

Running head: Determining Fire Hazards in Classrooms

Leading Community Risk Reduction

Determining Fire Hazards When Educators Decorate Their Classrooms in

Clinton, Mississippi

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

Abstract

Elementary schools in the community of Clinton, Mississippi are frequently decorated throughout the year. The amount of combustible materials attached to walls and ceilings for decoration or display purposes in schools can be excessive creating a high fuel load. Over the years Clinton Fire Department (CFD) has faced difficulty in enforcing fire codes that limit or prevent certain decorations and their configurations in the schools.

The problem was that the materials, quantities, and configurations of displays and decorations, did not meet fire code standards and therefore may threaten the lives of children and adults. The purpose of this research was to determine what types, quantities, and configurations of decorations are acceptable to meet fire code standards. The results from this research could prevent injuries and death in schools.

The descriptive research method was employed to answer the following research questions: What has history taught society concerning fires that are attributed to decorations and furnishings? What materials make up the decorations in the classrooms and in what configurations are the decorations displayed? What are the flammability characteristics for the materials in the classrooms? What are the implications when classroom decorations and configurations do not meet the fire code standards? How are other fire departments addressing the quantity and type of decorations used in areas such as classrooms, corridors, and exits?

The results of the Applied Research Project (ARP) were that teachers are often not aware of the implications of placing excessive decorations in schools. This ARP tested common materials found in decorations for their flammability. In order to demonstrate the implications of using excessive decorations a literature review of historical large-loss fires was conducted. In

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addition, a live fire demonstration was conducted involving a common classroom display to demonstrate the rapid flame spread and intensity of a school decorations fire.

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Determining if fire hazards exist when educators decorate classroom in Clinton, MS

INTRODUCTION

Classrooms, corridors, and exits within elementary schools in the community of Clinton, Mississippi are frequently decorated throughout the year by teachers using various types of materials to enhance student learning. The amount of combustible materials attached to walls and ceilings for decoration or display purposes in school classrooms can be excessive creating a high fuel load within the classroom threatening lives due to their dangerous levels. The excessive nature of these combustible materials significantly increases the risk of injury or death (S. Cooke, personal communication, June 16, 2008).

Over the years Clinton Fire Department (CFD) has faced difficulty in enforcing fire codes that limit or prevent certain decorations and their configurations in the schools. The researcher believes that decorations and furnishings made of various materials and configurations could initiate and sustain a fire in a school threatening the safety and lives of children and adults. If the decorations were ignited, the fire could cause any or all of the following conditions: rapid spread of flame; impairment or prevention of egress; intense heat, toxic smoke, and gases resulting in injuries and death (Phillipps & McFadden, 1982/1986).

The problem is that the materials, quantities, and configurations of displayed artwork, decorations, and furnishings in the schools of Clinton, MS have not been reviewed to determine if they meet fire code standards and therefore may threaten the lives of children and adults when placed in classrooms, corridors, and exits. The purpose of this research is to save lives and prevent injuries from fire by determining what types, quantities, and configurations of decorations in classrooms, corridors, and exits are acceptable to meet fire code standards.

Research may identify what implications exist when the fire codes are not followed or enforced. When this ARP is complete, stakeholders may gain a better understanding concerning the regulation of flammable decorations in schools. The results from this research can be presented to teachers, principals, superintendants, and other stakeholders responsible for the safety of children and adults attending classes or other functions in schools at the local and state levels. Failure to address the issue of flammable decorations in the schools in Clinton, MS may lead to a horrific tragedy.

The descriptive research method will be employed to answer the following research questions: What has history taught society concerning fires that are attributed to decorations and furnishings? What materials make up the decorations in the schools and in what configurations are the decorations displayed? What are the flammability characteristics for the materials in the schools? What are the implications when decorations and configurations do not meet the fire code standards for schools? How are other fire departments addressing the quantity and type of decorations used in areas of schools such as classrooms, corridors, and exits?

Research will be conducted to determine the make-up of the decorations in the school's classrooms, corridors, and exits by identifying the materials and the configurations that the materials are applied. Research will be conducted through a literature review, personal observations, interviews and questionnaires to determine the importance and significance of teachers using decorations in the classrooms and schools. Research will be conducted through interviews and questionnaires to determine how other fire prevention agencies determine what types and quantities of decorations and furnishings are acceptable in the classrooms, corridors, and exits of schools.

The flammability of the identified materials will be researched by performing a flammability field test to determine if they meet any standards and codes for the purpose of decorating classrooms.

BACKGROUND AND SIGNIFICANCE

Clinton Fire Department

The City of Clinton is centrally located in Mississippi, a state with one of the highest fire death rates in the United States per capita. According to the United States Fire Administration (USFA), the national fire death rate in 2005 was 12.3 deaths per million people. Mississippi's fire death rate was 22.3 deaths per million people (U.S. Fire Administration, 2008). CFD has long been a proponent of fire safety and injury prevention for nearly 40 years. CFD provides fire and emergency medical services for all schools within the city limits of Clinton, MS. Other duties include annual fire inspections for all educational facilities both public and private through the CFD Fire Marshal's Office.

Over the course of the department's history, CFD has been proactive in activities such as fire safety education and prevention. Since the early 1970s, CFD has been considered to be a strong advocate of fire safety education for children and adults. Programs such as: *Learn Not To Burn*©, *Remembering When*© and the *Juvenile Fire Setters Program*© serve as key components in CFD's current fire prevention programs. CFD has staffed a fire safety education officer for nearly four decades. Students from the Clinton schools, both public and private, as well as many from the Hinds County School District are taught fire safety education each year by CFD. Adopted in 1998, legislative efforts in fire prevention included a sprinkler ordinance requiring automatic sprinkler systems in all new educational facilities. This code exceeds many of the minimum requirements of current national fire codes by requiring automatic sprinkler systems in

new schools regardless of size or occupancy. In February 2006, the City of Clinton adopted the 2006 International Fire Code (2006 IFC) and the 2006 International Building Code (2006 IBC) to address life safety issues addressing Clinton's rapid commercial and residential growth (CFD, raw data, n.d).

Fire Deaths

According to CFD records, the department has unfortunately recorded five civilian fatalities in residential housing: Two fire fatalities, both in manufactured homes were recorded in 1987; one death in the Windsor Village Apartments complex in 1995; one death in one bedroom efficiency apartment in 2001; and one death in a one-bedroom house in 2007.

According to records and personal accounts, CFD does not have a single recorded fire death in an educational facility (CFD, raw data, n.d.).

City of Clinton

The City of Clinton is located on the western fringe of Jackson, Mississippi. The Department of Teacher Education & Leadership, responsible for the preparation of teachers, supervisors, and principals, is located on the campus of Mississippi College in Clinton, MS. The results of this ARP may be shared with the Department of Teacher Education & Leadership allowing the information to be disseminated through the Mississippi College of Education.

According to the United States Census Bureau (2000) the population for the City of Clinton, MS was 23,347. For this ARP, it is important to note that the population for children under five in Clinton is 1,431; for children age five to nine the population is 1,596. School enrollment figures from the 2000 census are: 449 for nursery school or preschool children, 329 for kindergarten, 2,756 for children in first grade through eighth grade, and 1,384 for ninth grade

through twelfth grade. The median family income is \$53,482 compared to the \$33,659 for the state. The median resident age is 33.1 years compared to 31.2 for the state.

The City of Clinton's Education System

The City of Clinton, MS has a very well-regarded school system. Each year, both public and private institutions attract new residents to Clinton that desire an exceptional education. The Clinton Public School District (CPSD) has numerous National Board Certified Teachers and is considered one of the top districts within the State of Mississippi and the South. CPSD is considered a high performing school district according to state standards gauged by the Mississippi Accreditation System (Clinton Public School District, 2007). Clinton's private schools, serving grades kindergarten to the twelfth grade, have also proven to be some of the very best within the State. CPSD has been designated as a "level five" district in excellence based on student performance on State tests and is considered above the State's norm according to the latest Mississippi Department of Education Accountability Levels (Clinton Public School District, 2007).

The CPSD Maintenance Department's responsibility is to strictly adhere to federal, state, and local regulations (CPSD, n.d.). Fire safety inspections are performed at each school by CFD personnel to comply with regulations set forth by CFD, and the Mississippi Department of Health (p.16). According to CPSD, each school has a safety plan called, "The Game Plan" (Guidelines for Arrows Managing Emergencies). This plan provides instructions to ensure safety and well-being of CPSD's students and staff. "The Game Plan" addresses four components:

1. Emergencies requiring evacuation such as fires, explosions, threats of explosions, or bomb threats.
2. Emergencies requiring sheltering-in-place such as tornados or severe weather.

3. Emergencies requiring maintaining a position, such as an earthquake, or a person with irrational behavior that may threaten individuals.
4. Emergencies concerning personal crises, such as accidents, life-threatening medical emergencies, or fatalities (Clinton Public School District, n.d.).

CPSD schools regularly execute practice drills including tornado and fire emergencies. A minimum of four drills are required and one must be conducted in August of each year. Also, on the first Monday of each month, schools implement some form of a safety reminder (p.13).

The CFD and the CPSD Maintenance Division have worked well together in the past as both parties have been responsive and aggressive in minimizing fire hazards that relate to the physical buildings. Fire inspections include inspecting basic hardware such as fire extinguishers, panic hardware, and emergency lighting within the CPSD's buildings and grounds. Annual inspections by CFD occur usually in the summer months of June and July when school is out of session. This is done to allow the school district time to make necessary corrections to any fire code violations that may exist. It should be noted that during these inspections, teachers and students are not usually occupying the school buildings, therefore decorations or displays are not usually in conspicuous places to be noticed or inspected by CFD personnel. The months of October, November, and December are riddled with various holidays and activities that often bring about numerous decorative and creative displays within the hallways and classrooms of schools.

Decorations are a Problem for Clinton Fire Department

In 2002, while serving as the fire department's fire and life safety education officer, the researcher noticed that many schools had a tremendous amount of combustible materials serving as decorations or displays within the classrooms, corridors and exits. Decorations in the form of

rain forests, jungles, seascapes, clouds, outer space, gardens, and city skylines were determined by the researcher to be formed of butcher paper, plastic, foam, cardboard, grass, straw, burlap, silk, glue, tape, etc. The decorations and displays were found to be suspended from the ceilings, draped over windows, and displayed in classrooms and corridors. The decorations often were observed covering the doors that provided classroom ingress and egress. In one particular instance, a classroom was observed as containing a rain forest motif that consisted of vines and giant leaves made from butcher paper draped throughout the classroom and hanging from light fixtures from the ceiling. In addition, walls, windows, and exits were covered or draped with various materials twisted and shaped to form a wide array of vines, branches, animals and other objects to compliment the motif. Usually these decorations were determined to be formed from types of butcher paper and construction paper. The result was a very interesting landscape that provided a creative 360° panoramic perspective of a rain forest. Aquariums with warming lights were also located within the classroom containing a variety of reptiles for the class to observe. The efforts placed in this classroom to decorate were both detailed and time consuming. The researcher found this classroom very interesting and educational, but dangerous to children and adults. Another classroom consisted of an outdoor tent configured into a space ship using foam pipe insulation around the tent's legs for decoration. Before this ARP began, it was recognized by neither educators nor fire safety personnel of the potential for disaster within the classrooms regarding flammable or combustible decorations. Only recently, after much attention was placed on the final results of investigations relating to *The Station Fire* in West Warwick, Rhode Island, where 100 people died, did the researcher realize the potential for death and destruction from fire due to excessive flammable materials placed in classrooms such as those mentioned. This is the case even today; a visit to an elementary school or church will often reveal many areas that

contain flammable materials as part of the decorations and displays in the classroom, corridors, and exits. This is a serious problem due to the fact that teachers are not aware of the potentially fatal and tragic situation that could happen if the decorations were ignited. If a fire were to occur in one of the classrooms that contained excessive decorations, the implications could be devastating. In the event of a fire, the heavy fire load created by such an innocent act as decorating a classroom could overcome the fire protection systems causing death or injury to the children, adults, and firefighters that occupy the building.

