Research Laboratory (BFRL) of the National Institute of Standards and Technology (NIST), under sponsorship of the United States Fire Administration (USFA), has conducted a series of experiments to demonstrate the suppression effectiveness of water-based fire fighting agents" (NIST, 1998). These experiments included seven agents that were listed on the U.S. Forest Service qualified products list. The agents tested did include at least one wetting agent. These agents were tested in various environments to measure their effectiveness. While these experiments were developed to measure the performance of the

chosen agents, the results were not very useful in determining how particular agents performed. Throughout the entire report the agents tested were named as Agent and a letter, not as their product name.

In 2008 UL released a report, as part of a 2006 Department of Homeland Security grant that examined four different areas using Class A foams and wetting agents. As part of the study UL examined physical properties, Class A wood crib tests, residential living room fires and fixed nozzle wood crib fire testing. These tests were conducted using either a 1.0% or 0.50% concentration level mixed with water. Just as with the NIST testing conducted in 1998 the UL testing did not report the results using specific product brand names. The products tested were only referred to as Agent and a letter. UL noted in the report the following information, "UL does conduct investigations without Classification, Listing or Recognition in Follow-Up Service when a need for test data in the interest of public safety has been indicated. Such investigations do not result in specific conclusions" (Underwriters Laboratories, 2008). The data generated by this report could not be linked to specific brand names which made the data virtually useless to potential users of the tested products.

UL does not provide a Listing Mark for wetting agent products complying with NFPA 18. UL provides the Classification Mark on wetting agents that have had various sections of the NFPA 18 standard evaluated by their company. Wetting agents Classified by UL have not been evaluated to each section of NFPA 18. These wetting agents have only been evaluated to the sections of NFPA 18 listed on the GOHR.GuideInfo Wetting Agents published by UL. The Class A and Class B fire tests are included in the UL Classification testing for wetting agents (UL-GOHR.GuideInfo, 2012).

When a wetting agent seeks UL Classification the wetting agent is tested at a particular concentrate percentage to each of the NFPA 18 extinguishment tests, as well as other perimeters as outlined in NFPA 18. The percent tested indicates the percentage of wetting agent concentrate that is mixed with water to perform the extinguishment test to meet the standard. The UL Classification lists a percentage of concentrate to be utilized with Class A and Class B fuels. The percentage listed on the UL Classification provides the potential user with a percentage that the product successfully met the requirements of NFPA 18. It could be assumed that the lower the concentrate percentage, the product was UL Classified as meeting NFPA 18, the better performing the product would be. This assumption lead to researching manufacturer concentrate recommendations in relation to the concentration level the product is UL Classified as complying with NFPA 18.

Amiran Biochemicals LLC., manufacturers "'Flameout' wetting agent concentrate, when added to water in concentrations of not less than 2% for Class A fires and not less than 6% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Flameout, 2012). The corporate website for Flameout recommends utilizing Flameout at 0.50% to 2% concentrate solution for Class A fires as a wetting agent and 2% to 6% concentrate solution for Class B fires as an aqueous film forming foam (AFFF) alternative (Amiran Biochemical, n.d.). Just-In Case Fire Ltd. is a distributor of Flameout and within the specification data for dilution for use they recommend using Flameout as a wetting agent at 0.5% to 1% concentrate solution for Class A fires and as an AFFF alternative at 2% to 6% concentrate solution. Just-In Case Fire Ltd. also states on their webpage that Flameout is the only UL Listed wetting agent for Class A and Class B fires (Just-In Case Fire Ltd, n.d.). Caleb Industries, an additional distributor of Flameout, suggests using the Flameout concentrate at a

1% to 3% solution for Class A fires and 3% to 6% concentrate solution for Class B fires (Caleb Industries, n.d.)

Baums Castorine Co Inc., manufacturers "'Novacool UEF' wetting agent concentrate, when added to water in concentrations of not less than 0.4% for Class A fires and not less than 0.5% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Novacool UEF, 2012). SW Fire Fighting Foam and Equipment, a distributor of Novacool UEF, recommends using the concentrate at the same percentages as the product is UL Classified (SW Fire Fighting Foam & Equipment, 2010-2012). A website that appears to represent Baum's Castorine recommends an application ratio of "0.40% standard, 1% and 3% optional" (Poland & Sons, 2011).

Bio-Ex SAS, manufacturers "Bio For C wetting agent concentrate, when added to water in concentrations of not less than 0.3% for Class A fires and not less than 0.5% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Bio For C, 2012). Recommended concentration levels from Bio-Ex are 0.10% concentrate solution on low fires, 0.30% concentrate solution on high fires, solid fires and urban fires, and a 0.50% concentrate solution on vehicle fires, warehouse flooding and hydrocarbon fires (Bio Ex, Bio For C, 2011)

Bio-Ex SAS, manufacturers "Bio For N wetting agent concentrate, when added to water in concentrations of not less than 0.5% for Class A fires and not less than 1% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Bio For N, 2012). Recommended concentration levels from Bio-Ex are 0.20% concentrate solution on low fires, 0.50% concentrate solution on high fires, solid fires and urban fires, and a 1.0% concentrate solution on vehicle fires, warehouse flooding and hydrocarbon fires (Bio Ex,

Bio For N, 2011). It should be noted the same manufacturer produces both Bio For C and Bio For N.

Chemguard, manufacturers "'First Class' wetting agent concentrate, when added to water in concentrations of not less than 0.24% for Class A fires and not less than 0.5% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Chemguard, 2012). The recommended dilution rate by Chemguard for First Class to be used as a wetting agent is 0.50% concentrate solution (Chemguard, 2012).

Fire Service Plus Inc., manufacturers "'FireAde 2000', wetting agent concentrate, when added to water in concentrations of not less than 0.25% for Class A fires and not less than 0.5% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-FireAde 2000, 2012). Fire Services Plus Inc., recommends using FireAde 2000 at 0.10% to 0.50% concentrate solution for wood, grass, coal, tires, hay, cotton, cardboard and initial knockdown. Cars, trucks and heavy equipment are recommended to be extinguished with a concentrate solution between 0.50% and 1.0%. Non-polar solvents such as gasoline, gasoline with 10% ethanol, JP4 and diesel are recommended to be extinguished as a wetting agent at a solution of 0.50% to 1.0% concentrate. If using FireAde 2000 as a liquid foam concentrate the manufacturer recommends using the concentrate at a 3% solution using a flow rate of 0.10 gpm per square foot for 10-20 minutes (Fire Service Plus, 2012).

Fire Suppression Products, manufacturers "Fire Cap Plus wetting agent concentrate, when added to water in concentrations of not less than 0.25% for Class A fires and not less than 0.3% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Fire Cap Plus, 2012). Fire Cap Plus recommends using a 0.25% to 0.50% concentrate solution for Class A fires. Class B, non-polar solvent, fires are

recommended to be extinguished with a 1% to 3% concentrate solution. Class B, polar solvent, fires are recommended to be extinguished with a 3% to 6% concentrate solution. A 2 ½ gallon water fire extinguisher is recommended to be filled with ten ounces of Fire Cap Plus concentrate and 320 ounces of water. This mix ratio will fill the water extinguisher with a 3% concentrate solution (Fire Cap Plus, 2011).

Fire-Freeze Worldwide Inc., manufacturers "Cold Fire wetting agent concentrate, when added to water in concentrations of not less than 0.15% for Class A fires and not less than 1.5% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Cold Fire, 2012). The Material Safety Data Sheet (MSDS) listed by the manufacturer states for dilution strength, "use at strengths of 1% to 10% in any type of water" (FireFreeze Worldwide, n.d.). A distributor of Cold Fire, Speer Operational Technologies, has posted a document with the manufacturer's name and contact information which has a recommended dilution strength as "use at full strength, do not dilute" (FireFreeze Worldwide, 2011). Speer Operational Technologies also provides additional documents with Cold Fire mixing percentages. One document has the Cold Fire logo at the top and is labeled Bulk Applications. The solution concentrate for Class A fires is listed at 1% to 3% and 3% to 6% for Class B fires. Information is provided on how to fill a 2 ½ gallon water fire extinguisher with Cold Fire for first response. The recommendation is to pour 256 ounces of water into the extinguisher, then pour 32 ounces of Cold Fire concentrate into the unit. These directions only provide a total of 288 ounces of water and concentrate in a 320 ounce fire extinguisher. Using the directions to fill the water fire extinguisher with Cold Fire concentrate and water results in a fire extinguisher with a nearly 13% concentrate solution (Cold Fire, n.d.) .

Gimaex of America LLC., A Giamex International Co., manufacturers "'One Seven' wetting agent concentrate, when added to water in concentrations of not less than 0.3% for Class A and Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-One Seven, 2012). The manufacturer information sheet states One Seven "features a low proportioning rate of 0.30%". There is no mention of One Seven being able to be utilized on Class B fires (Giamex of America, n.d.).

Hazard Control Technologies, Inc., manufacturers "'F-500' wetting agent concentrate, when added to water in concentrations of not less than 0.25% by volume for Class A fires and not less than 6% by volume for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-F-500, 2012). The F-500 corporate website list application rates for Class A fires as 0.25% to 1% and Class B fires from 1% to 6% concentrate solution (Hazard Control Technologies, n.d.). In addition to an overview of mixing percentages Hazard Control Technologies, Inc. offers several sample operating guidelines to assist departments in developing policies which would govern the use of F-500. One such guideline outlines the recommended re-servicing instructions for a 2 ½ gallon water fire extinguisher mixed with F-500 concentrate for use on Class A fires. The guideline recommends filling the extinguisher with 2 ½ gallons of water and then ten ounces of F-500 concentrate. The concentrate solution, mixed according to this guideline, would be over 3%. In addition to the guideline on filling a water extinguisher with F-500 concentrate there are guidelines "To establish a manner for the use of F-500 on Class A and Class B fires" (Hazard Control Technologies, 2011). This guideline provides recommendations on recommended concentrate mix percentages for each class of fire. For Class A fires the manufacturer recommends the following, "Generally speaking, F-500 is recommended for use at 1% on all Class A fires". For

Class B fires it is recommended, “as a general rule, liquids such as gasoline, jet fuel, and heptanes can be extinguished using a 3% concentrate application. There is no evidence that using a higher percentage rate on polar or non-polar solvents improves firefighting performance” (Hazard Control Technologies, 2011).

ICL Performance Products LP, manufacturers “’Phos-Chek WD881’ wetting agent concentrate, when added to water in concentrations of not less than 0.1% for Class A fires and not less than 0.25% for Class B fires” © 2012 UL LLC, “Reprinted from the Online Certifications Directory with permission from UL” (UL-Phos-Chek WD881, 2012). There are several different recommended concentrate solution mix ratios provided by the manufacturer for their Class A foams. The manufacturer doesn’t specify which one of their foams should be used at their recommended mixing ratios. There is a reference to using Phos-Chek WD 881 in the manufacturer’s Class ‘A’ Foam Operations Policy. The policy states that the department specify Phos-Chek WD 881. The general application rates stated in the policy state a normal direct attack setting of 0.30%, overhaul 0.10%, exposure control and brush pre-treatment of 1.0% (ICL Performance Products, 2012). There is no documentation that could be located providing information on utilization of Phos-Check WD 881 for Class B fires.

Kidde Fire Fighting, manufacturers “’HI COMBAT A’ wetting agent concentrate, when added to water in concentrations of not less than 0.3% for Class A and Class B fires” © 2012 UL LLC, “Reprinted from the Online Certifications Directory with permission from UL” (UL-Hi-Combat A, 2012). The manufacturer recommends using a 0.30% concentrate solution of Hi-Combat A for Class B hydrocarbon spill emulsification, 0.50% to 0.70% concentration solution for structural fire attack and overhaul and 0.70% to 1.0% concentrate solution for exposure protection (Angus Fire, 2007).

Kidde Fire Fighting, manufacturers "'Knockdown' wetting agent concentrate, when added to water in concentrations of not less than 0.3% for Class A and Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Knockdown, 2012). The manufacturer recommends using a 0.30% concentrate solution of Knockdown for Class B hydrocarbon spill emulsification, 0.50% to 0.70% concentration solution for structural fire attack and overhaul and 0.70% to 1.0% concentrate solution for exposure protection (National Foam, 2001). Knockdown and Hi-Combat A are manufactured by the same parent company, Kidde-Fire. The majority of the product information compared on Knockdown and Hi-Combat A shows the exact same data for both products, the only exception is the product name.

Verde Environmental, Inc., manufacturers "'Micro-Blaze Out' wetting agent concentrate, when added to water in concentrations of not less than 1% for Class A fires and not less than 3% for Class B fires" © 2012 UL LLC, "Reprinted from the Online Certifications Directory with permission from UL" (UL-Micro-Blaze Out, 2012). The manufacturer states Micro-Blaze Out mixed at 0.50% to 1.0% "offers superior fire fighting capabilities over using water alone or other wetting agents". They also state their product, when used on Class B fires, is "most effective when used in lower concentrations (2% to 3%)" (Micro-Blaze Out, 2009). The manufacturer provided data sheet on Micro-Blaze Out has a recommended proportioning setting of 1.0% concentrate solution for Class A fires and a 3.0% concentrate solution for Class B fires. The same data sheet states "Micro-Blaze Out can be used on hydrocarbon spill fires at a 1% to 3% solution mixed with water" (Micro-Blaze Out, n.d.).

Williams Fire & Hazard Control, Inc., manufacturers "'WFFF' wetting agent concentrate, when added to water in concentrations of not less than 0.5% for Class A and Class B fires" ©

2012 UL LLC, “Reprinted from the Online Certifications Directory with permission from UL” (UL-WFFF, 2012). The manufacturer states their product should be used at 0.50% concentrate solution when used as a wetting agent. If using WFFF as a foam concentrate the manufacturer states to use the concentrate with air aspirated nozzles at 0.30% to 0.50% concentrate solution. If using a non-air-aspirating nozzle it is recommended to use the product at 0.30% to 0.60% concentrate solution (Williams Fire & Hazard Control, 2010).

The review of available research clearly demonstrates the need to gain knowledge on specific wetting agent product performance. The studies completed by NIST and UL provided information on product performance but with the lack of product names linked to the performance the results were virtually useless to users of the tested wetting agents.

NFPA 18, until 2006, didn’t provide any defined fire testing perimeters for wetting agents. The information prior to the release of the 2006 edition of NFPA 18 left users with no means to determine if the product they purchased would perform as advertised. This lack of performance data clearly left users of these products at the mercy of the sales person selling the product.