Several factors are increasing the risk of fire for students and teachers in Clinton, MS: (a) egress is limited in most classrooms; (b) when children are involved, they are often dependent upon an adult to evacuate; (c) the decorations do not meet fire code regulations and therefore may be a fire hazard; (d) flames, toxic smoke, gas, and intense heat could overtake a classroom or corridor in seconds causing a great tragedy; and (e) only three of the eleven or 27% of schools in the City of Clinton, MS are equipped with automatic sprinkler systems.

The impact is that children and adults are at risk to be severely burned, injured or killed due to the amount of potentially dangerous decorations and their configurations in the classrooms and corridors of schools, churches, and other places of assembly.

Children are Attracted to Fire

The occurrence of a child setting fire in a classroom is considered a low-frequency high risk event (United States Fire Administration, 2007). If a fire were to occur in a classroom involving decorations, the results could be devastating taking into consideration the young children present and the increased amount of combustible material near exits. It is a natural interest for children to be drawn to fire. The element of fire is seen by children from the early days of their lives including birthday parties, weddings, special occasions, fireplaces, and

outdoor grilling just to name a few situations. These early exposures to fire usually are controlled, positive and pleasurable moments in the child's memory. The Federal Emergency Management Administration (FEMA) states that it is natural for children as young as age two to become fascinated with the physical characteristics such as the glow and warmth of fire. The child's instinct, to want to create fire and learn more about it, is a natural intuition. However, the children have little understanding of the properties and consequences of uncontrolled fire (Federal Emergency Management Administration, 2004). FEMA urges parents and caregivers that they are to protect the children by keeping matches and lighters out of reach in a secured place (p. SM. 2-19). FEMA warns of the juvenile fire setting problem by stating:

Fire behavior naturally emerges in most children around the age of three. Parents, caregivers, schools, and the fire service need to pay attention to children's interests...at [such] young ages. Because of the impact of psychological and social factors, a certain percentage of children become involved in risk behaviors that include unsupervised fire starting and intentional fire setting (FEMA, 2004, SM 2-28).

Enrollment in Schools

According to the National Center for Education Statistics (National Center for Educational Statistics, [NCES], 2008), enrollment in public elementary schools in the United States in the school year of 2003-2004 was 29,954,000. There were 61,572 elementary schools in the United States (NCES, Table 97). The NCES forecasts record levels of total elementary and secondary enrollment through at least 2016, reflecting expected increases in the school-age population. Public elementary school enrollment (pre-kindergarten through eighth grade) is projected to increase by 10% between 2007 and 2016. Public secondary school enrollment for

the ninth grade through the twelfth grade is expected to be 2% higher in 2016 than in 2007 (NCES, 2008).

Large loss-of-life fires that have occurred such as: The Rhode Island Nightclub Fire, West Warwick, RI, (100 deaths); The Coconut Grove Fire, Boston, MA, (492 deaths); The Rhythm Nightclub Fire, Natchez, MS, (207 deaths); and Our Lady of Angels Fire, Chicago, IL, (95 deaths), are all examples of gatherings that ended with disaster mainly due to an accidental fire initiated through some type of decorative material (National Fire Protection Association, 2008). Although nightclubs and schools may seem to differ, there are many similarities: (a) Usually both have a high occupancy rate, (b) they often attract community sponsored events such as dances and meetings; (c) they serve a wide range of clientele, (d) often, events spawn the desire to decorate for both types of occupancies, especially for dances or parties. Any type of assembly, whether it is a small classroom, gymnasium, church, nightclub, town hall, etc., that draws a crowd can serve as a fire trap if the proper fire protection measures are not taken. For this ARP, the research will focus on the decorations and displays that are introduced into the school building by its occupants. Every child that attends class in one of the 61,572 elementary schools in the United States is at risk to be severely burned or killed if a fire were to occur in their classroom. Conditions exist and are favorable for a tragedy when one takes into account: (a) that curious children start fires; and (b) classrooms and corridors are loaded with combustible and flammable decorations. The literature review for this ARP will explore areas to help solve this ARP's research questions.

LITERATURE REVIEW

What has history taught society concerning fires that are attributed to decorations and furnishings?

Our Lady of Angels Fire

One of the most significant school fires still spoken of today is the Our Lady of Angels Fire in Chicago, IL, which occurred on December 1, 1958. In January 1959, it was reported that 90 students and three nuns lost their lives and 77 were injured when smoke, heat, and fire cut off their normal means of escape through open stairways and corridors (Babcock & Wilson, 1959). NFPA reported that the death toll eventually totaled 95 (NFPA, 2008). The fire occurred during school hours at approximately 2:25 p.m. with a report from students that they could smell smoke. The first report of the actual fire occurred at 2:42 p.m. Babcock and Wilson reported that the fire spread rapidly due to (a) doors that were left opened; (b) developing fire gases; (c) combustible interior finishes in the corridor; and (d) extension into the classrooms through the large transoms over the doors (p. 160).

The literature gives an important account for the deaths and injuries sustained by the students and faculty during the fire in each of the six rooms on the second floor. In Room 207 containing 46 seventh-grade students, they attempted to evacuate through the corridor but were forced back in their room by smoke and flames (pp. 161-162). As panic ensued, many students jumped from the windows. In Room 208 twenty-five managed to escape, 13 were injured, unfortunately nine students and one teacher died. In Room 209, it was reported one student died and nine were injured. Twenty-nine students in the fourth-grade and one teacher died in Room 210; 15 were injured. Many were burned as they jumped from the classroom windows. In Room 211, 64 eighth-grade students panicked as they attempted to evacuate. It was reported that

many jumped for safety and many rescued by way of fire department ladders. Twenty-four students died; and 18 were injured in Room 211. In Room 212, a classroom with 55 fifth-grade students, 27 students and one teacher died; 21 were injured. Babcock and Wilson describe the interior walls and ceilings as wood lath and plaster. Ceilings of all classrooms were finished with cellulose fiber acoustical tile cemented directly to the plaster. The doors, door frames, window frames, transom frames, mop, and coat hook boards were all made of wood. On the second story, on the north wing, where significant destruction took place, Babcock and Wilson report of pressed paperboard blackboards in the rooms and a large amount of children's clothing hanging from hooks along both sides of the main corridor.

The authors point out many deficiencies resulting in this tragic loss of life: inadequate exits; grandfathered building codes; lack of an automatic sprinkler system; failure to warn other occupants of the fire; and a substandard fire alarm system. This literature is significant to this applied research project because it addresses housekeeping as a major contributor to the fire (p. 174). In addition, the literature briefly describes the different reactions by teachers and students as they attempted to evacuate. In their report, Babcock and Wilson point out that a large amount of bundled newspapers, exam papers, etc., were found among the debris at the base of the stairwell where the fire started. Also, school authorities claimed that combustibles were not supposed to be stored in this area. It was reported that a wooden storage closet consisting of wooden chairs, screen panels, and other combustible materials were stored at the base of the two front stairwells. One former student reported that newspapers from a paper drive in 1957 were stored at the foot of the rear stairway.

Babcock and Wilson, (1959) summarize their findings of this tragedy by stating:

The ninety-three deaths in this fire are an indictment of those in authority who have failed to recognize their life-safety obligations in housing children in structures which are “fire traps.” Schools that lack adequate exit facilities and approved types of automatic sprinkler or detection equipment, and which possess excessive amounts of highly combustible interior finish, substandard fire alerting means and poor housekeeping conditions must be rated as “fire traps.” School and fire authorities must take affirmative actions to rid their communities of such blights (p.175).

Literature addressing the Our Lady of Angels Fire contributes to this applied research project as it addressed: (a) the rapid spread of fire, heat, and toxic smoke; (b) the contributing circumstances such as the poor housekeeping of rubbish and debris in the boiler room; (c) children’s coats and other clothing in the corridors; (d) lack of approved types of automatic sprinklers and detection equipment; and (e) lack of evacuation planning. The high fire death rate of children and adults as result of this fire is a testimony of the importance of limiting or removing combustible material when possible in schools.

The Rhythm Night Club Fire

Another significant fire that occurred in a dance hall attributed to combustible decorations was the Rhythm Night Club Fire in Natchez, MS on April 23, 1940. This fire is also known as the Natchez Dance Hall Fire. Literature addressing the fire is limited. However, one document was found in the NFPA Journal archives. This NFPA document contains two different reports: One by the Mississippi State Rating Bureau, 1940; and one by Lyons, 1976. The Mississippi State Rating Bureau (MSRB, 1940) identified three hazards that attributed to the death of 207 African Americans: (a) the use of a highly combustible material for decorating purposes; (b) the over crowding of places of assembly; and (c) inadequate exits. The Mississippi

Department of Archives in Jackson, MS has limited information of this tragic fire. Information came primarily from the Mississippi Department of Archives and History through archived clippings from the local newspaper in Natchez, MS: *The Natchez Democrat*.

The material used for decorations was identified as Spanish moss. This organic material was draped throughout the span of the building from the ceiling and held in place with chicken wire that had been in place for three years (p.73). The Spanish moss decoration was anywhere from six inches to one foot in thickness draping down to appear as a cave-like setting. In a newspaper article, only hours after the fire, it was reported that the dance hall was decorated with hanging moss that caught fire at the front of the building and quickly “enveloped the entire hall”, (Trapped In Dance Hall Last Night, April 24, 1940). The dance hall was reported to have 746 people within its walls at the time of the fire with only one exit in the front of the building (MSRB, p.70). Lyons includes a diagram of the corrugated metal building measuring (38’ x 120’) with only one (38”) door serving as the entrance and exit (Lyons, 1976). Lyons describes this tragedy stating, “This incident presented lessons which should have spurred many cities into improving their fire prevention regulations.”

Lyons (p. 163) mentions two similar fires related to decorations. The first occurred from a combination of oak leaves hanging from the ceiling and boarded windows which resulted in 22 fire deaths and numerous injuries from panic initiated by a discarded match in Detroit, 1939. The second decorations-related fire killed nine people in 1936 at a New York City restaurant when fire from a window from the floor below flashed over festooned silk-cloth ceiling decorations. Lyon stresses the point, “Today, fire codes require that no furnishings or decorations of an explosive or highly flammable character shall be used in *any place of assembly or other occupancy*” [italics added] (Lyons, 1976).

Literature addressing the Rhythm Night Club Fire and others by Lyons influenced this ARP by substantiating that organic material such as Spanish moss, oak leaves, and silk can be a very dangerous choice of decoration for assemblies. This literature supports fire prevention efforts in places of assembly and type (E) educational facilities (i.e., schools, dance halls, and restaurants) by discouraging items such as Spanish moss, leaves, corn stalks, hay, straw, and other naturally occurring material because they support combustion.