The review of recommended solution concentrations from manufacturers and distributors as compared to the UL Classified solution concentrations differs for nearly every Classified wetting agent. These differences have the potential to cause fire departments to utilize their wetting agent at concentration levels that have not been evaluated by an independent testing agency. This difference in recommended concentration amounts violates Section 4.1.1.3 of NFPA 18 2011 edition which states, “wetting agent concentrate shall be used at the prescribed proportion(s), in accordance with its listing(s)” (NFPA 18, 2010, p. 18-6).

The results of the literature review clearly demonstrate the need for additional data to provide a wetting agent end user the ability to know the product they are using performs in the manner advertised by the manufacturer. The literature review also discovered many manufacturer or distributor recommended solution concentration levels which would make the wetting agent utilized not in compliance with NFPA 18. The literature review did not produce any information that would assist an end user in comparing the performance of wetting agents currently available to the fire service.

## Procedures

Prior to this research project it was known that UL provided independent testing of wetting agents in relation to NFPA 18. Searching the UL website for information relating to wetting agents was the first area of research, this began in April 2012. The UL website was referenced and it was determined there was an online certifications directory which listed each agent that was investigated by UL and determined to have met the requirements of NFPA 18. The online certifications directory was searched for items matching the search term, wetting agents. The results produced a link for each wetting agent investigated by UL (UL-Online Certification Directory, 2012). The link for each wetting agent provided the manufacturer name and contact information, NFPA standard and standard cycle year the agent complied with, the product name and concentration levels the product was tested with. The first copy of this information was obtained on April 2, 2012. During the research process the same information was accessed on August 26, 2012 and it was determined that on April 5, 2012 the sentence "wetting agents investigated to NFPA18-2006" was removed from each of the wetting agents listed in the UL Online Certifications Directory. The GOHR.GuideInfo Wetting Agents link in the UL Online Certifications Directory also had any reference to NFPA 18-2006 removed after

the material was accessed on April 2, 2012 (UL-GOHR.GuideInfo, 2012). The last updated date on the GOHR.GuideInfo Wetting Agents and each wetting agent guide now shows April 5, 2012.

Once it was determined which agents were investigated by UL an email was sent to an email contact for each manufacturer (Appendix A). The email contact information for each manufacturer was located using the search engine, Google.com.

The email request for UL testing information resulted in the manufacturers of Novacool UEF, Phos-Chek WD881 and Micro-Blaze Out providing a copy of all or the majority of the original UL testing data for their product. The manufacturer of First Class provided copies of a portion of their original UL testing data as well as a spreadsheet listing a portion of their testing results. The manufacturers of Flameout, Knockdown and Hi Combat A replied to the initial email request with information not specific to the UL testing data and when specific data was requested the manufacturers stopped answering emails that were sent to them. The manufacturers of Bio for C, Bio for N, Fire Cap Plus, One Seven and WFFF did not respond to the email request for information. The manufacturers of F-500 and FireAde 200 replied to the request for information by refusing to provide any information on their wetting agent. The manufacturer of Cold Fire was contacted by telephone, after several emails were returned undeliverable. The representative from Cold Fire stated the UL testing data for their product was available online. When they were told their UL information online didn't appear current they stated the current information would be sent (E.Giessler, personal communication, July 2012). The material was never received and all future emails and telephone messages were unanswered.

The online search engine, Google.com was extensively utilized to determine if there were any UL Wetting Agent testing results available online. This search discovered UL testing data for Cold Fire.

A search of previously collected data and information on wetting agents from the author's library located UL testing data for one currently classified wetting agent, F-500.

The lack of response in providing data from manufacturers of products Classified by UL prompted emails between the author and several email addresses at UL. These emails were attempts at getting copies of the UL testing data and performance information on UL Classified Wetting Agents. These emails took place from June 12, 2012 until October 6, 2012 (Appendix B).

In an effort to get clarification from NFPA on the intent of NFPA 18 regarding the release of independent testing, numerous emails were exchanged between the author and Sandra Stanek, Staff Liaison for NFPA 18. These emails were exchanged between June 12, 2012 and August 25, 2012 (Appendix C).

Research was conducted using the search engine, Google.com to determine if there were additional independent testing agencies in addition to UL that conducted NFPA 18 testing of wetting agents. It was determined that Factory Mutual (FM) and Southwest Research Institute (SWRI) conducted independent testing of various fire service products. An email was sent to each agency to determine if wetting agent testing was performed by them. Brian McDonald from FM replied, "We don't have an Approval Standard for wetting agents and have no FM Approved products in that category" (B. McDonald, personal communication, July 17, 2012). Barry Badders from SWRI replied stating, "I can find anything. It doesn't look like we do" (B. Badders, personal communication, July 17, 2012). These replies limited the search for independent testing data to UL.

The Albemarle Fire Department library was researched for any textbooks or reference material that contained data related to the performance of wetting agents. No data was located in

this search. There was some information regarding the history of wetting agents discovered during this phase of the research.

The online search engine, Google.com was utilized to search various terms and phrases to determine if there were any studies or research available that would provide additional performance data on wetting agents.

This online search determined there were two sources of independent research that had been conducted on wetting agents. One of the research documents was created by NIST and the other by UL. Those documents were reviewed for any information that could demonstrate the performance of any wetting agents currently Classified by UL.

Once it was determined that no additional UL testing results were going to be obtained the UL testing data that was obtained was reviewed. The UL testing data from Chemguard Inc. was reviewed for the product, First Class (Underwriter's Laboratories- First Class, n.d.). The UL testing data from ICL Performance Products Lp. was reviewed for the product, Phos-Chek WD881 (Underwriter's Laboratories-Phos-Chek WD881, 2008). The UL testing data from Fire Freeze Worldwide, Inc. was reviewed for the product, Cold Fire (Underwriter's Laboratories-Cold Fire, 1994). The UL testing data from Verde Environmental Inc. was reviewed for the product, Micro-Blaze Out (Underwriter's Laboratories-Micro-Blaze Out, 1996). The UL testing data from Hazard Control Technologies Inc. was reviewed for the product, F-500 (Underwriter's Laboratories-F-500, 1994). The UL testing data from Baum’s Castorine Inc. was reviewed for the product, Novacool UEF (Underwriter's Laboratories-Novacool UEF, 2007). Once all of the data was reviewed the testing results related to the Class A and Class B fire testing were organized into a table for each wetting agent. This data was then analyzed in table form to compare the performance of each product for each of the research questions. This review was

able to determine which variable(s) from each research question would be used as a benchmark for determining the best performing product for each research question. The best performing wetting agents from each research question were compared to determine the best overall performing wetting agent, of the wetting agents evaluated.

There were several limitations discovered during this research process. The major limitation discovered was the inability to get UL Classified wetting agent testing data released. The changes to NFPA 18, 2011 edition, which moved the Class A and Class B fire testing to separate chapters within the standard, made it impossible to obtain independent testing data unless the manufacturer was willing to release the data. If UL testing data was released by the manufacturer it was determined there are no means for the data to be verified by UL as being accurate. All of the wetting agent testing data is considered proprietary between UL and their customer (B. Shugarman, personal communication, October 23, 2012). There is virtually no performance data, other than information released by the manufacturer as sales information, available to users of UL Classified wetting agents.

## Results

The research process wasn't able to produce testing data on each of the wetting agents currently Classified by UL. The lack of data on each UL Classified wetting agent prevented the research questions from being answered to the fullest extent possible. The information obtained or provided by six wetting agent manufacturers did provide the ability to gain some performance comparisons of wetting agents currently Classified by UL. The information provided also provided the ability of the Albemarle Fire Department to determine if the wetting agent they are currently utilizing is the best performing wetting agent of those evaluated. The UL performance data provided was sufficient to discover there are differences in various brands of wetting agents.

The research determined that UL doesn't List wetting agents as they have in the past. UL currently only provides the Classification Mark for wetting agents, not the Listing Mark (UL-GOHR.GuideInfo, 2012).

*How did each brand of listed wetting agent perform on the NFPA 18 wood crib test?*

There were several variables reported on the NFPA 18 wood crib test. The reported variables were: Classified percentage, tested percentage, test date, control time, discharge duration, pre-burn, glowing embers, crib size and results. The results of these variables are reported in the tables listed in Appendix D.

First Class and Novacool UEF were evaluated at the same percentage as their UL Classification. First Class is Classified for Class A fires at 0.24% concentration and was tested to 0.24% concentration. Novacool UEF is Classified for Class A fires at 0.40% concentration and was tested to 0.40% concentration. Phos-Chek WD881 is UL Classified for Class A fires at 0.10%, the agent was tested at 0.25%. Cold Fire is UL Classified for Class A fires at 0.25%, the agent was tested at 0.15%. F-500 is UL Classified for Class A fires at 0.25%, the agent was tested at 1.0%, 3.0% and 6.0%. Micro-Blaze Out is UL Classified for Class A fires at 1.0%, the agent was tested at 3.0% (Appendix D).

The testing dates reported on the test data ranged from 1994 to 2007. Novacool UEF was the only product with test data reported after 1998. First Class did not report the date test data was created for their product. All other wetting agents with test data were tested between 1994 and 1998 (Appendix D).

The control time for the crib test was reported for First Class and Novacool UEF. The average control time on successful tests for First Class was 20.50 seconds. The average control

time on successful tests for Novacool UEF was 17.50 seconds. No other wetting agent had a control time reported on their UL testing data (Appendix D).

The discharge duration was reported for each of the wetting agents reporting data with the exception of First Class and Novacool UEF. The average discharge duration for Phos-Chek WD 881 was 52.9 seconds. The average discharge duration for Cold Fire was 58.75 seconds. The average discharge duration for F-500 at a 1% concentration was 52.05 seconds, at a 3% concentration it was 53 seconds and at a 6% concentration it was 57.50 seconds. The average discharge duration for Micro-Blaze Out at a 3% concentration was 58.50 seconds. The end of discharge time was reported for Novacool UEF. The end of discharge times reported for the successful tests of Novacool UEF are 35 seconds and 8:25. The 8:25 time does not appear to be accurate time. The difference in times reported for Novacool UEF make it impossible to determine and accurate average end of discharge time for Novacool UEF (Appendix D).

The application time was only reported for First Class. The average application time reported was 1:07. No application times were reported for the other evaluated wetting agents. This prohibited any type of product comparison using this variable (Appendix D).

The test crib pre-burn time was reported for each of the wetting agents with the exception of First Class. First Class did not report any pre-burn times. The average pre-burn time for Phos-Chek WD881 was 6:30. The average pre-burn time for Cold Fire was 7:49. The average pre-burn time for F-500 at a 1% concentration was 7:15, at a 3% concentration the time was 7:28, and at a 6% concentration the time was 7:15. The average pre-burn time for Micro-Blaze Out was 6:30. The average pre-burn reported on the successful test burns for Novacool UEF was 7:02 (Appendix D).

Glowing embers were reported as decreasing on two of the wetting agents, First Class and Novacool UEF. The other wetting agents did not report if there were increasing or decreasing glowing embers (Appendix D).

The crib size was reported on all wetting agents with the exception of First Class. Phos-Chek WD881 and Novacool UEF were tested using a 3-A wood crib. All other wetting agents reporting the size crib utilized were tested using a 2-A wood crib (Appendix D).

The last data set reported were the results of each agent. The results were reported as acceptable or unacceptable for First Class of Novacool UEF. First Class and Novacool UEF reported two consecutive acceptable tests. The remaining wetting agents all reported their results as extinguished (Appendix D).

The final conclusion regarding this research question is that the data presented is not consistent enough to use all of the variables to provide the potential user with the ability to determine the better performing agent when comparing all six wetting agents. The control time would provide a numerical ability to determine how quickly each agent controlled the fire. This time was only reported on two of the wetting agents, First Class and Novacool UEF. Novacool UEF controlled the fire faster than First Class. The other test data set with the potential to make a big difference in performance, is the size of the wood crib utilized. Two of the agents, Phos-Chek WD881 and Novacool UEF, were the only two agents that were tested using a 3-A wood crib. The remainder of the wetting agents analyzed were tested using a 2-A crib. The testing criteria within NFPA 18, 2011 edition states “tests shall be conducted according to the procedures detailed in this section and UL 711/ULC S508 for Class A fires utilizing a 3-A wood crib” (NFPA 18, 2010, p. 18-10). It is clear that only two of the wetting agents evaluated were tested to the criteria set forth in the 2011 edition of NFPA 18.

*How did each brand of listed wetting agent perform on the NFPA 18 deep-seated fire test?*

The variables analyzed within the UL NFPA 18 testing data for the deep-seated fire test were: Classified percentage, tested percentage, date tested, fire extinguished and runoff volume. There were no other data variables reported within the test data to provide performance measures on the evaluated wetting agents.

First Class and Novacool UEF were evaluated at the same percentage as their UL Classification. First Class is Classified for Class A fires at 0.24% concentration and was tested to 0.24% concentration. Novacool UEF is Classified for Class A fires at 0.40% concentration and was tested to 0.40% concentration. Phos-Chek WD881 is UL Classified for Class A fires at 0.10%, the agent was tested at 1.0%. The Phos-Chek WD881 documented testing percentage conflicts within the concentration percentage listed in the deep seated fire test results. The table within the UL testing data labeled *Verification of Solution Concentration* states a 0.25% premix concentration was utilized and in the data section labeled *Data with Solution as Test Liquid* the data states a 1% concentration was utilized (Underwriter's Laboratories-Phos-Chek WD881, 2008). Cold Fire is UL Classified for Class A fires at 0.25%, the agent was tested at 0.15%. F-500 is UL Classified for Class A fires at 0.25%, the agent was tested at 1.0%, 3.0% and 6.0%. Micro-Blaze Out is UL Classified for Class A fires at 1.0%, the agent was tested at 3.0% (Appendix E).

All of the data sets with the exception of First Class and Novacool UEF reported whether the fire was extinguished for the water only tests. All wetting agents reported the results of the deep seated cotton fire test when the wetting agent solution was utilized. Phos-Chek WD 881 was the only wetting agent that reported all three water fire tests extinguished the fire. Cold Fire

and Micro-Blaze Out were the only two wetting agents that reported the cotton fire was not extinguished on any of their tests. The F-500 water test reported the first two fires were extinguished and the third was not. All wetting agent products reported the fire was extinguished when using the solution concentration (Appendix E).