The Station Nightclub Fire

The fire at The Station Nightclub in West Warwick, Rhode Island in February 2003 is a modern example of the devastation that interior finish fires can produce. This fire, which claimed the lives of 100 victims and injured hundreds more, spread very quickly, primarily on the exposed flexible polyurethane foam material that had been installed on the walls and ceiling of the stage in the nightclub. The interior finish played a significant role in this fire in two ways: The interior finish easily ignited, and the interior finish allowed for the rapid spread of the fire within the building (NFPA, 2006; Hill & Grosshandler, 2005). The fire created conditions within the building that prevented many from reaching an exit before being overcome by smoke and heat (National Fire Protection Association, 2006).

The National Institute of Standards and Technology (NIST) has provided extensive literature based on the institute's investigations available through the NIST website. In one report, Hill and Grosshandler offer several findings and recommendations. One recommendation addressed building contents and finish materials to: "...specifically forbid with no exceptions certain classes of materials including non-fire retarded flexible polyurethane foams that are known to easily ignite and rapidly propagate flames from all new and existing nightclubs." The report also cites three specific and direct contributors to the substantial loss of life: (a) a

hazardous mix of building contents; (b) inadequate capability to extinguish the fire during its early stages of growth; and (c) the inability of exits to handle the all of the occupants in the short time available for such a fast growing fire (p. 9). This draft report details the rapid flame spread and the intense heat released within 90 to 120 seconds due to the non-fire retardant foam that was placed in the building for acoustical purposes (p.10).

The Cocoanut Grove Fire

The Cocoanut Grove Fire occurred on November 28, 1942. It was reported that more than 1,000 people were packed within the walls of this establishment. Shortly after 10:00 p.m. a fire broke out in a fake palm tree in the Melody Lounge and then spread across the ceiling decorations (Grant, 2007; National Fire Protection Association, 2006).

Decorations in the Cocoanut Night Club were made from various colorful fabrics, artificial leather on the walls, and cloth on the ceilings (NFPA, 1962). The imitation coconut trees were designed to add atmosphere to the main dance hall and dining area as well as the Melody Lounge located within the night club. The report states that a fire department inspector claimed that he had tested the artificial palms and that they were flameproof. The literature did not indicate by what method or standard the palms were tested. Certain circumstances prevented the investigation of the materials after the fire and therefore it was not proven that the decorations were flameproof. The fire flashed rapidly through the night club involving much of the decorative materials (NFPA). What started the Cocoanut Grove fire is unclear, but experts and testimonies support that “the combustible decorations, cloth finish on the ceiling and other readily combustible materials could have caused a quick, hot, and fast-spreading fire.”(NFPA, 1962, p.10).

The literature addressing both, The Station Nightclub Fire and the Coconut Grove Fire, was important to the ARP because the two fires were directly related to synthetic and artificial furnishings within each nightclub. It is important to understand that many decorations or displays whether they are for acoustical purposes or aesthetic purposes can be very flammable and should be regulated.

Vyto Babrauskas, a leading expert in the field of fire science, mentioned that one of the most notable tragedies about 100 years ago was the Paris Charity Bazaar Fire where the primary fuel was ballroom decorative buntings (Babrauskas, personal communication, 2008). A literature review was conducted seeking further information for the research project concerning the Paris Charity Bazaar Fire, but no information could be found.

Washington Reid School Fire

This literature review revealed a fire that occurred at Washington Reid School in Prince William County, Virginia. (Sharry & Stone, 1974) report the fire resulted in one death and two injuries when members of the PTA were building a “haunted house” in one of the elementary school classrooms for a Halloween carnival. Thirty minutes before 200 school children were to walk through the maze of highly combustible decorations, a fire broke out when the decorations were ignited by a light. The decorations consisted of: (a) eight foot high panels of flannel cloth that were painted with black lacquer-based paint and attached to one-by-three inch wood strips; (b) brown Kraft paper taped over the windows; and (c) “black lights”, also known as ultraviolet lights, were installed with temporary wiring. The report states, “When the flimsy ‘structure’ was completed, the men turned on a switch to test the lighting effects. Almost immediately, one of the panels burst into flames in an area where Kraft paper had been attached”. The report indicates that the fire started by a hot light bulb or an electric arc (p.15). Two of the men tried to

rip the paper down while three others retreated for fire extinguishers. One of the three men did pull a fire alarm while two fire extinguishers were used to stop the fire until the rapidly spreading fire forced the men to leave. One man failed to evacuate and was severely burned as his clothes caught on fire. He later died as a result of this event. This event was included in this literature review because it demonstrates what can happen in an instant when displays and decorations placed in classrooms ignite. It is important to note the actions of the occupants and the panic that ensued. If the 200 students had been in the classroom when the fire occurred, there may have been another incident much like that of the Our Lady of Angels, the Cocanut Grove, the Rhythm Night Club, and The Station Night Club fires. Sharry and Stone write, “Who can say what the loss of life might have been if the fire had occurred minutes later, when the room would have been filled with children?”

In response to the “Haunted House” fire, Chief Mary Beth Michos of the County of Prince William released a public service announcement outlining ten precautions and regulations in preparing a haunted house or carnival. Of the ten precautions, two are included in this literature review: first, “Highly flammable materials such as cotton batting, straw, dried plant material, certain plastics, etc. shall not be used as decorations or construction”; second, “Avoid use of combustible material in displays....If used, combustibles must be treated with an approved commercial flame-retardant treatment.” Chief Michos requested that samples of such materials must be submitted for flame tests prior to use (Michos, 2004).

Overview of the Fire Problem in Schools

The United States Fire Administration (USFA) reports from data compiled by National Fire Incident Reporting System (NFIRS) database, that the yearly national fire loss is estimated to be \$85 million in non-adult school properties. Fire departments in the United States respond

to an average 14,700 fires on school property. These fires have caused approximately 100 injuries, however no deaths were reported during the period of 2003 to 2005 (USFA, 2007). This report claims that school safety has improved since the 1970s due to the use of sprinkler systems and the use of safer construction materials (look for Making Schools Safe, page 1, ¶2). The data indicates that 55% of fires on school properties occur between 8 a.m. and 5 p.m. Thirty percent of the fires occur between 5 p.m. and midnight; 15% occur between midnight and 8 a.m. The data indicates that most fires occur during hours most often occupied by students (p. 3). Sixty-four percent of the structure fires in preschool and daycares are due to cooking, 7% are due to heating, and 6% are due to electrical distribution. In kindergarten and elementary schools, the leading causes of fires are 27% cooking, 25% incendiary, and 12% heating. Data extracted from NFIRS indicates the most suspicious activity occurs in middle, junior high, and high school with 47% incendiary or suspicious, 15% cooking, and 7% heating (United States Fire Administration, 2007).

In a study by NFPA (Hall, 2005) reports in 2002 an estimated 13,900 “child-playing” (children playing with fire) structure fires were reported in the U.S., with associated losses of 210 civilian deaths, 1,250 civilian injuries, and \$339 million in direct damage. Items ignited by children playing with fire at home are principally mattresses, bedding, or clothing, followed by upholstered furniture, trash, and papers. The majority of these fires related to children playing with fire begin in the bedroom. The median age of children who start reported fires by playing is five years old.

The literature indicated kindergarten and elementary school fires occur between 8 a.m. and 5 p.m., the timeframe that most children are occupying the buildings. Literature also indicates that 25% of the elementary fires are incendiary. The literature review indicates that

there is an increased potential for fire in kindergarten and elementary schools involving children playing with, or deliberately setting fires during normal operating hours. According to the U.S. Consumer Product Safety Commission, children under five years old playing with lighters cause more than 5,000 residential fires a year, resulting in approximately 150 deaths and more than 1,000 injuries. The majority of the children who start fires by playing with lighters are ages three and four, but the CPSC makes note that children as young as two are capable of operating lighters (Consumer Product Safety Commission, n.d.). The literature is important because it shows how easily a fire could be set in a classroom by a child. Children spend much of their waking day at school; it is only a matter of time before tragic fire occurs. With the amount of decorations allowed in classrooms and corridors; one touch of a lighter or match could lead to a tragic fire.

What educational benefit exists when teachers decorate their classrooms and corridors?

Fire officials conducting fire and life safety inspections often run across the situation of personalized classrooms and corridors that far exceed the fire code limitations for displayed student work, decorations, and artwork. Classrooms are encouraged to be individualized or personalized for the teacher and the students (Heyman, 1978). The literature review revealed information that may assist fire prevention officers in their efforts to prevent injuries and deaths within schools regarding displaying artwork and decorations. If we understand the ideas and motives behind teachers' decorating their classrooms; fire officials, public officials, and school administrators may be able to make recommendations to make the classrooms of schools in Clinton, MS and throughout the State a safer environment for its children and adults that occupy the schools.

The literature indicates that there has been a shift from the traditional classroom to a setting that provides more variety in the physical environment. Heyman classifies traditional classrooms in the same school as an “egg crate” style which portrays each room’s contents as “uniform-as-eggs” with a “sameness-among-many-units,” that basically institutionalizes the school (p.18). Heyman encourages educators to change the interior environment from the institutional format to a more student friendly setting. This is important literature because it demonstrates the momentum that the education field is gaining against institutionalized schools and teaching methods.

While researching the literature addressing creative classrooms, the researcher attempted to seek the views from industry professionals that have conducted research addressing education and facility design. A personal communication was established with Dr. Susan Wolff, a former educator, who has experience as an instructional dean and director at the community college and university levels with recent experience as Project Coordinator for the *New Designs for Career and Technical Education at the Secondary and Postsecondary Levels Project* for the School of Education, Oregon State University. Her research and work involves education and facility design for physical learning environments (Wolff, 2002). Wolff describes that most current school design and construction is based on the factory or industrialized model (S. Wolff, personal communication, May 20, 2008). Wolff explains prior to the industrial era, when factories became the “economic currency” in the early 20th century, it was thought that the best way to prepare workers for employment in the factories was to have them learn in an “all-minds-learn-in-the-same-way” while producing “people widgets” for the assembly line method. Wolff explained the public education system at that time was not to encourage creative thinking but to produce people who think and behave in the same way (S. Wolff, May 20, 2008).

Teachers feel compelled to create areas within their classrooms that contradict the traditional classroom setting with rows of desks or rows of tables and very little color or “props” to create a learning environment that brings relevancy and excitement (Wolff, 2002). Today’s teacher is moving away from the sterile, boring environment to one that is full of color, texture, different sights, sounds, and smells. Wolff describes this new learning environment within the classroom as a chance to discover. She explained, “Think of zoos, science museums, learning gardens, children’s museums – there is so much to stimulate the brain”. Wolff added, “Elementary teachers, in particular, know that young minds need a variety of stimulus to create the neural pathways in a developing brain.

This literature is important to the ARP because it indicates one of the main reasons that classrooms and corridors in schools are now so heavily decorated with displays, student work and furnishings.

Displaying Children’s Work is Important

In attempt to cover up the institutionalized setting, teachers often compensate by decorating the classroom. Heyman (1978) states that there are things about a classroom that cannot be changed by the teacher such as the wall and the windows, but emphasizes there are things that can be changed such as the furniture and its arrangement, wall and floor coverings, and anything else that is portable.