The runoff volume was the last data set compared on each wetting agent. Each wetting agent brand conducted three plain water tests and three tests were conducted using a wetting agent concentration. The runoff was collected for each test and an average was generated. To meet the NFPA 18, 2011 edition, standard for Section 6.3 the "wetting agent solutions shall extinguish deep-seated cotton fires and exhibit less runoff than water when tested in accordance with 6.3.2 and 6.3.3" (NFPA 18, 2010, p. 18-10). There is no mention within NFPA 18 of any averages in determining NFPA 18 compliance.

The runoff volume for the First Class solution tests were 65.3 ml, 72.4 ml and 89.7 ml. The average runoff for the First Class solution was 75.8 ml. The runoff volume for the water tests were 216.5 ml, 188.3 ml and 194.6 ml. The average runoff volume for water was 199.8 ml (Underwriter's Laboratories- First Class, n.d.).

The runoff volume for the Phos-Chek WD881 solution tests were 89.1 ml, 92.6 ml and 86.3 ml. The average runoff for the Phos-Chek WD881 solution was 89.3 ml. The runoff volume for the water tests were 215.2 ml, 193.9 ml and 222.7 ml. The average runoff volume for water was 210.6 ml (Underwriter's Laboratories-Phos-Chek WD881, 2008).

The runoff volume for the Cold Fire solution tests were 3 ml, 8 ml and 4 ml. The average runoff for the Cold Fire solution was 5 ml. The runoff volume for the water tests were 20 ml, 15 ml and 24 ml. The average runoff volume for water was 20 ml (Underwriter's Laboratories-Cold Fire, 1994).

The runoff volume for the F-500 solution tests conducted at 1% solution were 27 ml, 40 ml and 19 ml. The average runoff for the F-500 1% solution was 29 ml. The runoff volume for the F-500 solution tests conducted at 3% solution were 2 ml, 1 ml and 3 ml. The average runoff for the F-500 3% solution was 2 ml. The runoff volume for the F-500 solution tests conducted at 6% solution was 0 ml. The average runoff for the F-500 6% solution was 0 ml. The runoff volume for the water tests, which were used as a comparison for all three solution tests, were 228 ml, 231 ml and 233 ml. The average runoff volume for water was 231 ml (Underwriter's Laboratories-F-500, 1994).

The runoff volume for the Micro-Blaze Out solution tests were 15.6 ml, 20 ml and 19.8 ml. The average runoff for the Micro-Blaze Out solution was 18.5 ml. The runoff volume for the water tests were 1 ml, 3.93 ml and 2 ml. The average runoff volume for water was 2.3 ml. The runoff volume for the wetting agent solution was not less than the runoff volume for water (Underwriter's Laboratories-Micro-Blaze Out, 1996).

The runoff volume for the Novacool UEF solution tests were 43 ml, 88.7 ml and 83 ml. The average runoff for the Novacool UEF solution was 71.56 ml. The runoff volume for the water tests were 215.2 ml, 193.9 ml and 222.7 ml. The average runoff volume for water was 210.6 ml (Underwriter's Laboratories-Novacool UEF, 2007)

Review of the results from the deep seated cotton tests only prove the wetting agent solution is more absorbed than plain water. The difference in the water tests, including not extinguishing the fire, could result in differences in the amount of water not absorbed by the cotton. The NFPA 18 test states the test liquid is to be poured over the cotton. The rate at which the test liquid was poured could alter the amount of runoff volume from the water and wetting agent solution. There are too many variables within this test that can’t be controlled. The lack of

control of these variables prevents and accurate comparison of wetting agents using this test. There was also one product that did not exhibit less runoff than untreated water which is a requirement to pass NFPA 18, 2011 edition.

*How did each brand of listed wetting agent perform on the NFPA 18 wood fiber board penetration test?*

There were several variables compared when evaluating the wood fiber board tests in NFPA 18, 2011 edition. The variables analyzed within the UL NFPA 18 testing data for the wood fiber board fire test were: Classified percentage, tested percentage, date tested, fire extinguished, weight before test, weight after test, weight loss and runoff volume.

According to NFPA 18, 2011 edition, for a wetting agent to comply with the standard, the "wetting agent solutions shall extinguish wood fiber board fires and exhibit less runoff and weight loss than water". The wood fiber board tests were conducted according to Sections 6.4.2 and 6.4.3 of NFPA 18, 2011 edition (NFPA 18, 2010, p. 18-10).

First Class and Novacool UEF were evaluated at the same percentage as their UL Classification. First Class is Classified for Class A fires at 0.24% concentration and was tested to 0.24% concentration. Novacool UEF is Classified for Class A fires at 0.40% concentration and was tested to 0.40% concentration. Phos-Chek WD881 is Classified for Class A fires at 0.10% concentration and was tested to 0.25% concentration. Cold Fire was tested at 0.15% concentration and is UL Classified at 0.25%. F-500 was tested at 1%, 3% and 6% concentration percentages and is UL Classified at 0.25%. Micro-Blaze Out was tested at 3% concentration and is UL Classified at 1% (Appendix F).

First Class did not provide the test date with the UL testing data they provided. Cold Fire and F-500 were tested in 1994, Micro-Blaze Out was tested in 1996, Novacool UEF was tested in 2007 and Phos-Chek WD881 was tested in 2008 (Appendix F).

First Class, Phos-Chek WD881 and Novacool UEF were the only evaluated wetting agents that stated the wood fiber board fire was extinguished during their test. Cold Fire, F-500 and Micro-Blaze Out did not state if the wood fiber board was extinguished using their agent. Novacool UEF was the only wetting agent whose data stated if the untreated water extinguished the wood fiber board fire. The other evaluated wetting agents did not state if the untreated water extinguished the wood fiber board fire (Appendix F).

All evaluated wetting agents, with the exception of First Class, provided the weight before and weight after for each test. First Class did not provide any data regarding weight before or after for any of their tests. The weight after the test was greater than the weight before the test for Cold Fire, F-500 and Micro-Blaze Out on each of their listed tests. These results were totally opposite as the results for Novacool UEF and Phos-Chek WD 881. These two products showed a weight loss when comparing the weight before the test to the weight after the test. Novacool UEF was the only evaluated wetting agent that exhibited less weight loss than water on all three tests. Phos-Chek WD881 exhibited less weight loss than water on two of their three tests. The tests for Cold Fire showed a weight gain for untreated water of 13 grams, 36 grams and 70 grams. The weight gain for the three tests with Cold Fire treated water showed a weight gain of 33 grams, 38 grams and 122 grams. The weight gain for each of the tests with F-500 treated water was greater than plain water. The weight gain for each test of Micro-Blaze Out treated water was over double the weight gain as plain water (Appendix F).

First Class, Phos-Chek WD 881, Micro-Blaze Out and Novacool UEF all showed less run off using treated water to extinguish the fire rather than untreated water. The test data for Cold Fire and F-500 did not report the amount of runoff from their wood fiber board tests. First Class reported an average untreated water weight loss of 116.3 ml and treated water weight loss of 9.7 ml. The test data for Phos-Chek WD881 showed an average weight loss for untreated water of 12.3 ml and an average weight loss for treated water of 4.4 ml. The test data from Micro-Blaze Out reported an average weight loss using untreated water of 160 ml and an average weight loss of 16.8 ml for treated water. The test data for Novacool UEF reported an average weight loss for untreated water of 98.4 ml and an average weight loss of 67.4 ml with treated water (Appendix F).

If the procedures for conducting this test were followed as outlined in NFPA 18, 2011 edition, it isn't understood how the untreated water weight loss could vary from a low of 6.0 ml on one Phos-Chek WD881 test to a high of 182 ml on one of the Micro-Blaze Out tests. It appears there are variables outside of the described testing procedure not being controlled. It is not clear how there could be weight gain on the untreated water tests for Micro-Blaze Out and yet the same untreated water tests showed the greatest runoff of all of the testing data evaluated. It appears the control variable, untreated water, isn't consistent throughout the testing processes.

The wood fiber board test variables are too varied to allow the comparison of all of the evaluated wetting agents. Novacool UEF was the only evaluated product that met the requirements set forth in NFPA 18 Chapter 6 Section 6.4 (NFPA 18, 2010, p. 18-10).

*How did each brand of listed wetting agent perform on the NFPA 18 Class B fire extinguishment test?*

There were several variables compared when evaluating the Class B fire tests in NFPA 18, 2011 edition. The variables analyzed within the UL NFPA 18 testing data for the Class B fire test were: Classified percentage, tested percentage, date tested, control time, extinguishment time, application time, solution off time, application rate and results. All times for the Class B fire test results are expressed in minutes and seconds.

According to NFPA 18, 2011 edition, "products listed for use on Class B fires shall pass all of the fire tests specified in this chapter" (NFPA 18, 2010, p. 18-11). One of the variables utilized to compare the performance of the evaluated wetting agents for the Class B fire test is the extinguishment time. NFPA 18 states, "the fire shall be extinguished within 5 minutes of the start of the application of the wetting agent solution" (NFPA 18, 2010, p. 18-11).

First Class, Phos-Chek WD881 and Novacool UEF were only tested at their Classified percentages. F-500 and Micro-Blaze Out were tested at their Classified percentage as well as additional percentages. Cold Fire is Classified at 1.50% and was tested at 0.15% (Appendix G).

First Class did not provide the test date with their UL testing data. Cold Fire and F-500 were tested in 1994, Micro-Blaze Out was tested in 1996, Phos-Chek WD881 was tested in 1998 and Novacool UEF was tested in 2007 (Appendix G).

The control time was not provided by First Class and was not included in the testing data for Novacool UEF. Phos-Chek WD881 had control times of 1:40 and 1:22. Cold Fire had control times of 8:25, 8:45 and 12:20. F-500 was tested at three different percentages. The first test percentage was 1.0%. The control times for this percentage were 13:00 and 12:40. The second test percentage was 3.0%. The control times for this percentage were 2:35 and 4:10. The third percentage tested was 6.0%. The control times for this percentage were 2:10 and 2:30. Micro-Blaze Out had two Class B tests included with its UL testing data. The product was tested

at 2.0% and its Classified percentage of 3.0%. The control times for the 2.0% tests were :40 and :55. The control times for the 3.0% tests were :40 and :45 (Appendix G).

The extinguishment time was reported for each of the wetting agent concentrates evaluated. First Class reported extinguishment times for their product at 4:31 and 4:37. The UL testing data for Phos-Chek WD881 reported extinguishment times of 4:42 and 7:40. The UL testing data for Cold Fire reported extinguishment times of 8:48, 9:00 and 12:20. F-500 was tested at three percentages, 1.0%, 3.0% and 6.0%. The extinguishment times for the 1.0% tests were 19:35 and 15:35. The extinguishment times for the 3.0% tests were 5:07 and 6:50. The extinguishment times for the 6.0% tests were 3:07 and 3:13. Micro-Blaze Out was tested at two different percentages, 2.0% and 3.0%. The extinguishment times for the 2.0% tests were 6:40 and 9:34. The extinguishment times for the 3.0% tests were 5:42 and 7:20. The UL testing data for Novacool UEF reported extinguishment times for their Class B fire tests at 2:42 and 1:25 (Appendix G).

Novacool UEF was the only wetting agent evaluated whose UL testing data provided an application time and solution off time. The application time reported for each test was 5:00. The solution off time was reported as the same as the extinguishment time, 2:42 and 1:25 (Appendix G).

The application rate was reported by all of the wetting agents evaluated with the exception of First Class and Novacool UEF. The application rate reported for the other evaluated wetting agents was 0.20 gallons per minute (gpm) (Appendix G).

First Class and Novacool UEF both reported their results as acceptable. There were no results reported for the other evaluated wetting agents (Appendix G).

First Class, F-500 and Novacool UEF were the only three wetting agent concentrations that successfully completed the Class B fire tests at their Classified percentages as outlined in NFPA 18, 2011 edition, Chapter 7. There were other wetting agent concentrations that successfully extinguished one fire in less than five minutes. The three products listed above were the only three wetting agent concentrates to successfully extinguish two consecutive Class B fire tests in less than five minutes as outlined in NFPA 18, 2011 edition, Section 7.4 (NFPA 18, 2010, p. 18-11). Novacool UEF was the wetting agent concentrate that provided the quickest extinguishment time in the Class B fire tests (Appendix G).

## Discussion

There is little to no data available to potential users, other than information from manufacturers, regarding the performance of wetting agents. There were two studies discovered which examined the performance of extinguishing agents, including wetting agents. In 1998 NIST completed a study that included at least one wetting agent. There were several experiments conducted which examined the performance of the extinguishing agents tested (National Institute of Standards and Technology (NIST), 1998). In 2008, UL released a study which examined the performance of several wetting agents. This study only tested the extinguishing agents on Class A fuels and at two concentration levels, 1.0% and 0.50% (Underwriters Laboratories, 2008). The tested concentration levels for the UL study did not take into account the manufacturer recommended concentration levels for Class A fuels or the current UL Classification concentration level. The NIST and UL studies did not provide specific product results for potential wetting agent users to utilize. The information contained in both of these reports did not make reference to product brand names in the results of the studies. The products tested were only referred to as an Agent with a letter or number. The lack of utilizing

product names in these studies made the data obtained nearly useless for users of wetting agents. The lack of product names made it impossible to compare the data from the studies against the performance of the wetting agents during the UL NFPA 18 compliance testing.

The research discovered that many of the wetting agent manufacturers recommend using a different concentration level than the level utilized by UL during the NFPA 18 compliance testing. There was only one manufacturer that listed, within their product information, the same concentration mix percentage as the product is currently Classified by UL. This difference in recommended concentration amounts could result in end users violating Section 4.1.1.3 of NFPA 18, 2011 edition which states, “wetting agent concentrate shall be used at the prescribed proportion(s), in accordance with its listing(s)” (NFPA 18, 2010, p. 18-6). There were several wetting agents that had conflicting mix percentages from distributor to distributor. These differences have the potential to have end users of the wetting agent concentrate using the product at concentrations that won’t effectively work. This conflicting information makes it difficult for users of these products to determine which percentage is the correct percentage to safely utilize the wetting agent.

The manufacturer recommended concentration mix percentage differing from the UL Classified percentage makes access to the product UL testing data crucial in determining how the wetting agent performs. The 2011 edition of NFPA 18 moved the Class A and Class B fire tests to separate chapters which removed these performance tests from the section of the standard which requires the manufacturer to release testing data related to compliance with the wetting agent standard (NFPA 18, 2010, p. 18-10). This change to the NFPA 18 standard made it impossible for potential users of wetting agents to verify the products compliance with NFPA 18. There is no possible way to obtain the UL performance data unless the manufacturer releases

their UL testing data to the potential user. This difficulty became apparent during the research process when UL compliance testing data was requested. There are currently fourteen wetting agent concentrates Classified by UL. These fourteen wetting agent manufacturers were contacted and asked to provide their UL performance data. There were only four companies out of the fourteen willing to release their UL performance data for inclusion in this research. These four companies represent a very small majority of the wetting agents currently in use across the world. This means the majority of the users of UL Classified wetting agents have no means to verify the performance of the product that lives depend on.

It wasn't until the 2006 edition of NFPA 18 that specific Class A and Class B fire tests were outlined (NFPA 18, 2005, p. 18-6). It is unclear, prior to the release of the 2006 edition of NFPA 18, what fire tests were utilized for conducting UL testing of wetting agents. This date is important as the research, using manufacturer provided UL performance data, discovered only one wetting agent, Novacool UEF, had all of its Class A and Class B fire tests conducted after 2006. If the UL testing data that was evaluated was not created after the release of the 2006 edition of NFPA 18 how can these products be tested to the current standard?

The lack of UL performance data from each of the fourteen UL Classified wetting agents made it impossible to determine the best performing UL Classified wetting agent. The UL testing information that was provided showed many inconsistent variables for each of the four fire performance tests. These inconsistent variables provided another challenge in attempting to determine the best performing wetting agent of the evaluated agents. Utilizing the provided UL testing data the best overall performing wetting agent was determined. The NFPA 18 standard was utilized to determine which of the reported variables for each research question had the

greatest bearing on compliance with the standard. These variables were utilized to determine the best performing wetting agent concentrate for each of the four performance tests.

The control time variable was utilized from the Wood Crib Fire Test to determine which of the six wetting agents performed the best. This time was chosen due to the under control time being utilized as a benchmark in many fire departments. The control time was only reported on the First Class and Novacool UEF test data. Novacool UEF had a lower average control time on its two acceptable tests, 17.5 seconds. It is unclear if First Class was tested to the same size wood crib as Novacool UEF as that information wasn't provided by First Class (Appendix D).

The average total runoff volume was the variable utilized to determine the best performing wetting agent in the Deep Seated Fire Test. This variable was chosen due to the requirement within NFPA 18, 2011 edition, that the wetting agent concentrate shall exhibit less runoff than water (NFPA 18, 2010, p. 18-10). F-500 at 6.0% concentration exhibited the lowest amount of runoff, 0 ml. It should be noted that F-500 is UL Classified at 0.25%. There was no available UL performance data for F-500 at this percentage. The best performing wetting agent which was tested at the same percentage that it is UL Classified was Novacool UEF, average run off of 71.56 ml. First Class was the only other product that was tested at the same concentrate percentage as it is UL Classified. The average runoff for First Class was 75.8 ml (Appendix E).

The average total runoff and weight loss were the variables utilized to determine the best performing wetting agent in the Wood Fiber Board Fire Test. These variables were chosen due to the requirement within NFPA 18, 2011 edition, that the "wetting agent solution shall extinguish wood fiber board fires and exhibit less runoff and weight loss than water" (NFPA 18, 2010, p. 18-10). First Class did not provide the weight loss data for their product which makes it impossible to know if First Class complies with this section of NFPA 18. Novacool UEF

exhibited the lowest amount of weight loss, an average of 17.17 grams. Phos-Chek WD881 exhibited the lowest amount of runoff, an average of 4.4 ml (Appendix F).

The extinguishment time was the variable utilized from the Class B fire test to determine the best performing wetting agent. NFPA 18, 2011 edition, requires the Class B fire to be extinguished within five minutes (NFPA 18, 2010, p. 18-11). This variable was chosen as it relates to the time requirement in NFPA 18 and extinguishment is a common benchmark in many fire departments. Novacool UEF reported the fastest extinguishment times of the six wetting agents providing UL performance data. Novacool UEF extinguished the Class B fire tests in 1:25 and 2:42. The wetting agent concentrate with the next best times was F-500. F-500 extinguished the Class B fire tests in 3:07 and 3:13 (Appendix G).

The amount of time it takes for a wetting agent to extinguish the Class B fire is vital information for the fire officer in the field. Comparing the performance of two different wetting agents can demonstrate the importance of knowing how fast the wetting agent performs extinguishment. If Department A utilizes a wetting agent concentrate that takes an average of four minutes to complete the NFPA 18 Class B fire test. Then Department B utilizes a wetting agent that takes an average of two minutes to complete the NFPA 18 Class B fire test. Department A is going to be required to flow twice as much wetting agent solution to extinguish the same fire as Department B. This illustration clearly demonstrates the importance of obtaining the UL testing data from the manufacturer of the wetting agent in use by a fire department.

The data reviewed clearly showed that some currently UL Classified wetting agents do not comply with the NFPA 18 standard in regards to Class A and Class B fire testing. There were several Classified wetting agents that had data that didn't match the requirements as set

forth in the current edition of NFPA 18. The inability to verify if the submitted UL testing data is accurate leaves the end user to believe there are currently products bearing the UL Classification Mark as being NFPA 18 compliant that have not been tested to the current standard.

There are many variables to consider when choosing a wetting agent concentrate. The UL performance data has the ability to provide answers to several of those variables. The data provides the ability to see how the wetting agent performed in a controlled environment on tests other wetting agents also performed. This wasn't the case with the limited amount of UL data that was reviewed for this research. The majority of the wetting agents reviewed were tested prior to NFPA outlining what tests would be utilized to determine compliance. The UL performance data reviewed was very inconsistent from wetting agent to wetting agent. Water, the control variable, showed very different results from wetting agent test to wetting agent test. There was reporting of inconsistent variables from wetting agent concentrate to wetting agent concentrate. If all of the wetting agent concentrations currently Classified by UL meet the same NFPA 18 standard then why aren't the UL testing variables reported in the same manner?

This research discovered that UL performance data is not intended to provide the end user of wetting agents with information to assist in their decision making. The information generated by UL, in the course of determining a wetting agents compliance with NFPA 18, is not intended for the fire service. That information is proprietary information between UL and its customer. If the UL customer chooses not to release their UL testing data to users of their product there are no means by which the user can obtain the data. If the UL testing data is obtained there are no means to determine if the data provided by the manufacturer is factual and accurate, that information is proprietary. UL will not provide any information regarding their

testing of Classified wetting agents to anyone other than their customer (Appendix B). This performance information, which could have life or death implications, became locked in secrecy with the moving of the Class A and Class B fire tests to separate chapters in the current edition of NFPA 18 (NFPA 18, 2010, p. 18-11). This change to NFPA 18 leaves the fire service in the hands of sales people regarding performance of wetting agents.

The research did provide enough data to determine that Novacool UEF is the best performing wetting agent concentrate of the six wetting agents evaluated. This finding is important as Novacool UEF is the wetting agent concentrate currently in use by the Albemarle Fire Department. The research confirmed the findings of the limited field testing, which was initially conducted to decide to use Novacool UEF as the Albemarle Fire Department's wetting agent.

## Recommendations

The first recommendation from the research is that UL performance data in relation to compliance with NFPA 18 should be made available to potential users. The data should also be able to be verified as being factual and accurate. The release of this data will ensure the fire service that information being presented by sales personnel is factual and accurate. This data, if conducted to the most current edition of NFPA 18, will provide the fire service with the ability to know they are choosing the best performing wetting agent.

The second recommendation from the research is that UL should conduct testing of wetting agents to the same edition of NFPA 18. All wetting agents currently Classified by UL should be tested to the same standards to provide consistency with product evaluation. The research clearly showed that all current UL Classified wetting agents were not tested to the same standard. All current UL Classified wetting agents should be tested to provide the same data as it

relates to NFPA 18. The data sets being identical and available to the end user will allow an informed decision to be made regarding which wetting agents are the best performing products.

The third and most important recommendation discovered by this research is that any user of a UL Classified wetting agent should insist the manufacturer provide a copy of the original UL documentation showing the performance of their product on the Class A and Class B fire tests. If the manufacturer fails to produce this important documentation the user of their product has no means to verify if the performance being stated by the sales person is factual and accurate. If obtained, the UL performance data should be compared to the NFPA 18 standard to be sure the product being represented has successfully passed all of the requirements as set forth in NFPA 18. If the manufacturer will not produce a copy of their original UL NFPA Classification documentation it is recommended the wetting agent not be utilized. In addition to reviewing the UL testing information for accuracy and compliance, it is recommended that field testing be conducted to determine if the performance of the product matches the performance stated by the sales person. Do not take any sales person for their word when deciding which wetting agent to utilize for fire suppression activities.

The Albemarle Fire Department will continue to utilize Novacool UEF as their wetting agent. This decision is based on the comparison of the UL performance data for the six wetting agent concentrates represented in this research. In the future any wetting agents being considered by the Albemarle Fire Department will be required to provide a copy of the original UL performance data to ensure their products compliance with NFPA 18 and the wetting agent will undergo extensive field testing to verify its performance.

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# Appendix A

Email Requesting UL Testing Data

**From:** Oke, Shawn
**Sent:** Monday, June 11, 2012 4:38 PM
**To:** (Manufacturer Representative)
**Subject:** Information for Research Project

Mr. (insert manufacturer representative name here),

My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.

I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (insert product name here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.

You can email the information to (author's email address) or mail the information to the address listed below.

If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.

Thank you in advance for your assistance with my research.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

# Appendix B

## Emails Between Author and UL Regarding Access to UL Testing Data

**From:** Oke, Shawn
**Sent:** Tuesday, June 12, 2012 10:03 AM
**To:** 'Craig.S.Thames
**Subject:** UL Wetting Agent Question

Mr. Thames,

I am currently working on an applied research project as part of the National Fire Academy Executive Fire Officer Program. My research project is titled: Performance Comparison of Listed Wetting Agents. It is my goal to compile the testing data for each listed wetting agent in order to build a chart showing the performance of each agent as they relate to Sections 5.3.4 and 5.3.5 of NFPA 18.
I emailed the following email to a representative of each listed agent:

My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.

I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (name of product here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.

You can email the information to (email address inserted here) or mail the information to the address listed below.

If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.

Thank you in advance for your assistance with my research.

The reason for my email to you is that I have already had one manufacturer decline to provide me with the requested information. If I understand NFPA 18 Sections 5.1.2 and 5.1.3 correctly the results of the testing to become listed as complying with NFPA 18 must be made available by the manufacturer to potential users. I am specifically looking for the testing results for NFPA 18 Sections 5.3.4 and 5.3.5. Am I correct in my interpretation of this section that the testing results shall be made available if requested?

If my interpretation is correct, what are the ramifications if a manufacturer fails to release the requested information?

Thank you in advance for your reply.

Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Thames, Craig S [mailto:]
**Sent:** Tuesday, June 12, 2012 10:49 AM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Dear Mr. Oke,
Thank you for your inquiry. NFPA 18, Sec. 5.1.2 & 5.1.3 indicates that certain property values developed or identified by way of testing shall be made available by the manufacturer on a technical data sheet.

As a part of a product's certification, UL requirements mandate compliance with these requirement. Failure to make the information available to potential users may constitute noncompliance.
Please act on your concern and visit our online complaint form at, (http://ul.com/global/eng/pages/offerings/perspectives/consumer/fieldreport/), to file a complaint against the product referenced. With your input the engineering staff of UL's Market Surveillance Department will perform an investigation the product to determine the possible root cause and appropriate corrective actions if necessary. This is a free service offered by UL to the safety community, and to patrons who trust and rely upon the UL mark. The steps taken to resolve a given compliant are kept confidential; but please be assured that all aspects of every complaint are addressed in reaching conclusion. If you would like to discuss this matter more, please feel free to contact me.
I wasn't able to find the 5.3.4 or 5.3.5 reference in NFPA 18: 2011
If you are not aware, I am providing you a link to UL's public information,/presentation on Performance of Special Extinguishing Agents , which you may find useful in your study.
Warm Regards,

Craig S. Thames, P.E.
Lead MS Engineer
UL LLC

**From:** Oke, Shawn
**Sent:** Tuesday, June 12, 2012 11:23 AM
**To:** 'Thames, Craig S'
**Subject:** RE: UL Wetting Agent Question

Craig,

Thanks for your email.

I am conducting the research based on the requirements of the 2006 edition of NFPA 18. Section 5.3.4 is the Class A Fire Extinguishment Tests and Section 5.3.5 is the Class B Fire Extinguishment Tests.

Am I not correct that all of the results of Chapter 5 are reportable under Sections 5.1.2 and 5.1.3? Would you recommend letting the manufacturer know, that as a requirement of their UL listing, they must provide the requested information?

Thanks for the attached link to the study. The information isn't at the link as it is showing disabled. Don't worry I have reviewed it several times in the past. The major issue I have with that study and many others is the lack of putting specific product names with performance. I am hoping my current research project will provide the fire service with the ability to look at the performance of each listed wetting agent so they are able to make a better informed decision regarding the performance of specific products.

Thanks again for your help.

Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Thames, Craig S [mailto:craig.s.thames@ul.com]
**Sent:** Tuesday, June 12, 2012 12:23 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Hi Shawn,

Sorry for not catching on to your references to NFPA 18:2006.

UL requires the following values to be reported on the manufacturer's Technical Datasheet:

- 5.2.1 Agent Pour point temperature
- 5.2.3 Agent Separation
- 5.2.5 Agent pH
- 5.2.6 Agent Viscosity at (2, 21 & 49C)
- 5.2.2 Solution Miscibility in water at upper and lower concentration
- 5.2.4 Solution Impact of Low Temp on Surface Tension at min and max concentration in water
- 5.3.1 Solution Surface Tension at min and max concentration in water
- 5.3.2 Solution Separation on Standing at min and max concentration in water

The 5.3.4 Class A Fire test (wood Crib, Deep Seated Fire, and Wood Fiber Board Penetration Test), times to extinguishment and 5.3.5 Class B Fire test times to extinguishment were not required by NFPA 18: 2006 or UL requirements.

As far as the complaint, if you fill out the complaint form we can work with the manufacturer to let them know of the requirement and apply corrective actions. Your information will be kept confidential if you choose.