In the Encyclopedia of Education, (Deighton, 1971) claims, “The first six or seven years in the life of every individual have been recently recognized as peak years in his [formative years] making the physical setting into which the child first ventures outside his home and family particularly important”. Deighton stresses the importance of the educational environment but points out that fire safety is important as well:

The young child's built in tools for learning; his keen perceptiveness and insatiable curiosity, his urge toward independence and self-realization, and his boundless energy, combines to make the physical environment a highly significant factor in his development. Only the insight and skill of staff members and the excellence of the program itself have a greater bearing on the child's well being. At the same time that appropriateness and adequacy of space receive major attention, unnecessary and preventable hazards have to be anticipated and eliminated. This means providing traffic-free play areas, traffic free access to school entrances; *fully fire safe premises* with multiple exits from every classroom; plenty of well-dispersed, glare free lighting by both natural and artificial means [italics added](Deighton, 1971).

Literature specifically addressing the importance of bulletin boards and the stimulated environment stated that teachers of grades K-6 are constantly looking for ways to motivate students and to make the classroom more attractive (Black, n.d.). Bulletin boards, especially those using a fresh approach, spark student interest and extend an exciting invitation to learn (p. 1). The impact of the electronic age on today's student cannot be overemphasised nor can it be ignored. Black describes the average child spending approximately 6.5 hours per day in the company of a television set and high tech video that delivers a steady stream of loud music, fast moving pictures, animals that dance and sing to catchy jingles. Children sleep on sheets that are decorated with brightly colored cartoon characters and popular cultural figures; these images appear again on cereal boxes, lunch boxes, t-shirts, notebooks, etc. Black is quoted:

Children today are living in a highly stimulated world. It seems only logical that teachers should attempt to create a stimulating classroom environment that capitalizes on some of the out-of school influences that fascinate children. One way to accomplish this

is through the use of attractive instructional displays. The elementary school curriculum must focus on affective learning experiences, especially those involving acceptable behaviors in groups and positive interpersonal skills, classroom displays are helpful in doing so.

Literature Supporting the Use of Poster Art

Three principal ingredients of creativity are: inspiration, imagination, and ingenuity; these are the basic to posters or any type of display (Caplin, 1981). In Caplin's book, Emeritus Professor of Art, Robert Iglehart of the University of Michigan prefaces the book by stating:

It is educationally important that we use display and visual techniques, and it is educationally important that we use them adequately. Visual learning and visual expression are central aspects of a school program, especially so in elementary schools. The good classroom should have its own quality and its own life; it is the children's immediate world. It should be made not only comfortable and healthful; but vivid and stimulating.

In schools that value art and creative expression, both classroom teacher and art specialists provide space, time, and materials for children's work in art. The walls of classrooms and the walls of the school itself are alive with the shapes and colors of children's paintings, collages, and other works. Such displays...include children's work at different times [of the year], let children know that their artwork is valued and, in turn, create in them a sense of pride in their ways of expressing themselves (Oppenheim, 1989). "A classroom filled with the work of children is not only a delight to be in, but also sends a powerful message to students that their work and their learning are most important in this classroom" (Clayton, 2001, p.102).

Bulletin boards are an important part of the classroom environment. Traditionally bulletin boards have been part of the elementary school classroom to relay information, help keep track of days and holidays, call attention to special awards and events, or simply create an interesting and decorative area in the classroom, (Flores, 1983). Dungey (1989) said, “A classroom of bare walls or chalkboards limits students’ natural curiosity and interest.” Bulletin boards can help achieve a sense of belonging, a cooperative spirit, and excitement about learning.”

Kim, Park, and Lee (2001), “While children engage in art activities, they think deeply about the topic, express their original thoughts, and, by using various materials, learn the physical characteristics of these materials.” (Kim, et al,) submit that the act of displaying artwork from students builds esteem and encourages learning:

Children take delight in seeing their work put to use in some way. In seeing that their work is respected, children become aware of [their] own self worth and this increases their self esteem. When the learning environment includes the children’s own creations, a connection between the topic and the environment is formed, thereby creating increasing effectiveness of learning. (Kim et al., 2001)

Artwork plays an important role within the framework of Mississippi’s education system. In a recent article in Jackson, Mississippi’s newspaper, *The Clarion-Ledger*, Helmes reported that more than 30 schools across the state of Mississippi are participating in the Whole Schools Initiative Program aimed at expanding regular classroom instruction to include the arts and promote collaboration between arts and classroom teachers. Helmes reports that teachers want to “integrate the arts” so that the lessons will be more meaningful to more students. Teachers believe that the students will be more likely to remember the lessons and therefore will perform better on tests (Helmes, Feb. 16, 2008, Artful Approach).

(Pattemore, 1974) said that young children react to their surroundings, and that their attention span and awareness will be determined by the atmosphere of the classroom (p. 65). Pattemore stresses that there “need to be many visual stimuli” but also restraint and order when decorations are displayed should be maintained. Pattemore describes the classroom as an environment affecting learning and a laboratory for the ongoing study of environment. He writes “The disposition of the classroom is of great importance at every grade level” (Pattemore, 1974, p. 66). Pattemore describes a classroom as an “enclosure of space” (p. 65), “...whatever room we are in at the moment tends to control our actions-become part of us.” Pattemore states that children are affected by this controlled environment. Discussing walls and display areas, Pattemore claims that walls are a part of the total room environment offering endless possibilities for interesting treatment-both decorative and functional (p. 72). The classroom should have the appearance of a working area for children displaying what they are producing in various subjects as well as photographs, maps, and other materials that relate to subjects being studied (Pattemore, 1974).

Dr. Jeff Lackney, a partner, educational planner, and architect specializing in the use of space within learning environments and institutions, has conducted extensive research and is an expert on the influence of the physical setting on learning. Dr. Lackney commented:

It is unfortunate that student works and hands-on projects are considered fire hazards as doing so severely hampers the ability of teachers to teach using more innovative project-based and hands-on learning strategies. It is quite unfortunate that fire departments are dictating how school buildings should be used and not the other way around (Lackney, personal communication, June 24, 2008).

Teachers are urged to create a “rich sensory environment” within their early education classrooms (Thompson, 1973). This environment provides students a background where they are introduced to games, puzzles, and other visual challenges which, according to Thompson, the students do much better in school as a rule than students that were denied this early training. Thompson claims that schooling with some degree of proficiency in visual literacy enjoys a significant advantage over students who do not (p. 200). Thompson states that visual literacy is a new and important study which challenges teachers to develop materials and implement strategies for teaching children how to process visual information in a logical, orderly fashion, and at an early age (p. 203). Thompson also discusses that color affects the students’ performance. Thompson stated, “Even the paint on the walls of classrooms may influence what and how students learn.” Thompson explains that studies have shown that in some instances just repainting a classroom in traditional green may produce measurable gain in class achievement. The literature also discusses the importance of color in the classrooms, how it affects mood, and classroom performance on both the student and the teacher.

Feldman (1997), advising of the importance of atmosphere for children:

There is a powerful relationship between environment and behavior. If we want children to feel comfortable, confident, secure and happy, then we must create beautiful schools where they can grow and develop to their fullest potential. In a world where children spend more waking hours in school than they do in their own homes, the need to provide them with warm, nurturing spaces is particularly important.

Clayton (2001) stresses the importance of classroom displays that celebrate students’ efforts by generating excitement about the planned curriculum, increasing the children’s investment in learning, and teaching children to appreciate their own artwork as well as their

fellow classmates. In addition, displays can foster a powerful sense of individual and group “ownership” of the classroom. Clayton points out in the literature of *Goals of Creating Classroom Displays*, that classroom displays: (a) acknowledge and celebrate every child’s efforts; (b) build a sense of individual and group ownership of the classroom; (c) have a meaningful connection to the curriculum, serving as an effective tool for teaching; and (d) generate excitement about learning.

What materials make up the decorations in the classrooms and in what configurations are the decorations displayed?

Decorations can consist of almost any material imaginable. A literature search found several sources that provided teachers a list of materials to use when decorating in their classroom. In an instructional book entitled, *Off the Wall: School Year Bulletin Boards and Displays for the Library*, Skaggs (1995) lists the following items as materials essential for backgrounds for displays: construction paper, newspaper, old bed sheets, black plastic bags, wallpaper, brown mailing paper, wrapping paper, fabrics, burlap, and paper tablecloths. In *Bulletin Bored? Or Bulletin Boards!*, Sivak and Passatore (1998) list: construction paper, poster board, fun fur, yarn, felt, burlap, silk, lining material, and satin as materials for a Halloween display portraying a Frankenstein motif. Another list offered by Sivak and Passatore recommended cotton gauze and strips of white fabric to display a Mummy motif. The flammability of the materials listed was not addressed in the literature.

In the literature review, ideas were offered to save money when teachers needed to change the arrangement of the classroom without elaborate or expensive equipment. Shallcross (1981) describes that the classroom requires a physical arrangement that is supportive to the kinds of activities the teacher desires to conduct or allow. Virtually any existing classroom can

be arranged to allow large group and small group spaces, as well as for students to work alone.

If dividers or bookshelves aren't available, one can use such things as cardboard cartons, old curtains, or if materials are scarce, train the students to imagine a divider (Shallcross, 1981).

Flame spread of the fabrics or materials was not mentioned within the literature.

On a school visit, Wolff (2008) recalled a classroom décor that was focused on the forest and its wildlife. She stated, "The teacher had created a canopy of trees using construction paper, netting, other craft type materials, and had the children creating the 'critters and plants.'" Wolff warned, "If these materials were not treated with some sort of fire proofing...those materials would certainly have added to the fuel load in the classroom and no doubt increased the intensity and speed of a fire" (Pam Wolff, personal communication, May 20, 2008). Wolff proposed:

Unless flammability issues are stressed in teacher education programs...the understanding of harm levels will lay somewhat latent unless a situation brings the consequences to bear. This makes me think of the flammability of Christmas trees. Seeing an actual tree (flocked or not) set on fire and watching how quickly they burst into flame – it is something I have never forgotten. Perhaps part of teacher and administrator training needs to be "live demos" of how quickly classroom materials become a potential for injury or death.

The suggestion by Wolff led the researcher to further discussion of "training teachers and administrators concerning classroom decorations" with two university educators in Mississippi. At Jackson State University, the Department Chair, Dr. Richard Washington, stated that he was not aware of any type of fire safety message addressing decorations in classrooms in their curriculum. Williams indicated that the department did teach *Methods of Materials* to the future educators. This subject addressed materials in regards to "too much clutter in the rooms", but

this was due to materials that were "...blocking or hindering the level of instruction; not fire safety." The flammability of materials is not addressed in their curriculum nor is it in the textbooks, but it was an important issue according to Washington. Washington stated that this ARP would be beneficial to the education profession and the Mississippi Department of Education should be interested in this research as well. Washington requested that CFD participate in their program each year for their teacher to address the issue (R. Washington, personal communication, Aug. 6, 2008).

At Mississippi College, the Dean of Educational Studies, Dr. Tom Williams stated that he had been in education for nearly 40 years and has never known anyone to address the issues of fire safety involving classroom decorations. Williams said that he could see where a child could bring a lighter to school and mischievously ignite a "frilly" bulletin board as a prank. Williams requested that CFD present the results of the ARP to the Mississippi College School of Education at a bi-monthly "professional block" designed to prepare teachers about to receive their education degree. Williams did indicate that Mississippi College may want to help host a pilot program to address this subject (T. Williams, personal communication, Aug. 6, 2008).