I'm sorry about the link. I'm assuming it will be reestablished soon.

Warm Regards,

Craig S. Thames, P.E.
Lead MS Engineer, UL LLC

**From:** Oke, Shawn [mailto:]
**Sent:** Tuesday, June 12, 2012 1:27 PM
**To:** Thames, Craig S
**Subject:** RE: UL Wetting Agent Question

Craig,

In order to comply with the wording of NFPA 18:2006 Section 5.1, all of the information developed in response to the requirements of Chapter 5 shall be reported not just selected portions. How can UL not require all of the information to be reported as the standard states it should be reported?

If you would rather talk about the issues feel free to give me a call in the office, (phone number here).

Thanks,
Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Thames, Craig S [mailto:]
**Sent:** Tuesday, June 12, 2012 3:27 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Hi Shawn,

Your formulation seems very reasonable. Regarding the Class A and B fire tests I believe the goal is fire extinguishment within a specified time frame or extinguishment and no re-ignition within a specified time frame. With this in mind, requiring the manufacturer to again make this statement, (extinguishment and no re-ignition within specified time range), may be redundant, as it would be understood by the authorization to apply the UL mark.

Would you like a formal interpretation from our Principal Engineer, (Engineer responsible for determining UL requirements)?

Warm Regards,

Craig S. Thames, P.E.
Lead MS Engineer
UL LLC

**From:** Oke, Shawn
**Sent:** Tuesday, June 12, 2012 4:07 PM
**To:** 'Thames, Craig S'
**Subject:** RE: UL Wetting Agent Question

Craig,

Can you give me the contact information for the Principal Engineer so I can address my concerns with them?

Thanks again for your help with my research!!

Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Thames, Craig S [mailto:]
**Sent:** Wednesday, June 13, 2012 10:18 AM
**To:** Oke, Shawn
**Cc:** Kirkpatrick, Jerauld R.
**Subject:** FW: UL Wetting Agent Question

Hi Shawn,
I have copied Jerauld, (Jerry), Kirkpatrick to assist you with your inquiry. Jerry is not the Principle Engineer but is a technical expert in Wetting Agents. Jerry has access to our dialog over the last few days by copy on this email string, but if you can list any other concerns you'd like to discuss in an email to Jerry it will best prepare him to give the meaningful answers you are looking for.

Warm Regards,

Craig S. Thames, P.E.
Lead MS Engineer

UL LLC

**From:** Oke, Shawn
**Sent:** Wednesday, June 13, 2012 10:44 AM
**To:** 'Thames, Craig S'
**Cc:** Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

Craig,

Thanks for all of your time and help with this matter!!!

Jerry,

I think my biggest concern is the lack of available performance data as it relates to wetting agents and their compliance to NFPA 18. It deeply concerns me that one of the major agent manufacturer's declines to provide any information on their product for any reason, much less a research project. I have read Section 5.1 of NFPA 18:2006 so many times that I can almost recite it word for word. There is nothing in that section which outlines specific information that shall be released on the technical sheet or to potential users. The standard clearly states "the information developed in response to the requirements of this chapter shall be reported on the manufacturer's technical data sheet and made available to potential users". Isn't the lengthy report generated during the UL testing process "the information developed in response to the requirements of this chapter"?

Again, thank you for your help and time with this matter!!!!

Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Kirkpatrick, Jerauld R. [mailto:]
**Sent:** Wednesday, June 13, 2012 1:55 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Mr. Oke,

Thank you for writing. However, it isn't clear to me what your concern(s) are. Does this manufacturer refuse to provide their technical data sheet to you? Or is the information provided on their technical data sheet not to your satisfaction.
Best Regards,

Jerry Kirkpatrick

Lead Engineering Associate
Building Materials & Systems

UL LLC

**From:** Oke, Shawn
**Sent:** Wednesday, June 13, 2012 3:03 PM
**To:** 'Kirkpatrick, Jerauld R.'
**Subject:** RE: UL Wetting Agent Question

The two concerns that you mentioned are my issues. One manufacturer did decline to give me any information.

Here is the email I sent all of the listed manufacturers:
**My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.**
**I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (insert product name here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.**
**You can email the information to ---------- or mail the information to the address listed below.**
**If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.**
**Thank you in advance for your assistance with my research.**

Here is the reply I received from the manufacturer:
Shawn, thanks for your interest but, I respectfully decline. Good luck with your project!

The other issue is that some manufacturers have not been willing to release the information developed in response to the requirements of NFPA 18:2006 Chapter 5. I am trying to get an interpretation as to what information must be released according to Section 5.1.

According to the email from Mr. Thames yesterday the manufacturer isn't required by UL or the standard to release all of the information developed in response to the requirements of Chapter 5 of NFPA 18. That isn't how I read Section 5.1.

Thanks for all of your help with this matter!!!

Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Kirkpatrick, Jerauld R. [mailto:]
**Sent:** Wednesday, June 13, 2012 4:29 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Shawn,
Regarding your question regarding the interpretation of Para. 5.1.3, the results of the testing required in Chapter 5 of NFPA 18 ( Pour Point, Miscibility, Separation, etc.) is to be reported in their product's technical data sheet.

Please note, Para. 5.1.3 of NFPA 18 only requires the technical datasheet to be made available to potential users the of the product. Therefore, the manufacturers that have declined to provide the information that you have requested are not technically violating any requirements.

I understand that this may not be the answer you were seeking, however we welcome any comments or suggestions you may have regarding this matter.

Best Regards,

Jerry Kirkpatrick
Lead Engineering Associate
Building Materials & Systems

_____
UL LLC

**From:** Oke, Shawn
**Sent:** Wednesday, June 13, 2012 4:37 PM
**To:** 'Kirkpatrick, Jerauld R.'
**Subject:** RE: UL Wetting Agent Question

Jerry,

If the results of the testing required in Chapter 5 of NFPA 18 are to be reported on the technical data sheet why aren't they reporting the data from Sections 5.3.4 and 5.3.5?

I will send another email to the manufacturer and request the data as a fire chief and not an EFO student since they aren't able to discern the difference.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Kirkpatrick, Jerauld R. [mailto:]
**Sent:** Wednesday, June 13, 2012 4:57 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

UL only requires confirmation of compliance with Para 5.3.4 and 5.3.5. For example, the following should be present in their technical data sheet:

| FIRE EXTINGUISHMENT |
| --- |
| X% for Class A fires in ordinary combustibles and x% for Class B fires in flammable or combustible liquids that are not soluble in water and ordinarily stored at atmospheric temperatures and pressures |

We do not require specific details of this testing if that is what you are seeking.

Just to be clear, all UL Classified Wetting Agents have complied the requirements of 5.3.4 and 5.3.5.

Best Regards,

Jerry Kirkpatrick
Lead Engineering Associate
Building Materials & Systems

_____
UL LLC

**From:** Oke, Shawn
**Sent:** Wednesday, June 13, 2012 5:14 PM
**To:** 'Kirkpatrick, Jerauld R.'
**Subject:** RE: UL Wetting Agent Question

That has been my issue since beginning my research. How can UL only require confirmation with Sections 5.3.4 and 5.3.5 when the standard states that "the information developed in response to the requirements of this chapter shall be reported on the manufacturer's technical data sheet and made available to potential users"?

Aren't the specifics of Sections 5.3.4 and 5.3.5 considered information in response to the requirements of Chapter 5?

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Kirkpatrick, Jerauld R. []
**Sent:** Thursday, June 14, 2012 11:33 AM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Mr. Oke,

UL feels that the technical data sheet needs to only indicate compliance to the requirement.

If a potential customer requires specific details regarding these tests, they can request a copy of the report from the manufacturer before making their purchase decision.

Best Regards,

Jerry Kirkpatrick
Lead Engineering Associate
Building Materials & Systems
_____
UL LLC

**From:** Oke, Shawn
**Sent:** Thursday, June 14, 2012 1:34 PM
**To:** Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

If the manufacturer refuses to provide the information to a potential customer are they considered out of compliance with NFPA 18?

Thanks,
Shawn

**From:** Kirkpatrick, Jerauld R. [Jerauld.R.Kirkpatrick@ul.com]
**Sent:** Thursday, June 14, 2012 3:41 PM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Mr. Oke,

No, as I have stated, UL only requires the manufacturer to provide confirmation of compliance to the fire tests on their

technical data sheets. UL does not require the manufacturers to provide any other details of the test results other than the technical data sheets. It is the manufacturer's decision to provide further specific test details.

Thank you again for writing and for your concerns.

Best Regards,

Jerry Kirkpatrick
Lead Engineering Associate
Building Materials & Systems
_____
UL LLC

**From:** Oke, Shawn
**Sent:** Thursday, June 14, 2012 7:18 PM
**To:** Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

Can you please tell me who or how UL made the determination on what components of NFPA 18:2006 Chapter 5 that the manufacturer would be required to release to potential users or customers?

Thanks,
Shawn

**From:** Oke, Shawn
**Sent:** Friday, June 15, 2012 4:13 PM
**To:** Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

Jerry,

Did you get the email that I sent yesterday afternoon?

Shawn

**From:** Kirkpatrick, Jerauld R. []
**Sent:** Monday, June 18, 2012 11:43 AM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.
**Subject:** RE: UL Wetting Agent Question

Mr. Oke,

The Primary Designated Engineer (PDE) for Wetting Agents is Blake Shugarman. I have copied him on this message.

Just so we are all clear about your concerns, it is my understanding that you feel that the wetting agent manufacturers should make specific details of the Class A and Class B fire testing (Sections 5.3.4 and 5.3.5) available to potential users and others with an interest in the product. You are not concerned about the reporting of the other testing required in Chap. 5 of NFPA 18.

Please advise if I have not summarized your concerns accurately.

Best Regards,

Jerry Kirkpatrick
Lead Engineering Associate
Building Materials & Systems
_____
UL LLC

**From:** Oke, Shawn
**Sent:** Monday, June 18, 2012 2:06 PM
**To:** Kirkpatrick, Jerauld R.
**Cc:** Shugarman, Blake M.
**Subject:** RE: UL Wetting Agent Question

In working on my research I have been working to gather data as it relates to Chapter 5 of NFPA 18:2006. My primary focus has been the results from the Class A and Class B fire testing sections. In reading Section One of Chapter Five all of the information developed in the course of testing as it relates to Chapter 5 should be available to potential users, not portions of the chapter as you have stated. As a fire chief I should be able to get any data as it relates to Chapter 5 of NFPA 18:2006 if the product complies with the standard.

Shawn Oke, Fire Chief
Albemarle Fire Department

**From:** Shugarman, Blake M. []
**Sent:** Monday, June 18, 2012 2:51 PM
**To:** Oke, Shawn; Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

The UL certification program no longer references NFPA 18-2006 and our certification program is to the applicable portions of NFPA 18-2011 as noted in the Guide Information of the On-line Certification directory. Specific information regarding the UL Listing of the product is available from the manufacturer. Please note that NFPA 18-2011 was revised to move the Class A and Class B fire extinguishment tests to chapters 6 and 7, respectively.

We apologize for not being able to provide the specific information you are requesting. Please do understand that the data generated under a UL certification program is proprietary information between UL and the Applicant. The dissemination of information generated in response to chapter 5 as referenced in NFPA 18-2011, is at the manufacturer's discretion to make this information available to potential users or not. It is not enforceable by UL's certification program and we are therefore unable to provide further guidance other than to contact the manufacturer to request additional information.
Should you have any questions or comments, please contact me.

Blake M. Shugarman
Principal Engineer - Special Hazard Fire Suppression
Product Safety
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UL LLC

**From:** Oke, Shawn
**Sent:** Monday, June 18, 2012 3:21 PM
**To:** Shugarman, Blake M.; Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

None of the current wetting agents have been tested to the 2011 standard. In order to comply with the 2006 standard, which is what each wetting agent currently meets, is the manufacturer required to release the data? If they fail to release the data doesn't that mean they don't meet the standard that your website currently shows them being in compliance with?

Shawn

**From:** Shugarman, Blake M. [Blake.M.Shugarman@ul.com]
**Sent:** Monday, June 18, 2012 4:51 PM
**To:** Oke, Shawn; Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

The dissemination of information generated in response to chapter 5 as referenced in NFPA 18-2011 and/or NFPA 18-2006, is at the manufacturer's discretion to make this information available to potential users or not. It is not enforceable by UL's certification program and we are therefore unable to provide further guidance other than to contact the manufacturer to request additional information.

Should you have any questions or comments, please contact me.

Blake M. Shugarman
Principal Engineer - Special Hazard Fire Suppression
Product Safety

**From:** Oke, Shawn
**Sent:** Monday, June 18, 2012 5:08 PM
**To:** Shugarman, Blake M.; Kirkpatrick, Jerauld R.
**Cc:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Blake,

If Chapter 5 Section 1 calls for all of the information to be made available in order to comply with the standard. How can UL not require the release of the information? The standard doesn't state the release of information is at the manufacturer's discretion. Please explain to me where in Chapter 5, Section 1 that it states the manufacturer has discretion in what information they release. The standard clearly states "the information developed in response to the requirements of this chapter shall be reported on the manufacturer's technical data sheet and made available to potential users". I would like to know who or how the required release of information was determined?

All of the currently listed wetting agents were tested under NFPA 18:2006. In order to carry the UL mark don't they have to comply with the entire NFPA 18:2006 standard?

As the 2011 standard has moved the burn tests to separate chapters to avoid the release of information how do end users verify that UL even did the testing or if the product passed the

tests?

Thanks,
Shawn Oke, Fire Chief
Albemarle Fire Department

**From:** Shugarman, Blake M. []
**Sent:** Monday, June 18, 2012 6:11 PM
**To:** Oke, Shawn; Kirkpatrick, Jerauld R.
**Subject:** RE: UL Wetting Agent Question

Dear Mr. Oke,

Unfortunately, I am no longer in the office. I would welcome the opportunity to discuss in further detail. Please provide your contact information and a few times you will be available over the next week. My schedule has been rather full as of late; therefore the request for multiple times.

Should you have any questions or comments, please contact me.

Blake M. Shugarman
Principal Engineer - Special Hazard Fire Suppression
Product Safety
UL LLC

**From:** Oke, Shawn
**Sent:** Monday, June 18, 2012 9:25 PM
**To:** Shugarman, Blake M.
**Subject:** RE: UL Wetting Agent Question

I am actually on vacation this week. I will be back in the office on Monday. I will email you next week and see what your schedule looks like.