The research included a literature review that included literature describing tips for teachers when they decorate. One article (Winslow, 2007, p.65) claimed that grocery stores discard the honeycomb tissue paper decorations that hang from the ceiling. Teachers can obtain these discarded decorations after a particular holiday by asking the manager. Winslow suggested looking for items in thrift shops, garage sales, and bookstores to help teachers save money when decorating. In another article, *Quick and Easy Classroom Makeover*, Adams (2006) advises the teacher to use old sheets, tablecloths, and oilcloth to add color to the room (p.39). Suggestions within the article included: using beaded curtains to hide storage areas; adding table lamps from

thrift stores and garage sales; using Christmas lights as a border. The article mentions using plastic shower curtains because they are “cheap and colorful” (p. 40). The literature did not mention anything concerning fire safety nor did it recommend looking for lamps that were rated from an underwriting laboratory such as Underwriter’s Laboratories (UL®).

A personal observation was made while visiting a particular classroom by the researcher of a classroom that was transformed into a rain forest consisting of vines, large leaves, branches, trees, and wildlife; all made from various paper products. Consequently, a literature search on the internet for instructions to build a classroom rain forest was conducted and revealed one particular website that offered specific materials and detailed instructions to create a rain forest. To make a tree, the directions specified to use butcher paper and then “loosely wrap posts or wall areas between windows”. To hang a canopy, the site describes the use of many yards of green material attached at several points on the ceiling suggesting, “...if you can drape loosely over some fluorescent lights, the room gets a green hue.” Branches were described as newspaper tubes, wrapped in foil with paper-mache. Vines are fashioned from hanging lengths of jute-type rope hanging from the branches, ceiling or trees. The directions to make leaves involve using a variety of green paper of various sizes hung throughout the trees, vines, and branches. Directions to make items such as: bag gorillas, styrofoam birds, paper-mache monkeys, felt bats, paper flowers, etc., are all described in the website (How to turn your classroom, n.d.). Nothing within this website mentioned either fire safety or the flammability of the materials involving the rain forest display.

What are the flammability characteristics for the materials in the classrooms?

For this ARP, it is important that research included the burning characteristics of paper since paper is the key material in decorations and displays in the schools. Other materials include

cloth, plastic, burlap, leaves, sticks, vines, cotton, etc. In *Kirk's Fire Investigation*, Deehan (2002) describes paper as "...one of the more interesting substances involved in fires, partially because of its frequent use in kindling fires and partially because of its unusual properties as [it] regards [to] combustion" (p. 96). Deehan explains that people use newspaper as a kindling, but a picture magazine makes for poor kindling. Dehaan describes cellulose as the basic ingredient of all paper and that it is a readily combustible material such as in a newspaper. Dehaan points out that "slick" paper such as in a magazine does not burn very well because of the high content of clay, which is not combustible. The literature contributes to the ARP because of the explanation of the easiness of ignition of paper. In Dehaan's own words, he explains about the burning characteristics of paper:

Paper ignites easily because, like wood, it has a low thermal inertia so its surface temperature goes up rapidly, and it is thermally thin, allowing rapid heat saturation of its entire thickness. If exposed as a single sheet rather than a compressed in a stack, its large surface area promotes rapid burning, and a high, but brief heat release rate (HRR)...A pile of loosely crumpled sheets of paper is not only easy to ignite, but quickly raises the temperature of nearby combustibles to their ignition points and thus initiates a fast moving, very destructive fire.

Deehan points out that thin paper, if exposed on walls or ceilings, will support an extremely fast fire spread (p. 97). Dehaan describes the sequence of a room fire as: (a) the beginning stage when the flames are localized at the very moment of ignition and the room has a normal 21% oxygen content; (b) the free-burning stage is the point of the fire that the fire grows in intensity as more fuel is involved. Convection and radiation force the flames upward and outward igniting the surrounding fuels to begin to burn. Dehaan explains, "Survival is still

possible in the room if one stays in the cooler layer [on the floor] and does not breathe the gases higher up.” As the fire grows and more products are ignited, it contributes a quantity of heat to the room at a rate influenced by the fuel present, its configuration, and how it was ignited. This situation explained by Dehaan is important to the research because decorations and displays often have exorbitant amounts of materials that contribute to the fire load as well as does the configuration. Upward flame spread on a fuel surface requires two conditions to occur: first, the flame from the currently burning material must extend beyond the burning area to expose the adjacent area to a heat flux high enough to ignite the adjacent area; and second, the heat flux must be applied long enough to ignite the adjacent fuel surface (Williamson & Mowrer, 2004); (c) the post-flashover stage is a stage where combustion is based on a “balancing act” between fuel, air, heat, and the consumption rate. Ventilation may be limited, thus slowing the burning process down, however, if the room has plenty of ventilation, the contents may be completely engulfed within 5 to 10 minutes of the first established flame (DeHaan, 2002). Mehaffey (1987) describes when a fire in a confined room starts to burn, it will burn the same way it would out in the open for a short time. When the heat and smoke start to bank down, this confinement begins to influence fire development. The smoke produced by the burning object rises to form a hot gas layer below the ceiling which heats up the ceiling and upper walls of the room. As the heating of other combustibles in the room occurs, flames will suddenly sweep across the room involving most combustibles in the [room] (Mehaffey, 2005). The literature explains the basics of fire behavior and indicates the rapid progression of a fire from its very early stage of ignition to a fully involved room. This information demonstrates to anyone in charge of classrooms of the importance of limiting decorations due to the possibilities of rapid flame spread along with the possibilities of flashover within a classroom. In NFPA’s fire safety video, *Fire: Countdown to*

Disaster, the point is clearly made that fire is relentless, destroying everything in its path. This video presents actual footage of a typical carpeted bedroom with a bed, dresser, chair and drapes being engulfed in flames. The video demonstrates the buoyant flames spreading from a chair to the drapes thus producing toxic gases and intense heat bringing the room and its contents to a point of flashover in two minutes. The video's basic premise is important to the research because it demonstrates the rapid flame spread in a typical room allowing the viewer to realize how quickly a fire can spread (National Fire Protection Association, 1984).

Corridor Tests

The literature review revealed a report from Scotland, *Fire Safety in Schools*; this report addresses the corridor fire (Scottish Executive, 2003):

A serious situation may arise if a fire starts in a corridor, since it may not be detected before smoke cuts off [the] escape [route] from nearby rooms....a corridor which serves as a safe exit for any room should have non-combustible finishes to exposed walls and ceiling surfaces (p. 5). Corridors often have displays along their length. Stairwells and entrance foyers are a popular location for notices and posters. Displays are often suspended from ceilings, light fixtures or placed close to heaters. The cardboard, paper, and plastic that go into these displays can be a means of rapid fire spread (p. 8).

The corridors often have displays along their length. Stairwells and entrance foyers are a popular location for notices and posters. Displays are often suspended from ceilings, light fixtures or placed close to heaters. The cardboard, paper, and plastic that go into these displays can be a means of rapid fire spread (Scottish Executive, 2003).

Research was conducted in Sweden by the Swedish National Testing Research Institute investigating the fire development along a school corridor if the code regulations for school corridors are violated by posting flammable material such as paper and posters along the corridor. Three different test scenarios were performed: One with “code compliant” conditions; one scenario included paper covering 100% of the walls; and the last scenario included paper drawings mounted on polystyrene boards mounted on 50% of the walls in a checkerboard pattern (Andersson, 2002). The report does not indicate the fire code standard followed. Results were that no flame spread occurred during the first two tests involving gypsum board. The second test involved both walls 100% covered with basic copy paper with drawings attached with masking tape. The fire spread along both walls but the ceiling was not ignited. The report describes that “all paper and drawings on the burner wall [ignition point] had either been consumed in the fire or fallen on the floor.” Two thirds of the paper and drawings on the opposite wall was consumed in the fire and fell down on the floor. The last scenario involved testing the corridors with a checker board style pattern of polystyrene boards with drawings attached. The checker board pattern resulted in the 50% coverage. The test results for the 50% Test was that no flame spread occurred, the polystyrene board melted away from the burner while the paper burnt, but there was very little flame spread down the corridor compared to the second scenario. The discussion supports that artwork mounted on the polystyrene boards exhibit the best scenario due to the tendency for this material to melt away from the flame and resist the spread of flame along the corridor (p.22).

What fire code standards apply to the decorations and configurations and what are the implications when classroom decorations do not meet the fire code?

The literature review included a review of fire codes addressing decorations, displays, artwork, and clothing in the corridors, classroom and exits. The (Uniform Fire Code, [UFC] 2003) addresses that clothing and personal effects "...shall not be stored in corridors." Exceptions are: (1) corridors protected by an automatic sprinkler system; (2) corridors protected by a smoke detection system; (3) corridors that use metal lockers to store clothing, books, etc., (NFPA, Uniform Fire Code, 15.7.4.2). Clothing in corridors can lead to devastating circumstances. Winter clothing in the corridors of the Our Lady of Angels Fire was a major contributor to the rapid extension and heavy smoke within the corridors and classrooms (Babcock & Wilson, 1959). The UFC addresses artwork and teaching materials such that any item shall be permitted to be attached directly to walls in accordance with the following: (1) the artwork and teaching materials shall not exceed 20% of the wall area in a building that is not protected with an automatic sprinkler system; (2) the artwork and teaching materials shall not exceed 50% of the wall area in a building that is protected throughout by an approved automatic sprinkler system (NFPA, 2003). CFD has adopted the 2006 International Fire Code (IFC). In the IFC, artwork and teaching materials are limited on the walls of corridors to not more than 20% of the wall area. The code only applies to corridors and not classrooms (International Fire Code, 2006).

According to Steve Cooke, Fire Marshal for Woodinville Fire Marshal's Office, representing Washington State Association of Fire Marshals, a public comment was submitted to the International Code Council (ICC) proposing to address decorations in the classrooms in addition to the corridors. The code called for a change in terminology from "*Artwork*" to "*Decoration and Display Material*". The public comment form submitted by Cooke also

addressed specifics of the code to be changed in order to address decorations in the classroom as follows:

Combustible material attached to walls as decoration or display shall meet the following criteria:

1. Combustible material shall not exceed 30 percent of the wall area in a room or 20 percent in a corridor that is not protected throughout by an approved automatic sprinkler system in accordance with Section 903.1.1.
2. Combustible material shall not exceed 50 percent of the wall area in a room or 20 percent in a corridor that is not protected throughout by an approved automatic sprinkler system in accordance with Section 903.1.1.

Cooke Submitted the request for the proposed code modification presented at the ICC conference by explaining:

...Combustible materials significantly increase the danger to occupants in the event of a fire. This proposal will give the fire code official the means to limit the amount of combustible material hung on classroom walls that is *absent* from the current code language. It is not congruent to require (E) occupancy rooms to meet the interior wall finish requirements of 803.3, but then allow an unlimited amount of combustible material to be attached to the walls.

Cooke explains that the reason for the code change was the fact that the International Building Code limits the flame spread rating and the smoke spread rating of the wall covering of (E) occupancies, including classrooms, yet a teacher can completely cover the walls with

"artwork" and teaching material and there is no means to regulate the amount (S. Cooke, June 12, 2008).