Shawn

**From:** Oke, Shawn
**Sent:** Thursday, June 21, 2012 7:08 AM
**To:** Shugarman, Blake M.
**Cc:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Blake,

I have been in contact with NFPA regarding the release of

information that I am requesting from the manufacturers. I specifically asked them about the release of data from the Class A and Class B fire testing. They stated the information must be released to the AHJ (which I am) and if the manufacturer fails to release the information I am suppose to contact the testing agency for them to get me the information. Can you please tell me who I should make this formal request for denied information too? I would also like to know what procedure UL has in place to handle the manufacturer failing to comply with NFPA 18:2006.

Please let me know if you have any questions.

Shawn Oke, Fire Chief
Albemarle Fire Department

**From:** Shugarman, Blake M.
**Sent:** Thursday, June 21, 2012 8:07 AM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Question

Please e-mail me next week to see what my schedule looks like so we can discuss in further detail.

Should you have any questions or comments, please contact me.

Blake M. Shugarman
Principal Engineer - Special Hazard Fire Suppression Product Safety
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UL LLC

**From:** Oke, Shawn
**Sent:** Monday, June 25, 2012 7:32 AM
**To:** 'Shugarman, Blake M.'
**Subject:** RE: UL Wetting Agent Question

Blake,

What is your schedule like this week so we can discuss my issues.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Friday, June 29, 2012 6:53 AM
**To:** 'Shugarman, Blake M.'
**Subject:** Phone Message

Blake,

I just got your phone message from last night. I totally understand the hectic life!! Would trying to talk next week help? If next week works better email me a day and time I will do my best to make it work.

Thanks,
Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department
**From:** Oke, Shawn
**Sent:** Wednesday, July 11, 2012 3:59 PM
**To:** 'Shugarman, Blake M.'
**Subject:** UL Wetting Agent Questions

Blake,

Will you please provide, via email, answers to the following questions?

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ?

2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard?

3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested?

4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested?

5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual?

6. Can UL provide certificates of compliance for each NFPA 18 classified product?

7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%?

Thank you for providing the requested information.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Wednesday, July 11, 2012 4:32 PM
**To:** 'Edward.D.Minasian@ul.com'
**Subject:** STP 162

Mr. Minasian,

I am trying to determine who at UL oversees the testing of wetting agents to the NFPA 18 standard. Could you provide me with the name and contact information for that person?

Can you guide me to the place where I can find a list of products that UL has listed or classified as complying with UL 162?

Thank you in advance for any help you can provide.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Monday, July 16, 2012 3:33 PM
**To:** 'Shugarman, Blake M.'
**Subject:** UL Wetting Agent Questions

Blake,

Did you get the questions I emailed to you on July 11?

Please respond to my email so I know you have my questions and are working on getting answers to them.

Thanks,

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Shugarman, Blake M.
**Sent:** Tuesday, July 31, 2012 7:19 AM
**To:** Oke, Shawn
**Subject:** RE: UL Wetting Agent Questions

Mr. Oke,

My apologies for the delay. I anticipate providing a response by the end of this week.

Should you have any questions or comments, please contact me.

Blake M. Shugarman
Principal Engineer - Special Hazard Fire Suppression Product Safety
UL LLC

**From:** Oke, Shawn
**Sent:** Tuesday, July 31, 2012 7:20 AM
**To:** 'Shugarman, Blake M.'
**Subject:** RE: UL Wetting Agent Questions

Thank you

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Shawn Oke
**Sent:** Sunday, August 26, 2012 3:44 PM
**To:** Blake.M.Shugarman@ul.com
**Subject:** Wetting Agent Question

Mr. Shugarman,

Can you tell me what year NFPA 18 standard the UL wetting agents meet?

Are NFPA 18 agents that are on your website considered listed or classified?

Thanks

**From:** Oke, Shawn
**Sent:** Tuesday, September 11, 2012 5:05 PM
**To:** 'george.e.laverick@xx.xx.com
**Subject:** NFPA 18 Questions

Mr. Laverick,

I was given your name to contact from Sandra Stanek at NFPA. I have been communicating with her in regards to NFPA 18 and UL testing. Would you be able to provide some answers to me regarding NFPA 18 and the testing that is conducted by UL?

Thank you in advance for your time.

Shawn

**From:** Laverick, George E. [mailto:George.E.Laverick@ul.com]
**Sent:** Tuesday, September 11, 2012 5:05 PM
**To:** Oke, Shawn
**Subject:** Automatic reply: NFPA 18 Questions
I am currently out of the office and will return on Thursday, September 27 . I will have limited access to e-mail, so I will reply after I return.
If the matter requires an immediate response, please contact Neil Lakomiak

**From:** Oke, Shawn [mailto:soke@ci.albemarle.nc.us]
**Sent:** Tuesday, September 11, 2012 4:10 PM
**To:** Lakomiak, Neil
**Subject:** FW: NFPA 18 Questions

Mr. Lakomiak,

I sent an email to Mr. Laverick regarding some questions I have related to NFPA 18. I was given his name by Sandra Stanek from NFPA. Would you be able to answer my questions?

Thank you in advance for any help you could provide.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Lakomiak, Neil [mailto:Neil.Lakomiak@ul.com]
**Sent:** Tuesday, September 11, 2012 5:22 PM
**To:** Oke, Shawn
**Subject:** RE: NFPA 18 Questions

Hi Shawn:

George is out of the office attending ISO meetings this week. If you'd like to run your questions by me, I'll do my best to get you some answers.

I look forward to talking with you,

**From:** Oke, Shawn
**Sent:** Tuesday, September 11, 2012 5:56 PM
**To:** Lakomiak, Neil
**Subject:** RE: NFPA 18 Questions

Thanks for your fast reply. If you would please let me know that you got my email when you get it. We have been having email issues and I want to be sure the email went through.

I have the following questions about NFPA 18 and UL:

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ?

2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard?

3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested?

4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested?

5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual?

6. Will UL please provide certificates of compliance for each NFPA 18 classified product?

7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%?

8. What NFPA 18 cycle do the currently UL classified wetting agents comply with?

9. Is there a specific date that the currently classified wetting agents became compliant with the NFPA standard cycle they currently meet?

Again, thank you in advance for any help you can provide.

Have a great day

Shawn

**From:** Laverick, George E.
**Sent:** Wednesday, September 12, 2012 3:42 AM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.
**Subject:** NFPA 18 Questions

Shawn:

I am no longer on the NFPA 18 Committee. However, Blake Shugarman of UL is currently serving on the NFPA 18 Committee and is familiar with the UL Certification and testing.

Please contact Blake for questions on the specific tests conducted by UL. You can contact Blake using the above e-mail or phone.

Regards,

**George E. Laverick FSFPE**
Principal Engineer- Fire Extinguishers and Fire Suppression Products
Distinguished Member of Technical Staff
Product Safety
UL LLC

**From:** Laverick, George E.
**Sent:** Wednesday, September 12, 2012 8:23 AM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.
**Subject:** NFPA 18 Questions

Shawn:

Please e-mail me your questions.

I am out of the country and I have limited e-mail access, but we will attempt to assist you.

Regards,

George E. Laverick FSFPE
Principal Engineer- Fire Extinguishers and Fire Suppression Products Distinguished Member of Technical Staff Product Safety

**From:** Oke, Shawn
**Sent:** Wednesday, September 12, 2012 8:36 AM
**To:** 'Laverick, George E.'
**Cc:** Shugarman, Blake M.
**Subject:** RE: NFPA 18 Questions

Here are the questions that I sent back in July, with a few additions.

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ?

2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard?

3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested?

4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested?

5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual?

6. Will UL please provide certificates of compliance for each NFPA 18 classified product? If they will, please provide me with those certificates for each classified product.

7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%?

8. What NFPA 18 cycle do the currently UL classified wetting agents comply with?

9. Is there a specific date that the currently classified wetting agents became compliant with the NFPA standard cycle they currently meet? If there is a date what was that date?

10. Why did UL stop listing wetting agents, classifying them instead?

11. Can a wetting agent be classified as meeting a particular standard cycle without being tested to the sections that changed during the revision?

Thank you for answers that either of you can provide. If either of you are unable to answer these questions will you please refer me to someone within UL that has the ability to answer my questions.

Thanks!!
Shawn

**From:** Shugarman, Blake M.
**Sent:** Wednesday, September 12, 2012 8:36 AM
**To:** Oke, Shawn
**Subject:** Automatic reply: NFPA 18 Questions

I'm currently out of the office and anticipate returning on 13 Sep 2012.

**From:** Lakomiak, Neil
**Sent:** Thursday, September 13, 2012 10:21 PM
**To:** Oke, Shawn
**Subject:** RE: NFPA 18 Questions

Hi Shawn:

Just confirming receipt of your email. I'll look to get back to you soon on these.

**From:** Lakomiak, Neil [mailto:Neil.Lakomiak@ul.com]
**Sent:** Monday, September 17, 2012 12:25 PM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.; Laverick, George E.
**Subject:** RE: NFPA 18 Questions

Hi Shawn:

We're working on a response and will be back in touch with you shortly.

**From:** Oke, Shawn
**Sent:** Monday, September 17, 2012 2:26 PM
**To:** 'Lakomiak, Neil'
**Cc:** Shugarman, Blake M.; Laverick, George E.
**Subject:** RE: NFPA 18 Questions

Thank You

If these questions aren't able to be answered by any of you please send me to someone at UL that can provide answers to my questions.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Friday, October 05, 2012 9:35 AM
**To:** 'Lakomiak, Neil'
**Cc:** Shugarman, Blake M.; Laverick, George E.
**Subject:** RE: NFPA 18 Questions

It has been several weeks since your last email. Have you been able to get answers to any of the questions that I emailed to you on September 11? If you aren't able to provide these answers within the next five business days please provide me with a contact within UL that I can discuss my questions with.

Thank You

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Lakomiak, Neil
**Sent:** Friday, October 05, 2012 1:35 PM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.; Laverick, George E.
**Subject:** RE: NFPA 18 Questions

Good Afternoon Chief Oke:

My apologies for the delay. Blake Shugarman will be calling you today with answers to your questions.

Take care,

**From:** Oke, Shawn
**Sent:** Friday, October 05, 2012 2:41 PM
**To:** Lakomiak, Neil
**Cc:** Shugarman, Blake M.; Laverick, George E.; Oke, Shawn
**Subject:** RE: NFPA 18 Questions

Thank you for your reply.

Rather than a phone call would you please respond to my answers via email.

Thank You,
Shawn

**From:** Lakomiak, Neil
**Sent:** Friday, October 05, 2012 2:43 PM
**To:** Oke, Shawn
**Cc:** Shugarman, Blake M.; Laverick, George E.
**Subject:** RE: NFPA 18 Questions

We can do both

**From:** Shugarman, Blake M. [mailto:Blake.M.Shugarman@ul.com]
**Sent:** Friday, October 05, 2012 2:49 PM
**To:** Oke, Shawn
**Cc:** Laverick, George E.; Lakomiak, Neil
**Subject:** RE: NFPA 18 Questions

Chief Oke,

Confirming my voicemail message, please refer to the following. If you would like to discuss in greater detail, please let me know and we can schedule a time to discuss next week or later this afternoon.

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ? No, this information is intended to be provided by the manufacturer.

2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard? Each product undergoes an Industry File Review. For NFPA 18-2006 as compared to NFPA 18-2011, no additional testing was considered necessary to determine compliance with UL's Classification Program.

3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested? These products, as with other UL certified products, are covered under UL's Follow-up Service Program.

4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested? Classified products are subjected to identification tests under UL's Follow-up Service Program.

5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual? The UL Mark on the product is the manufacturer's declaration that the product was manufactured in accordance with all applicable requirements and was in compliance with those requirements when it was shipped from the factory. The manufacturer's technical data sheet should be made available.

6. Will UL please provide certificates of compliance for each NFPA 18 classified product? We are not in a position to provide you certificates of compliance. Certificates of compliance are only issued to the Classified company. Inclusion of the product in the UL Online Certification provides verification that representative samples of the product have been evaluated and the product is eligible to bear the UL Mark.

7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%? Unfortunately, this is proprietary information between UL and UL's customer.

8. What NFPA 18 cycle do the currently UL classified wetting agents comply with? The wetting agents comply with portions of NFPA 18-2011 under UL's Classification program. Wetting agent concentrates have been investigated for pour point, miscibility, separation, impact of low temperature on surface tension, pH, and viscosity test.

Wetting agent solutions have been investigated for separation on standing, Class A fire extinguishment, and Class B fire extinguishment tests.

9. Is there a specific date that the currently classified wetting agents became compliant with the NFPA standard cycle they currently meet? The currently classified products have been compliant since the effective date of UL's certification program for NFPA 18-2011, which in this case is the same as the effective date of NFPA 18-2011, August 25, 2010.

Should you have any questions or comments, please contact me.

**Blake M. Shugarman**
**Principal Engineer - Special Hazard Fire Suppression**
Product Safety
---
UL LLC

**From:** Oke, Shawn
**Sent:** Saturday, October 06, 2012 9:21 AM
**To:** Shugarman, Blake M.
**Cc:** Laverick, George E.; Lakomiak, Neil
**Subject:** RE: NFPA 18 Questions

Thank you for your email.

I have a couple of follow up questions if you don't mind answering them.

1. If the manufacturer provides the AHJ a copy of their UL test data how can the AHJ verify the information provided is accurate and factual?

2. Please provide me with the UL 711 revision dates since 1995.

3. Please provide me with a copy of the UL Follow-up Service Program that you mentioned in the previous email.

4. If the classified agents became NFPA 18-2011 compliant in August 2010 why did UL continue to show them as NFPA 18-2006 compliant until April 2012?

Thank you in advance for your answers.

Shawn

## Appendix C

Emails between the author and NFPA 18 Staff Liaison

**From:** Oke, Shawn
**Sent:** Tuesday, June 12, 2012 2:51 PM
**To:** Stanek, Sandra
**Subject:** Question on NFPA 18

Sandra,

I have a question regarding NFPA 18:2006, Section 5.1. Can you advise me who I can speak with to get my question answered?

Thanks!!
Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Stanek, Sandra
**Sent:** Wednesday, June 13, 2012 8:52 AM
**To:** Oke, Shawn
**Subject:** RE: Question on NFPA 18

Hello Shawn,

I am the person who can answer your question as I am the Staff Liaison for NFPA 18 & 18A. We are all currently attending the NFPA Conference in Las Vegas. If you would please state the question in an email reply I will try to answer it from here, or will answer on my return next Monday. I will be checking my emails later this afternoon.

Thanks,

**From:** Oke, Shawn
**Sent:** Wednesday, June 13, 2012 9:42 AM
**To:** Stanek, Sandra
**Subject:** RE: Question on NFPA 18

Sandra,
If you are busy with your conference please feel free to wait until you return home to answer my email. Please forgive me but I will be out of the office from June 14-24. We are heading to Disneyworld on family vacation so my work time will be limited over the next ten days.
I am currently a third year Executive Fire Officer Program student at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied

research project which is titled: Performance Comparison of Listed Wetting Agents. I have sent the following email to each UL listed wetting agent manufacturer:

**My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.**
**I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (insert product name here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.**
**You can email the information to _____ or mail the information to the address listed below.**
**If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.**
**Thank you in advance for your assistance with my research.**

I have already had one manufacturer decline to give me any information on their product. I am conducting this research, as I see a real need, to provide members of the fire service with the ability to examine performance data on NFPA 18 listed wetting agents. I also want to be sure our department is utilizing the best agent on the market based on independent testing data and not sales pitches.

It is my interpretation of NFPA 18:2006 Section 5.1.2 and Section 5.1.3 that all of the results and information developed in the course of independent testing of all sections of Chapter 5 shall be made available to potential users.

Is my interpretation correct? If it is not, can you please let me know what information, according to NFPA 18:2006 Section 5.1.2 and Section 5.1.3, the manufacturer has to release to potential users?

Thank you in advance for your help with this matter. I look forward to hearing back from you in the near future.

Enjoy your conference!!!

Shawn Oke, Chief
Albemarle Fire Department
Albemarle, NC

**From:** Oke, Shawn
**Sent:** Monday, June 18, 2012 6:02 PM
**To:** Stanek, Sandra
**Subject:** RE: Question on NFPA 18

Sandra,

Where you able to get an answer on the NFPA 18 question I sent you last week?

Thanks!!!

Shawn Oke, Fire Chief
Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Wednesday, June 20, 2012 7:11 AM
**To:** Stanek, Sandra
**Subject:** RE: Question on NFPA 18

Sandra,

I am currently a third year Executive Fire Officer Program student at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents. I have sent the following email to each UL listed wetting agent manufacturer:

My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.

I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (insert product name here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.

You can email the information to xxxx@xx.xxxxxxxxx.xx.xx or mail the information to the address listed below.

If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.

Thank you in advance for your assistance with my research.

I have already had one manufacturer decline to give me any information on their product and several others stop answering my emails once I ask for the specific data. I am conducting this research, as I see a real need, to provide members of the fire service with the ability to examine performance data on NFPA 18 listed wetting agents. I also want to be sure our department is utilizing the best agent on the market based on independent testing data and not sales pitches.

It is my interpretation of NFPA 18:2006 Section 5.1.2 and Section 5.1.3 that all of the results and information developed in the course of independent testing of all sections of Chapter 5 shall be made available to potential users.

Is my interpretation correct? If it is not, can you please let me know what information, according to NFPA 18:2006 Section 5.1.2 and Section 5.1.3, the manufacturer has to release to potential users? I realize the 2011 standard made changes to this section and moved the testing to separate chapters. The current listed products all meet the 2006 standard which is why I am using that standard.

Thanks for your help!! My work time has been very limited as the family vacation comes first. I really appreciate your email and will reply as quickly as I can.

Shawn Oke, Fire Chief
Albemarle Fire Department
Albemarle, NC

**From:** Oke, Shawn
**Sent:** Wednesday, June 20, 2012 7:11 AM
**To:** Stanek, Sandra
**Subject:** RE: Question on NFPA 18

Sandra,

I am currently a third year Executive Fire Officer Program student at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents. I have sent the following email to each UL listed wetting agent manufacturer:

My name is Shawn Oke and I am the fire chief for the City of Albemarle, NC fire department. I am currently a third year student in the Executive Fire Officer Program at the National Fire Academy. A requirement of each class in the Executive Fire Officer Program is the successful completion of an Applied Research Project. I am currently conducting research as part of my applied research project which is titled: Performance Comparison of Listed Wetting Agents.

I am writing to ask if you would please provide me a copy of the manufacturer's technical data sheet for (insert product name here) which shows the results of the Underwriters Laboratories testing related to the 2006 edition of NFPA 18 Standard on Wetting Agents, Chapter 5.

You can email the information to soke@ci.albemarle.nc.us or mail the information to the address listed below.

If you are interested in receiving a copy of my completed research project please let me know. Once my project is graded I will be happy to forward a copy to you.

Thank you in advance for your assistance with my research.

I have already had one manufacturer decline to give me any information on their product and several others stop answering my emails once I ask for the specific data. I am conducting this research, as I see a real need, to provide members of the fire service with the ability to examine performance data on NFPA 18 listed wetting agents. I also want to be sure our department is utilizing the best agent on the market based on independent testing data and not sales pitches.

It is my interpretation of NFPA 18:2006 Section 5.1.2 and Section 5.1.3 that all of the results and information developed in the course of independent testing of all sections of Chapter 5 shall be made available to potential users.
[Sandra Stanek]

**[Sandra Stanek] As an AHJ you can request this information from the manufacturers. Anyone else cannot, so make sure you are identifying yourself to the manufacturer. This information is always proprietary. Let them know that you, as an AHJ are requesting this information for your department. If they still will not give you the information, request it directly from the testing lab & tell the manufacturer you will do this, unless**

**they give you the information. I believe they will share it with you.**

Is my interpretation correct? If it is not, can you please let me know what information, according to NFPA 18:2006 Section 5.1.2 and Section 5.1.3, the manufacturer has to release to potential users? I realize the 2011 standard made changes to this section and moved the testing to separate chapters. The current listed products all meet the 2006 standard which is why I am using that standard.

Thanks for your help!! My work time has been very limited as the family vacation comes first. I really appreciate your email and will reply as quickly as I can.

Shawn Oke, Fire Chief
Albemarle Fire Department
Albemarle, NC

**From:** Oke, Shawn
**Sent:** Wednesday, June 20, 2012 10:59 AM
**To:** Stanek, Sandra
**Subject:** RE: Question on NFPA 18

Sandra,

Thanks for the reply. If the manufacturer won't release the information and I contact the testing agency and let them know will they require the information to be released?

Thanks,
Shawn

**From:** Stanek, Sandra [SStanek@nfpa.org]
**Sent**: Wednesday, June 20, 2012 12:02 PM
**To:** Oke, Shawn
**Subject:** RE: Question on NFPA 18

The testing lab will probably have to get the permission from the Manufacturer. Just remind them you are an AHJ, as they HAVE to release it to you.

**From:** Oke, Shawn
**Sent:** Saturday, August 25, 2012 1:12 PM
**To:** Stanek, Sandra
**Cc:** Oke, Shawn
**Subject:** RE: Question on NFPA 18

Sandra,

I am writing for a your guidance regarding the issue we discussed back in June (see below). I have been trying to get UL to communicate with me regarding the release of testing data which you stated they have to release. I have not been able to get any information or even have my questions answered. I emailed Blake Shugarman at UL the following questions on July 11:

Will you please provide, via email, answers to the following questions?

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ?
2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard?
3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested?
4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested?
5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual?
6. Can UL provide certificates of compliance for each NFPA 18 classified product?
7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%?

I have not gotten a response from him other than he will get me answers. I, as an end user, have major concerns with NFPA stating testing data must be released and UL not communicating or releasing any data.

Can you please provide me direction from the standpoint of NFPA regarding what should be done? It is obvious there are conflicting interpretations of the NFPA 18 standard between you and NFPA.

Thank you in advance for any help you can provide.

Shawn Oke, Fire Chief
City of Albemarle, NC Fire Department

**From:** Stanek, Sandra [SStanek@nfpa.org]
**Sent:** Saturday, August 25, 2012 1:12 PM
**To:** Oke, Shawn
**Subject:** Out of Office: Question on NFPA 18

*I will be out of the office on vacation and will return on Aug. 29th. I will respond to any correspondence when I return.*

**From:** Oke, Shawn
**Sent:** Tuesday, September 11, 2012 11:35 AM
**To:** 'Stanek, Sandra'
**Subject:** FW: Question on NFPA 18

Sandra,

I am following up on the email I sent you on August 25 (see the email below). Will you please provide me with guidance as the NFPA 18 liaison?

Thanks,
Shawn

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Tuesday, September 11, 2012 2:22 PM
**To:** 'Stanek, Sandra'
**Subject:** RE: Question on NFPA 18

Sandra,

Thank you for your email.

I really wasn't expecting answers from you regarding the questions I sent Blake. I am just at wits end trying to get answers from UL. I have even emailed the ethics@ul.com email address and haven't gotten a reply.

As an end user I am very troubled with what I am seeing in regards to the NFPA 18 standard and UL. I have noticed a couple things that really give me great concern. The NFPA 18 standard

states that wetting agents must be "listed" to comply with the standard. UL has not listed wetting agents in several years, they have been classified. Classification and Listing are two different categories according to information I have found on the UL website. According to what I understand in the standard the product has to be listed, not classified.

Is Blake Shugarman or any other member of UL serving on the NFPA 18 committee not a conflict of interest? It seems to me that the "independent testing agency" shouldn't be involved in creating a standard they are profiting from. They are also considered an independent testing agency yet they have a vote in the standard they test?

In the beginning of April UL removed any reference from the classification page regarding what NFPA 18 standard cycle the classified agents meet. The classifications page, prior to the first week in April, listed that the agents were compliant with NFPA 18:2006, now they say nothing about the standard or cycle that products meet.

I am at wits end with trying to get someone from UL to answer my questions. There is currently no method for an end user to determine anything about NFPA 18 compliance and performance. Any manufacturer of these products can make up whatever information they would like and there is no method for the AHJ to determine the validity of the information.

Shawn Oke, Fire Chief
City of Albemarle Fire Department

**From:** Oke, Shawn
**Sent:** Saturday, August 25, 2012 1:13 PM
**To:** Stanek, Sandra
**Cc:** Oke, Shawn
**Subject:** RE: Question on NFPA 18

Sandra,

I am writing for your guidance regarding the issue we discussed back in June (see below). I have been trying to get UL to communicate with me regarding the release of testing data which you stated they have to release. I have not been able to get any information or even have my questions answered. I emailed Blake Shugarman at UL the following questions on July 11:

Will you please provide, via email, answers to the following questions?

1. If a manufacturer refuses to provide an AHJ requested data as it relates to NFPA 18:2006 Section 5.1.2 and Section 5.1.3 will UL provide the requested data to the AHJ

**[Sandra Stanek] I cannot answer this question for UL Labs. You may be able to go to someone else other than Blake Sugarman that has the answers. I deal with George Laverick at UL**

2. When a new NFPA 18 standard is released does each classified product undergo UL testing on all sections of the new standard?

**[Sandra Stanek] No , just on the new additions pertinent to UL listing**

3. How often does UL conduct quality testing to ensure the classified products continue to perform to the standard at which they were tested?
**[Sandra Stanek] Again, I cannot answer for UL**

4. How are products verified that they continue to meet the requirements of NFPA 18 once they are initially tested?
**[Sandra Stanek] The products hold current UL Listings**

5. How can an AHJ verify if the performance data provided by the manufacturer is accurate and factual?
**[Sandra Stanek] The AHJ can go to UL for verification**

6. Can UL provide certificates of compliance for each NFPA 18 classified product?
**[Sandra Stanek] Again I cannot answer for UL**

7. What date was Cold Fires Class B test conducted that classified it to its current level of 1.5%?
**[Sandra Stanek] I can only attest to the published NFPA 18. Again check with UL**

I have not gotten a response from him other than he will get me answers. I, as an end user, have major concerns with NFPA stating testing data must be released and UL not communicating or releasing any data.

Can you please provide me direction from the standpoint of NFPA regarding what should be done? It is obvious there are conflicting interpretations of the NFPA 18 standard between you and NFPA.
[**Sandra Stanek]**
**I would call George Laverick at UL & describe your dilemma**.

Thank you in advance for any help you can provide.