The proposal was voted down, due in a large part that: (a) a lack of history of the loss of life or major incidences of classroom fires; (b) concerns were raised as to the hazard of the combustible art work on the walls, i.e., Will the fire travel fast enough to trap the students in the classroom? Cooke added that some felt that the students could evacuate quick enough so that a horizontal spread of the fire would not pose a threat; (c) no tests have been conducted to establish a threat; (d) there are political implications of having to enforce the code, i.e., having to tell the schools that they have to remove art work from the walls. Due to the political nature of the title of the code proposal, Cooke eliminated the word "artwork" and simply titled it as "Decoration and display material" (S. Cooke, personal communication, June 12, 2008).

What are other fire departments and other agencies doing to address the quantity and type of decorations used in areas such as classrooms, exits, and corridors?

The Alliance of Schools for Cooperative Insurance Programs (ASCIP) recommends each school district in California to review its guidelines to ensure that classrooms are not overloaded with child artwork and project materials. The ASCIP also made the recommendation that purchasing departments, when available, purchase only art rolls, crepe paper, and similar project materials that are certified to be non-flammable or fire resistive by the manufacturer. The ASCIP, in its memo, stated, "The added cost of purchasing safer materials now may prove prudent later, if the tragedy of a classroom fire can be avoided." (Alliance of Schools for Cooperative Insurance Programs, 2006)

The Denver Fire Prevention Bureau and Denver Public Schools Risk Management offer clear definitions of fire codes for the Denver Public School classroom. The literature contains three pages of fire code safety issues such as:

- Three foot rule around the classroom exit door to the hallway or corridor: “There cannot be any combustible/flammable material within 36 inches of adjacent space around the door”.
- Placement of combustible materials on the classroom door is prohibited.
- “Forty-percent Rule”: Classrooms, wall displays, child art, etc., cannot cover more than 40% of that wall surface.
- “Twenty-percent Rule”: hallways and corridors cannot cover more than 20% of that wall space.
- Other topics include regulating: Hanging teacher aids from ceilings; wires strung across the ceiling; storage distances from ceilings; classroom exit door clearances; use of cloth in classrooms such as table covers and fabrics on walls; candles in classrooms; purchasing new and used furniture for the classroom (Denver Fire Prevention Bureau, 2006).

The literature review includes Gwinnet County’s Department of Fire and Emergency Services Administrative Rule addressing artwork and teaching materials: The department provides criteria for placement of artwork and teaching materials with 20% limitations and minimum distances from exits set at ten feet, measured from the outer edge of the door frame. If the building has an approved automatic sprinkler system, the minimum distance can be lowered to five feet from the outer edges of the door (Gwinnet County Department of Fire and Emergency Services, 2006).

The Commonwealth of Massachusetts, Executive Office of Public Safety, Department of Fire Services, addresses school decorations and regulations in a “Frequently Asked Questions” format. Particularly, in this document, there are several areas addressing cork board, bulletin boards, and paper that must be attached directly to the wall. The document states, “Paper must be applied directly to the wall.” This is explained that this rule occurs to minimize “air spaces” or surface area of the paper (Massachusetts Department of Fire Services, n.d.).

There are numerous sources that address artwork and displays provided on the Internet. This literature is a representation of various interpretations based on different fire codes that are adopted by the appropriate jurisdiction. The intentions of this ARP were to show only a small glimpse of the availability of literature addressing materials, quantities and configurations of decorations and displays.

PROCEDURES

Procedures for conducting this applied research project include: (a) a literature review to determine what history has taught society concerning fires that are attributed to decorations and furnishings. Also the literature review will be conducted to determine the reasoning behind the movement from the traditional classroom setting to a modern, creative learning environment; (b) personal observations during sight inspections of classrooms to determine the type, amount, and configurations of the displays, decorations, and student work that are in use in the classrooms and corridors; (c) Questionnaires for teachers and school administrators to determine the type, amount, and various configurations of the decorations in the classrooms; (d) Questionnaires for fire chiefs and fire marshals (authorities having jurisdiction) to determine the magnitude of the problem; (e) A field test using methods and procedures from NFPA 705 to determine if the materials identified from the sight inspection and from the questionnaires are flammable; (f) A

field test involving a scenario of a live burn in a controlled environment using common materials identified as decoration and display materials.

Procedures for the Literature Review

What has history taught society concerning fires that are attributed to decorations and furnishings? The literature review began in Emmitsburg, Maryland at the National Fire Academy's Learning Resource Center in October 2007 during the Executive Fire Officer Course, *Leading Community Risk Reduction*. Research began by searching for subject matter including fires that occurred in schools, fires caused by decorations, fires in assemblies. The literature review continued in Clinton, MS at the Mississippi College Leland Speed Library which contains an extensive collection of elementary education sources; this procedure was established to investigate literature that relates to the classroom environment as it relates to displays and decorations influencing students that are studying to become educators. The literature review at Mississippi College would also review literature concerning fire safety methods within the classroom. The literature review continued at the Mississippi Department of Archives and History (MDAH), particularly reviewing information concerning the Rhythm Night Club Fire in Natchez, MS. Research was conducted at the MDAH by searching through various records of the State Fire Marshal documents searching for school fires that occurred in Mississippi. Additionally, newspaper clippings of the Rhythm Night Club Fire were reviewed at the MDAH to determine if any additional information concerning this fire existed other than what was available in the National Fire Academy's LRC or other publications. Research was conducted in the Jackson Public School District's Teacher Resource Center reviewing materials and literature related to displays and decorations used during classroom instruction. A literature review addressing the ARP research questions was attempted through the Internet using search engines

such as: Google®, Lycos®, and several others. Personal communications with leading professionals in fire research, education, architecture; members of CFD, CPSD, and community stakeholders were conducted. A copy of the letter requesting information related to this ARP is available, see (Appendix C) for a sample request letter sent to the leading professionals in their respective fields of expertise. Records from Clinton Fire Department were researched for the ARP to determine the number of school fires, deaths, or injuries that occurred on school property. The researcher attempted to research the design of schools and the logic behind the design and creation of learning environments.

Procedures for the Sight Inspection to Determine the Materials Used in Decorations

What materials make up the decorations in the classrooms and in what configurations are the decorations displayed?

A sight inspection was conducted on several elementary schools and churches throughout the City of Clinton, MS over a nine month period beginning in October, 2007 until June, 2008. The inspections conducted were done while performing other duties such as public education presentations, responding to false alarms, open house opportunities, and PTA meetings. Furthermore, the researcher had a family member attending kindergarten and therefore frequent and incidental visits were conducted throughout the year, especially during special events. The sight inspections were made to determine: (a) The type and quantities of materials that make up the decorations and displays; (b) the configurations that the decorations displayed in the schools and churches; (c) if there are any decorations in the path of the exits or corridors; and (d) other hazards that the decorations generate.

Photographs were taken of the decorations using a Canon Rebel® EOS 35 mm camera and a Sony® Digital Handycam 8 mm camera to document the uses and configurations of the

decorations in the classroom. The photographs would provide a means of documentation to allow the researcher to recall and recreate particular configurations, and to identify materials found in the classroom, corridors and exits. This ARP was designed to document actual circumstances in order to prepare a display for live a live-fire test scenario.

The researcher attempted to determine the flammability characteristics for the following items found in schools during the investigations. Items found were: paper, butcher paper, crepe paper, streamers, etc. In addition, the following items were determined to be in the classrooms:

- Glue, paste, etc.;
- plastic shower curtains, cotton sheets and burlap material;
- masking tape, Scotch® tape;
- hay bails, pine straw (these are used during Halloween);
- canvas;
- carpet squares;
- artwork on ordinary paper displayed.

The preceding list of materials was used during the field testing to determine if the materials were flammable. This information was important to the ARP because the determination could be made if the materials are flammable or not.

Questionnaire for Teachers and School Administrators

Based on the applied research project and the researcher's observations in several classrooms in Clinton, MS, a questionnaire was designed. To determine what hazards are being introduced into the classroom throughout the year, a questionnaire was designed to find the following: (a) the percentage of teachers and administrators that decorate; (b) how often are they decorated; (c) the frequency of the change-out of decorations; (d) what type of materials; and (e)

the configurations of the decorations. In addition, an idea of the awareness from the teachers and administration concerning these materials might be formed by this questionnaire. The researcher employed a survey website, Survey Monkey.com®, an online survey tool allowing the researcher to design a ten-question questionnaire distributed to teachers and administrators by e-mail. The survey period began in May, 2008 and ended in July, 2008. The answers were collected and analyzed to determine what particular materials are most often used within the classrooms, corridors and exits. A materials list was formulated based on the personal observations of the researcher and the answers from the questionnaire.

Questionnaire for Fire Marshals and Fire Chiefs

A questionnaire was designed for fire marshals and fire chiefs that inspected educational facilities. This questionnaire was designed to determine if this particular issue was only relative to Clinton, MS or was it a problem throughout the state or country. Determining the amount of schools that contained automatic sprinkler systems was very important because the limitations on the amount of decorations were determined by these criteria. The questionnaire addressed the response of several situations in which the researcher personally observed during inspections to determine how different authorities having jurisdiction (AHJ) would respond to the different fire code issues. The researcher employed a survey website, Survey Monkey.com®, which allowed the researcher to design a ten-question questionnaire. The questionnaire was distributed by e-mail primarily through the Mississippi Fire Chiefs Association members' list of fire marshals and fire chiefs that are responsible for inspections of educational facilities. The questionnaire period began in May and ended in July. The materials list for testing was formulated based on the personal observations of the researcher and the answers from the questionnaire.

Field Test of Materials Identified

What are the flammability characteristics for the materials in the classrooms?

The researcher attempted to determine if the materials found in school displays are combustible. The researcher visited selected schools observing various materials and configurations that were used in displays, decorations, and students' artwork or class work. An inventory of different materials was documented according to the researcher's personal observations while investigating schools and based upon the results of materials identified from the questionnaires. A personal communication with Dr. Vyto Babrauskas, a renowned fire researcher and developer of the cone calorimeter, was made through e-mail and the following responses are documented. Research questions: (1) Do you have any suggestions on obtaining the above listed items as to their (HRR) characteristics to determine if classroom decorations that are located in schools are a fire hazard and pose a risk to students and teachers? Babrauskas' response, "I'm sorry but none of these have been reported." (2) What are your thoughts on classroom decorations and/or artwork that are displayed in locations such as: exits in the classroom, across the ceiling, over windows, throughout the corridors, etc? Babrauskas' response, "Obviously only small and insignificant decorations ought to be permitted in the kind of locations that you list" (V. Babrauskas, personal communication, May 10, 2008). More research will need to be conducted in the future to determine the HRR of classrooms with displays and decorations of paper and the other materials listed. Babrauskas advised that the researcher should request that a fire testing facility may be able to help address the research.

Several requests were made to various testing laboratories equipped to burn materials and measure flammability and heat release rates of the identified products found in decorations and displays. Laboratories were contacted by the researcher through e-mail requesting tests to be

conducted to determine the heat release rates of common materials assembled within a decorative display configured for a classroom. The following laboratories were contacted: The Bureau of Alcohol, Tobacco, Firearms, and Explosives; the National Institute Standards Technology (NIST); and Underwriter's Laboratories. In response to the researcher's request Chief John L. Allen of the Bureau of Alcohol, Tobacco, Firearms, and Explosives, Fire Research Laboratory replied:

Although this does fit the mission of the Fire Research Laboratory we currently do not have the necessary capabilities or personnel in place to provide you the assistance you need. The Fire Research Laboratory has experienced severe personnel shortages recently. We are in the process of restructuring and hope to bring staffing levels up in the near future (J. Allen, personal communication, May 14, 2008).