Shawn Oke, Fire Chief
City of Albemarle, NC Fire Department

# Appendix D

## NFPA 18 Wood Crib Fire Test Results

Table D1. First Class UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.24% | | | | | | | |
| | Tested Percentage: 0.24% | | | | | | | |
| | Test Date: Not Provided | | | | | | | |
| **First Class** | Test | Control Time min:s | Extinguish Time min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | :23 | :34 | 1:06 | * | Increasing | * | Unacceptable |
| | 2 | :23 | :43 | 1:06 | * | Decreasing | * | Acceptable |
| | 3 | :18 | :41 | 1:09 | * | Decreasing | * | Acceptable |
| | | | | | * Data not provided within testing information | | | |

Table D2. Phos-Chek WD881 UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.10% | | | | | | | |
| | Tested Percentage: 0.25% | | | | | | | |
| | Test Date: August 1998 | | | | | | | |
| **Phos-Chek WD881** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 56.0 | * | 6:30 | * | 3-A | Exinguished |
| | 2 | * | 49.8 | * | 6:30 | * | 3-A | Exinguished |
| | | | | | * Data not provided within testing information | | | |

Table D3. Cold Fire UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | | |
| | Tested Percentage: 0.15% | | | | | | | |
| | Test Date: June 1994 | | | | | | | |
| **Cold Fire** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 59.0 | * | 7:50 | * | 2-A | Extinguished |
| | 2 | * | 58.5 | * | 7:48 | * | 2-A | Extinguished |
| | | | | | * Data not provided within testing information | | | |

Table D4. F-500 UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | | |
| | Tested Percentage: 1.00% | | | | | | | |
| | Test Date: December 1994 | | | | | | | |
| **F500** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 51.3 | * | 7:00 | * | 2-A | Extinguished |
| | 2 | * | 52.8 | * | 7:30 | * | 2-A | Extinguished |
| | | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | | |
| | Tested Percentage: 3.00% | | | | | | | |
| | Test Date: December 1994 | | | | | | | |
| **F500** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 52.0 | * | 7:40 | * | 2-A | Extinguished |
| | 2 | * | 54.0 | * | 7:15 | * | 2-A | Extinguished |
| | | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | | |
| | Tested Percentage: 6.00% | | | | | | | |
| | Test Date: December 1994 | | | | | | | |
| **F500** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 56.0 | * | 7:30 | * | 2-A | Extinguished |
| | 2 | * | 59.0 | * | 7:00 | * | 2-A | Extinguished |
| | | | | | | | | |

* Data not provided within testing information

Table D5. Micro-Blazeout UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 1.00% | | | | | | | |
| | Tested Percentage: 3.00% | | | | | | | |
| | Test Date: February 1996 | | | | | | | |
| **Micro- Blazeout** | Test | Control Time min:s | Discharge Duration min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | * | 58.0 | * | 6.30 | * | 2-A | Extinguished |
| | 2 | * | 59.0 | * | 6.30 | * | 2-A | Extinguished |
| | | | | | * Data not provided within testing information | | | |

Table D6. Novacool UEF UL Class A Test Results for Crib Test

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.40% | | | | | | | |
| | Tested Percentage: 0.40% | | | | | | | |
| | Test Date: May 2007 | | | | | | | |
| **Novacool UEF** | Test | Control Time min:s | End of Discharge min:s | Application Time min:s | Preburn min:s | Glowing Embers | Crib Size | Results |
| | 1 | :25 | :40 | * | 7:26 | Increasing | 3-A | Unacceptable |
| | 2 | :15 | :35 | * | 6:42 | Decreasing | 3-A | Acceptable |
| | 3 | :20 | 8:25 | * | 7:25 | Decreasing | 3-A | Acceptable |
| | | | | | * Data not provided within testing information | | | |

# Appendix E

## NFPA 18 Deep Seated Fire Test Results

Table E1. First Class UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.24% | | | | | | |
| | Tested Percentage: 0.24% | | | | | | |
| | Test Date: Not Provided | | | | | | |
| **First Class** | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | * | | | | 216.5 ml |
| | | 2 | * | | | | 188.3 ml |
| | | 3 | * | | | | 194.6 ml |
| | | Average | | | | | 199.8 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 65.3 ml |
| | | 2 | Yes | | | | 72.4 ml |
| | | 3 | Yes | | | | 89.7 ml |
| | | Average | | | | | 75.8 ml |
| | | | | * Data not provided within testing information | | | |

l

Table E2. Phos-Chek WD881 UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.10% | | | | | | |
| | Tested Percentage: 1.00% | | | | | | |
| | Test Date: October 2008 | | | | | | |
| **Phos-Chek WD881** | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | Yes | | | | 215.2 ml |
| | | 2 | Yes | | | | 193.9 ml |
| | | 3 | Yes | | | | 222.7 ml |
| | | Average | | | | | 210.6 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 89.1 ml |
| | | 2 | Yes | | | | 92.6 ml |
| | | 3 | Yes | | | | 86.3 ml |
| | | Average | | | | | 89.3 ml |

Table E3. Cold Fire UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 0.15% | | | | | | |
| | Test Date: June 1994 | | | | | | |
| **Cold Fire** | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | No | | | | 20 ml |
| | | 2 | No | | | | 15 ml |
| | | 3 | No | | | | 24 ml |
| | | Average | | | | | 20 ml |
| | | | | | | | |
| | Solution | 1 | yes | | | | 3 ml |
| | | 2 | yes | | | | 8 ml |
| | | 3 | yes | | | | 4 ml |
| | | Average | | | | | 5 ml |

Table E4. Micro-Blaze Out UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 1.00% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: February 1996 | | | | | | |
| **Micro- Blaze Out** | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | No | | | | 1 ml |
| | | 2 | No | | | | 3.93 ml |
| | | 3 | No | | | | 2 ml |
| | | Average | | | | | 2.3 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 15.6 ml |
| | | 2 | Yes | | | | 20 ml |
| | | 3 | Yes | | | | 19.8 ml |
| | | Average | | | | | 18.5 ml |

Table E5. F-500 UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 1.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| F500 | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | No | | | | 228 ml |
| | | 2 | No | | | | 231 ml |
| | | 3 | Yes | | | | 233 ml |
| | | Average | | | | | 231 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 27 ml |
| | | 2 | Yes | | | | 40 ml |
| | | 3 | Yes | | | | 19 ml |
| | | Average | | | | | 29 ml |
| | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| F500 | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | No | | | | 228 ml |
| | | 2 | No | | | | 231 ml |
| | | 3 | Yes | | | | 233 ml |
| | | Average | | | | | 231 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 2 ml |
| | | 2 | Yes | | | | 1 ml |
| | | 3 | Yes | | | | 3 ml |
| | | Average | | | | | 2 ml |
| | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 6.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| F500 | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | No | | | | 228 ml |
| | | 2 | No | | | | 231 ml |
| | | 3 | Yes | | | | 233 ml |
| | | Average | | | | | 231 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 0 ml |
| | | 2 | Yes | | | | 0 ml |
| | | 3 | Yes | | | | 0 ml |
| | | Average | | | | | 0 ml |

Table E6. Novacool UEF UL Class A Test Results for Deep Seated Fire

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.40% | | | | | | |
| | Tested Percentage: 0.40% | | | | | | |
| | Test Date: October 2008 | | | | | | |
| **Novacool UEF** | | | Fire Extinguished? | | | | Run Off Volume |
| | Water | 1 | * | | | | 215.2 ml |
| | | 2 | * | | | | 193.9 ml |
| | | 3 | * | | | | 222.7 ml |
| | | Average | | | | | 210.6 ml |
| | | | | | | | |
| | Solution | 1 | Yes | | | | 43 ml |
| | | 2 | Yes | | | | 88.7 ml |
| | | 3 | Yes | | | | 83 ml |
| | | Average | | | | | 71.56 ml |
| | | | | * Data not provided within testing information | | | |

Appendix F

NFPA 18 Wood Fiber Board Fire Test Results

Table F1. First Class UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.24% | | | | | | |
| | Tested Percentage: 0.24% | | | | | | |
| | Test Date: Not Provided | | | | | | |
| **First Class** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | * | * | * | 139.8 |
| | | 2 | * | * | * | * | 104.6 |
| | | 3 | * | * | * | * | 104.6 |
| | | Average | | | | | 116.3 |
| | Solution | | | | | | |
| | | 1 | Yes | * | * | * | 6.7 |
| | | 2 | Yes | * | * | * | 12.5 |
| | | 3 | Yes | * | * | * | 9.8 |
| | | Average | | | | | 9.7 |
| | | | | * Data not provided within testing information | | | |

Table F2. Phos-Chek WD881 UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.10% | | | | | | |
| | Tested Percentage: 0.25% | | | | | | |
| | Test Date: October 2008 | | | | | | |
| **Phos-Chek WD881** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 377.8 | 331.3 | 46.5 | 17.4 |
| | | 2 | * | 376.2 | 326.1 | 50.1 | 6.0 |
| | | 3 | * | 380.0 | 335.0 | 45.0 | 13.6 |
| | | Average | | | | | 12.3 |
| | Solution | | | | | | |
| | | 1 | Yes | 373.0 | 332.7 | 40.3 | 5.9 |
| | | 2 | Yes | 379.1 | 324.2 | 54.9 | 3.6 |
| | | 3 | Yes | 377.4 | 336.2 | 41.2 | 3.7 |
| | | Average | | | | | 4.4 |
| | | | | * Data not provided within testing information | | | |

Table F3. Cold Fire UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 0.15% | | | | | | |
| | Test Date: June 1994 | | | | | | |
| **Cold Fire** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 266.0 | 302.0 | 0 | * |
| | | 2 | * | 285.0 | 355.0 | 0 | * |
| | | 3 | * | 293.0 | 306.0 | 0 | * |
| | Solution | | | | | | |
| | | 1 | * | 280.0 | 318.0 | 0 | * |
| | | 2 | * | 279.0 | 312.0 | 0 | * |
| | | 3 | * | 290.0 | 412.0 | 0 | * |
| | | | | * Data not provided within testing information | | | |

Table F4. Micro-Blazeout UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 1.00% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: February 1996 | | | | | | |
| **Micro- Blazeout** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 264.0 | 322.0 | None | 118.0 |
| | | 2 | * | 264.0 | 340.0 | None | 182.0 |
| | | 3 | * | 264.0 | 330.0 | None | 180.0 |
| | | Average | | | | | 160.0 |
| | Solution | | | | | | |
| | | 1 | * | 266.0 | 463.0 | None | 14.5 |
| | | 2 | * | 263.0 | 440.0 | None | 18.0 |
| | | 3 | * | 268.0 | 463.0 | None | 18.0 |
| | | Average | | | | | 16.8 |
| | | | | * Data not provided within testing information | | | |

Table F5. F-500 UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 1.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 278.0 | 335.0 | None | * |
| | | 2 | * | 283.0 | 398.0 | None | * |
| | | 3 | * | 285.0 | 349.0 | None | * |
| | Solution | | | | | | |
| | | 1 | * | 286.0 | 432.0 | None | * |
| | | 2 | * | 284.0 | 435.0 | None | * |
| | | 3 | * | 286.0 | 431.0 | None | * |
| | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 278.0 | 335.0 | None | * |
| | | 2 | * | 283.0 | 398.0 | None | * |
| | | 3 | * | 285.0 | 349.0 | None | * |
| | Solution | | | | | | |
| | | 1 | * | 279.0 | 438.0 | None | * |
| | | 2 | * | 280.0 | 438.0 | None | * |
| | | 3 | * | 279.0 | 444.0 | None | * |
| | | | | | | | |
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 6.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | * | 278.0 | 335.0 | None | * |
| | | 2 | * | 283.0 | 398.0 | None | * |
| | | 3 | * | 285.0 | 349.0 | None | * |
| | Solution | | | | | | |
| | | 1 | * | 281.0 | 443.0 | None | * |
| | | 2 | * | 284.0 | 428.0 | None | * |
| | | 3 | * | 286.0 | 427.0 | None | * |
| | | | | * Data not provided within testing information | | | |

Table F6. Novacool UEF UL Class A Test Results for Wood Fiber Board

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.40% | | | | | | |
| | Tested Percentage: 0.40% | | | | | | |
| | Test Date: August 2007 | | | | | | |
| **Novacool UEF** | | | Fire Extinguished? | Weight Before (g) | Weight After (g) | Weight Loss (g) | Run Off (ml) |
| | Water | 1 | Yes | 381.0 | 359.0 | 22.0 | 91.4 |
| | | 2 | Yes | 387.0 | 366.5 | 20.5 | 101.3 |
| | | 3 | Yes | 386.5 | 367.5 | 19.0 | 102.4 |
| | | Average | | | | | 98.4 |
| | Solution | | | | | | |
| | | 1 | Yes | 378.7 | 359.8 | 18.9 | 83.3 |
| | | 2 | Yes | 376.5 | 362.0 | 14.5 | 72.4 |
| | | 3 | Yes | 389.1 | 371.0 | 18.1 | 46.6 |
| | | Average | | | | | 67.4 |

# Appendix G

## NFPA 18 Class B Fire Test Results

Table G1. First Class UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.24% | | | | | | |
| | Tested Percentage: 0.24% | | | | | | |
| | Test Date: Not Provided | | | | | | |
| **First Class** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | * | 4:31 | * | * | * | Acceptable |
| | 2 | * | 4:37 | * | * | * | Acceptable |
| | | | | * Data not provided within testing information | | | |

Table G2. Phos-Chek WD-881 UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.25% | | | | | | |
| | Tested Percentage: 0.25% | | | | | | |
| | Test Date: August 1998 | | | | | | |
| **Phos-Chek WD881** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | 1:40 | 4:42 | * | * | 0.20 | * |
| | 2 | 1:22 | 7:40 | * | * | 0.20 | * |
| | | | | * Data not provided within testing information | | | |

Table G3. Cold Fire UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 1.50% | | | | | | |
| | Tested Percentage: 0.15% | | | | | | |
| | Test Date: June 1994 | | | | | | |
| **Cold Fire** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | 8:25 | 8:48 | * | * | 0.20 | * |
| | 2 | 8:45 | 9:00 | * | * | 0.20 | * |
| | 3 | 12:05 | 12:20 | * | * | 0.20 | * |
| | | | | * Data not provided within testing information | | | |

Table G4. F-500 UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 6.00% | | | | | | |
| | Tested Percentage: 1.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | 13:00 | 19:35 | * | * | 0.20 | * |
| | 2 | 12:40 | 15:35 | * | * | 0.20 | * |
| | | | | | | | |
| | Classified Percentage: 6.00% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | 2:35 | 5:07 | * | * | 0.20 | * |
| | 2 | 4:10 | 6:50 | * | * | 0.20 | * |
| | | | | | | | |
| | Classified Percentage: 6.00% | | | | | | |
| | Tested Percentage: 6.00% | | | | | | |
| | Test Date: December 1994 | | | | | | |
| **F500** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | 2:10 | 3:07 | * | * | 0.20 | * |
| | 2 | 2:30 | 3:13 | * | * | 0.20 | * |
| | | | | * Data not provided within testing information | | | |

Table G5. Micro-Blaze Out UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 3.00% | | | | | | |
| | Tested Percentage: 2.00% | | | | | | |
| | Test Date: February 1996 | | | | | | |
| **Micro- Blaze Out** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | :40 | 6:40 | * | * | 0.20 | * |
| | 2 | :55 | 9:34 | * | * | 0.20 | * |
| | | | | | | | |
| | Classified Percentage: 3.00% | | | | | | |
| | Tested Percentage: 3.00% | | | | | | |
| | Test Date: February 1996 | | | | | | |
| **Micro- Blaze Out** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 1 | :40 | 5:42 | * | * | 0.20 | * |
| | 2 | :45 | 7:20 | * | * | 0.20 | * |
| | | | | * Data not provided within testing information | | | |

Table G6. Novacool UEF UL Class B Test Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Classified Percentage: 0.50% | | | | | | |
| | Tested Percentage: 0.50% | | | | | | |
| | Test Date: May 2007 | | | | | | |
| **Novacool UEF** | Test | Control Time min:s | Extinguishment min:s | Application Time min:s | Solution Off min:s | Application Rate (gpm) | Results |
| | | | | | | | |
| | 3 | * | 2:42 | 5:00 | 2:42 | * | Acceptable |
| | 4 | * | 1:25 | 5:00 | 1:25 | * | Acceptable |
| | | | | * Data not provided within testing information | | | |