In response to the researcher's request, W. Grosshandler, of the NIST Fire Research Division replied:

This is a worthwhile project; however we are unable to assist you directly. I can refer you to our publicly available online fire research library (<http://www.bfrl.nist.gov/fris/>). You might also check with the National Association of State Fire Marshals. They have had a long standing interest in the fire safety of our schools (W. Grosshandler, personal communication, November 11, 2007).

Underwriter's Laboratories Incorporated Senior Staff Engineer Bob Backstrom replied:

[I] fully understand the concern and applaud you for this project. Unfortunately we have not conducted heat release tests on the materials of interest....Various tests that can be performed to determine the HRR of materials & fuel packages including the Cone calorimeter (ASTM E1354) and various product calorimeter methods including a

standard currently under development by NFPA - NFPA 289. Although material level data is easily attained with the small scale cone test, a product level test would seem more useful given that the HRR of concern are the products in the classroom. It has been our experience that in addition to a material's fundamental fire properties, geometry, orientation, ventilation and end use are highly influential on a product's HRR (B. Backstrom, personal communication, June 6, 2008).

Backstrom was interested in the research and offered to pursue some experimentation and testing on various items under a product calorimeter. However tests were unable to be performed before the completion date of the ARP. Results may be available from the researcher at a later date.

NFPA 705 Field Flame Test

A basic test procedure was needed to determine the flammability of materials found in the displays, decorations, and artwork within the schools and churches. A search on the internet revealed NFPA 705 was an appropriate method to test materials. Determining the flame spread of the identified materials using the NFPA 705 field testing procedure is rudimentary (NFPA 705, Recommended Practice for a Field Flame Test for Textiles and Films, 2003 Edition). The field match test does not require the more rigorous laboratory testing methods incorporated into the small- or large-scale testing such as conditioning of specimen, reproducibility, and repeatability (NFPA 705, *Recommended Practice for a Field Flame Test for Textiles and Films*, 2003 Edition). NFPA 705 is a recommended practice for field flame testing of fabrics and plastic films, to determine their tendency to ignite and sustain burning. (Madrzykowski and Stroup, 2008) describe the test, "...as the most basic flammability test, which fire safety professionals

can use to determine if further testing is required” (p. 2-35). Therefore NFPA 705 was determined to be a satisfactory testing procedure for the ARP.

The testing procedure calls for a sample of material, at least (1/2 in. x 4 in.) to be exposed to an open flame from a common wood kitchen match for a maximum of 12 seconds. The flame should not extend the length of the sample or a distance of four inches from the bottom of the sample. There should not be more than two seconds of after flame on the sample, and materials that break or drip flaming particles on the floor below the sample would fail if the materials continue to burn after reaching the floor. If the test results in the ignition and rapid consumption of the sample, clearly the material is a flammability hazard (Madrzykowski and Stroup, 2008). Madrzykowski and Stroup cautioned that, “If the test results in no ignition, it does not mean that the material complies with applicable fire safety standards. The test results can be affected by environmental conditions, sample size, and flame exposure size. Additional testing is required to quantify the flammability of the material”. NFPA 705 details the procedures to accomplish a safe and successful field test: (NFPA 705, Section 1.1.1) claims that this recommended practice provides guidance to enforcement officials for the field application of an open flame to textiles and films that have been in use in the field or for which reliable laboratory data are not available. (Chapter 1, Administration). Section 1.3.1 claims that the recommendations apply to materials used in the interior of building, for protective outdoor coverings such as tarpaulins, tents, and for plastic films (with or without reinforcing or backing) used for decorative or other purposes inside buildings or as temporary or permanent enclosures for buildings under construction. Section 1.3.1.2, states the field test method has utility only when the authority having jurisdiction has no reliable data and, therefore, is forced to rely solely on the field test findings.

Procedures as defined by NFPA include the following (NFPA 705, 2003, see also Appendix D for a detailed format): Specimens should be samples removed from existing material and should be dry and be a minimum of 12.7 mm x 101.6 mm (1/2 in. x 4 in.). The fire exposure should be from a common wood kitchen match or source with equivalent flame properties to represent the open flame and be applied for 12 seconds.

Methods as defined by NFPA 705 are: The test should be performed in a draft-free and safe location free of other combustibles (Sec.4.3.1). If there was a draft during the test; it could cause the material to pass the flame test and therefore the results could be incorrect. This may allow some material to remain in a building that should have been removed. As stated in the Literature Review section of this ARP, The Cocoanut Grove Fire did have a report that the palm trees that were reported as flame proof. The NFPA report (1962) reported that a fire department inspector claimed that he had tested the artificial palms and that they were flameproof. The literature did not indicate by what method or standard the palms were tested. Certain circumstances [probably they were water soaked and polluted samples] prevented the investigation of the materials after the fire and therefore it was not proven that the decorations were flameproof. The sample should be suspended (preferably by means of a spring clip, tongs, or similar device) with the long axis vertical; the flame should be supplied to the center of the bottom edge, 12.7 mm (1/2 in.) above the bottom of the flame (Sec. 4.3.2). After 12 seconds of exposure, the match is to be removed gently away from the sample. The requirements for a sample to pass the test during the exposure are flaming should not spread over the complete length of the sample or, in the case of larger samples, in excess of 101.6 mm (4 in.) from the bottom of the sample. There should be not more than 2 seconds of after-flame; and any materials

that do break or drip flaming particles should be rejected if the materials continue to burn once they reach the floor.

In order that samples of decorations could be tested for flame spread, a field testing device was designed and built by the researcher using standard materials found in a hardware store. The researcher built the tester based on the procedures that are detailed in the NFPA 705 Standard (see Appendix A: photograph of the tester). One example of a commercially-made tester is available from Govmark Fire Laboratories http://www.govmark.com/tst_701tm1.htm.

The following materials were used to build a custom NFPA 705 testing device:

- Two (1/2" x 30") sections of steel plumbing pipe
- Two (1/2") 90 degree elbows
- One (1/2" x 10") section of steel plumbing pipe
- Two (1/2") floor flanges
- One sheet of 3/4" 24" x 30" plywood for the base
- Eight (3/4") wood screws
- One (1 1/4") alligator clip or battery clip to hold the match
- One paint can opener (optional for holding alligator clip) found at a paint store or <http://www.anthonyco.com/canopeners.html>
- One 1/4" minimum metal rod or strip to hold the ignition source
- One 1" electrical metallic tubing set screw coupling
- One #1 steel conduit hanger, with carriage bolt & nut, for 3/4" pipe
- Four to six curtain-clip rings (rings with alligator clips attached to hold material to test)

Based on the information gathered from the questionnaires and personal observations, the researcher assembled a list of materials that teachers “most often used” in classrooms to display school work. The researcher then attempted to field test the following samples from the list:

- Butcher Paper
- Construction Paper
- Burlap
- Felt
- Foam rubber sheets
- Poster board
- Crepe paper
- Pipe insulation (found on the legs of a space ship made from an outdoor tent)
- Copy paper
- Laminated paper

See (Appendix B) for the *NFPA 705 Materials Field Test Form* that was used to record specific data that was pertinent to this ARP. All materials tested were cut to a (4” x 11.5”) sample. Three samples were supplied for each material that was tested to obtain an average ignition time and full combustion time. One sample sheet of felt and burlap was treated with the over-the-counter fire proofing substance. For each sample, a standard wooden kitchen match was placed horizontally in the alligator clip and pivoted away approximately 90° from the suspended sample. The same brand of matches was used during the entire test. The kitchen match was lit and then pivoted back around to attempt to ignite the sample. The results were recorded on the appropriate form and any additional observations were noted.

Procedures for the Live Fire Demonstration

What are the implications when classroom decorations and configurations do not meet the fire code standards?

To determine this research question, a live-fire test would need to be conducted. After determining the configurations of the displays and decorations, the researcher purchased materials similar to materials found in the displays and decorations within the schools in Clinton, MS. The display that will be ignited for the demonstration was created from a list of materials that were identified as “materials most often used” from the questionnaire for teachers. This display was built according to a display that was actually found in one of the kindergarten classrooms.

The on-sight investigations, photographs, interviews, along with the data gathered from the questionnaire provided the researcher a list of materials used in decorations in a classroom, school, or church. This list of materials was then used to collect the actual materials at the Jackson Public Schools Teacher’s Resource Center (JPSTRC) in Jackson, Mississippi. This center provides teachers with a multitude of resources to assist with classroom projects and to upgrade technological and professional skills (JPSTRC, 2008, website ¶1). The materials purchased from the JPSTRC and local stores that sell schools supplies were used to test the flammability of the materials using the NFPA 705 standard and to recreate a specific prop (configuration of a tree) that was found in a school classroom. The researcher obtained burlap, felt samples, and fabric glue from Hancock Fabrics located in Brandon, MS. Butcher paper of various colors and poster board was purchased at the JPSTRC. Assorted construction paper was purchased from office supply stores and general merchandise or discount stores.

The display was created to mimic a tree in the forest; very similar to a tree that might be portrayed within a children's story book. The materials list included the following items that can be easily obtained to build the tree:

- One - 6' coat rack made of wood that broken. Teacher often use discarded items to save money such as a coat rack, shelves, tents, etc. (K. Burnside, personal communication, June 10, 2008).
- Butcher paper approximately 64' of both brown and green to form the trunk and leaves
- Ten sheets of (8.5" x 11") felt for the leaves
- 1 roll of Scotch® tape
- Staples and fabric glue
- Newspaper, approximately 40 full sheets of newsprint or three-days-worth of newspapers (bundled or wadded for stuffing branches and trunk)
- Three 36 in. wooden dowels for branches

The tree trunk was made from butcher paper and stuffed with loosely bundled newspaper wrapped around the hat rack. The leaves of the tree were fashioned from butcher paper and stuffed with bundled newspaper. In addition, paper and felt leaves were cut and glued randomly over the green butcher paper to allow for a three-dimensional appearance. The tree was made in one afternoon. The researcher attempted to make the tree at the estimated time and cost that an educator would spend on the project. The researcher made the tree in approximately ninety minutes and the total cost for the project was approximately \$10.00.

Permission was granted by the Mississippi Fire Academy to use their facilities to set up the fire test of the decorations. With the assistances from CFD personnel, the decorations were

installed against a wall as they would appear in a typical classroom setting. The decorations were to be ignited approximately 18 inches from the floor using a standard kitchen match (NFPA 705, 2003); much the same way that a child playing with matches may start a fire. The average height of electrical receptacles in Clinton, MS is about sixteen to eighteen inches above the floor; this allows the researcher to also recreate a small flame from a short circuit fire within an electrical receptacle. The display will be placed approximately two feet from an exit replicating actual displays discovered during personal observations by the researcher.

The building that the test was conducted in was made of reinforced concrete and brick masonry. Weather conditions were average for the time of year and ambient temperatures were ninety-degrees Fahrenheit. The display was attached to the masonry wall using masking and duct tape. This test was conducted by trained fire instructors in a controlled environment. A Class: A, B, C fire extinguisher was supplied by the fire academy. A video was made using a Sony™ 8 mm Digital Camera for documenting the testing of the burning display.

The live fire test of the display was important for this ARP because the researcher can better understand and demonstrate to administrators, educators, and parents how displays commonly found in the classrooms, corridors and exits in schools, churches, and places of assembly can quickly burn. The spread of flame, rate of consumption, fall down of materials, production of smoke and heat were observed during this live fire test. The video taken of this testing process may be used to educate firefighters, teachers and administrators concerning decorations and displays.

Assumptions and Limitations

Both tests: the NFPA 705 field flame test for individual materials found in displays and the live fire scenario of a displayed configuration were limited to observations by the researcher

and CFD personnel. Technical information was limited to the time that the sample materials take to burn; physical characteristics of the burning material; and color of smoke and flame intensity. Personal observations were important to the research project. Due to time constraints and minimal technical equipment, the researcher recommends that further testing from a fire research laboratory be conducted. Specific data such as HRR of materials could not be evaluated. Data from these tests could lead to more specific fire codes addressing the quantity and type of materials allowed to be used in decorations and displays in classrooms, corridors, and exits.

The live fire demonstration only involved one configured display. This demonstration was conducted to exhibit the flammable characteristics involving a display that often exists in classrooms, corridors, and exits. The researcher assumes that other objects within a typical classroom would also contribute to the rapid flame spread of the materials. This demonstration was isolated from other combustibles to demonstrate the intensity of a single display. Other factors would include the height of the ceiling which would cause the heat and smoke from the burning material to bank down and therefore contribute to ignition of other contents in a classroom. Other tests should be performed to demonstrate the same fire scenario under the protection of an automatic sprinkler system.

RESULTS

Results of the Questionnaire for Teachers and School Administrators

The questionnaire was formulated for teachers and administrators from all over the State of Mississippi. Forty-six participants answered six multiple choice questions relating to displays and decorations. The first multiple choice question of the applied research project questionnaire asked participants: *Do you use decorations in your classroom?* An explanation was given to the participants that decorations referred to items such as: paper decorations, artwork by students,

wall hangings, streamers, etc. Ninety-eight percent (45 participants) answered “yes” and only 2% (1 participant) responded “no”. This positive response along with the comments that were offered in the “comments” section of the first question indicates that teachers overwhelmingly believe in using decorations within their classrooms and corridors. Additional comments made in the questionnaire fell into five main categories; they were:

- “To enhance children’s self-esteem and to please administration and parents.”
- “To enhance the learning environment...”
- “To show students work so that they feel ownership of what they have completed”
- “To brighten up the classroom...to create an interesting environment...to make the room inviting...”
- “To allow students visuals to help them with multiplication problems, spelling and grammar...”

The second question was designed to determine how often the decorations were changed out; examples are given such as holidays, special events, school promotions, etc. This information may indicate the frequency of decorating which would give the authority having jurisdiction an idea of how often inspections should be performed throughout the school year. The second question asked participants: *When you do decorate your classroom, how often would you estimate that you change the themes or decorations throughout the school year?*

Two percent (1 participant) responded decorating (0 times per year); 26% (12 participants) responded as decorating (1 -3 times per year); 37% (17 participants) answered (4 – 6 times per year); 21% (12 participants) responded as decorating (7 to 9 times per year); 9% (4 participants) indicated that they decorate more than (10 times per year). Concerning the

frequency that decorations are changed out within the classroom, it can be concluded through the data gathered from the questionnaire that annual inspections for schools by (CFD) should be increased from annual inspections to quarterly inspections to enhance the safety of the children and adults that occupy the schools.

The third question asked participants: *What types of paper materials do you utilize in creating your classroom decorations?* Results included percentages shown in the right column indicating the percentage of the 46 participants that utilize various types of material. Types of paper materials reported being utilized in creating classroom decorations were selected as:

- Laminated paper 96%
- Construction paper 89%
- Butcher paper 85%
- Copy paper 67%
- Crepe paper 26%
- Other paper types 26%
- Newsprint paper 15%

Laminated paper, construction paper, and butcher paper were the most popular materials used by teachers according to the data. These products were observed by the researcher during the sight inspections. The information from the questionnaire and the personal observations are similar.

The fourth question asked participants: *What other types of materials have been used in decorating your classroom or hallway?* Types of other materials that are utilized in decorating the classroom or hallway:

- Christmas trees 93%

- Vines (natural material) 11%
- Hay/Wheat straw (baled) 11%
- Bamboo 7%
- Corn stalks 7%
- Hay/Wheat straw(loose, spread out) 7%
- Pine straw (loose) 7%
- Dried grass 7%
- Pine straw (baled) 4%

The fifth question asked participants: *Do you know if the decorations or furniture mentioned in this survey pose any type of fire hazard for the students or adults?* This question was designed to capture data for the applied research project in addressing what percentage of the participants are aware of any fire hazards presented by using decorations or furniture in the classroom. Surprisingly, nearly 48% of the participants were not sure concerning the possible fire hazards presented in the items. Nine percent answered “Yes”; 34% percent answered “No”; and nine percent answered “Maybe”.

The sixth question stated: *Would you say that decorations/furniture mentioned in this survey play an important part in setting the tone for the classroom and learning environment?* Ninety-one percent of the participants answered “Yes” that decoration/furnishing play an important role in setting the tone of the classroom. Only nine percent disagreed by answering “No”. This information supports the concept that decorations and furnishings in the classrooms, corridors, and exits support the learning environment and therefore teachers are not supportive of the traditional “institutionalized” classroom.

Results of the Questionnaire for Fire Marshals and Fire Chiefs

Results from the questionnaire are summarized from twelve responding fire marshals and fire chiefs in the local municipalities from around the Jackson-Metropolitan area. Approximately 92% or eleven of the twelve participants were fire chiefs with duties serving as the fire marshal and the AHJ. One participant served as the fire marshal.

The first question addressing the fire marshals and fire chiefs having authority having jurisdiction (AHJ) asked: *Does your department enforce fire codes in any (public or private) school or school district in your jurisdiction?* Nearly 92% of the respondents answered “yes” indicating that the schools and churches rely upon trained fire personnel to determine fire code compliance and to make recommendations concerning life safety issues. All twelve respondents indicated that either the IFC 2003 or the IFC 2006 was the code adopted by their respective local authority having jurisdiction.

The second question solicited information concerning sprinkler systems: *Are any of the school(s) in your jurisdiction equipped with a sprinkler system?* Surprisingly, 16.7% of the respondents are representing jurisdictions with automatic sprinkler systems in all schools within their respective jurisdiction. Fifty percent of the respondents have some schools that contain automatic sprinkler systems, 25% of the representatives do not have any sprinklers systems within their school. Eight percent of the respondents are not sure of the status of the automatic sprinkler systems. This information would allow the researcher to compare the City of Clinton, MS schools to the other surrounding cities. This information shows that most schools should not allow decorations and displays to be installed more than the 20% Rule within the various fire codes. Answer may be substantially different if the schools were sprinkled, therefore the 50% Rule could stand.

The third question asked: *Has your department ever addressed fire hazards relating to the amount of decorations or artwork in the classrooms or hallways?* This question was very important for the research in that it provided information on the degree of the problem in other jurisdictions. Sixty-seven percent of the fire chiefs and fire marshals that responded to the questionnaire replied “Yes”, and 25% replied “No”, with 8% were not sure. Comments for this particular question were noted as:

- “We have asked the schools to limit the decorations and also not leave them up over a week.”
- “We do not allow anything hanging from ceiling.”
- “We have informed the schools of the hazards, as well as day cares. An additional problem and probably the largest hazard would be Vacation Bible School.”
- “We have experienced excessive pine straw and hay bales for Halloween. We have required schools to remove certain items on occasion.”
- “As the Fire inspector in the City of Brandon, MS the main buildings are all concrete block building, it[s] not really a main concern to me in the sprinklered building. Now in those portable buildings, I have concerns in those buildings.”

The fourth question was designed to determine: *What are the three biggest concerns for the safety of the students in schools in order of importance?* The following were given as examples: shootings, bombs, fires, violence, terrorism, heavy fire load, specific hazards, flammable decorations, etc.) School violence, school shootings, and severe weather were the biggest concerns of the fire chiefs and fire marshals. Fires were a concern, but violence in school is the overriding issue according to the questionnaire. It should be mentioned, that a school shooting in Pearl, Mississippi occurred in October, 1997 when a student, Luke Woodham

shot and killed two students and wounded seven others. The city of Pearl, MS is within twenty-five miles of most of the respondents of the questionnaire. This may affect the results of this question.

The fifth question: *Do you have a policy addressing excessive decorations or artwork in schools?* This question revealed that only 25% of the fire chiefs and fire marshals that were questioned had a policy addressing decorations or artwork in school. Seventy-five percent of the AHJs did not have such a policy. The data indicates that the problem of decorations and displays is possibly not perceived as an immediate threat. The problem could be perceived by this information that decorations and displays are a “low risk” threat. Other immediate problems may overshadow issues such as decorating and displaying student work because the risk is not realized.

The sixth question revealed a percentage of the respondents that had discovered a particular listed material during their inspections. The question was: *What type of materials have you determined make up these decorations or artwork? (Choose all that apply).* The answers are listed as the percentage of fire chiefs or fire marshals to the material:

Artwork on Avg. Size sheet of paper	66.7%
Craft paper	66.7%
Hay Baled	58.3%
Hay Loose (manger scene)	58.3%
Butcher Paper	58.3%
Pine Straw Loose	41.7%
Cotton Cloth	41.7%
Egg Crate (Foam)	41.7%

Pine Straw Baled	33.3%
Corn Stalks	33.3%
Foam Rubber	33.3%
Plastic Sheeting	33.3%
Laminated Paper	25.0%
Shower Curtain	8.3%
Other	16.7%

Other materials listed by the respondents included: Crepe paper streamers hanging from the ceilings give a great deal of fire load; glue, tape, synthetic fabric, clay, wood, popsicle sticks, string, cardboard, styro-foam, and glass. Other hazards that have been found in classrooms that pose a fire hazard were listed on the questionnaire. The fire chiefs and fire marshals selected products that have been found within the classrooms. For example: Ten percent of the respondents (fire chiefs or fire marshals) have found lava lamps in the classrooms during inspections. The lava lamps may increase the chances of fire within the classroom. Other hazards are listed:

Halogen Lamps	50%
Hot Plates	60%
Extension cords	100%
Lava lamps	10%
Candles	70%
Other	20%

Finally the questionnaire asked respondents to select their likely response to certain fire hazards listed in the far left column. The list of fire hazards were compiled from personal observations made by the researcher during annual fire safety inspections in schools. The choices of responses include the following: (a) *Not a problem*. No comment is made and no hazard is noted; (b) *It may be an issue*. For example: It depends on the age of the students with the only action taken including a comment made to teacher or principal to point out a code violation; (c) *This issue is important*, a warning will be made to remove the hazard due to potential risk; (d) *This issue is extremely important*. Removal of the hazard should be done immediately. The results indicate that most fire chiefs and fire marshal see the hazards listed as a potential hazard but are not inclined to see any of the hazards as an immediate hazard that should be removed. Two exceptions were: (a) candles in the classroom, and (b) decorations covering or obscuring the fire alarm pull stations; these seem to pose as a direct threat to the code officials and received an immediate response. To view responses by the fire chiefs and fire marshals see (Appendix E).

The researcher tested the following most frequently used items in the classroom, corridors, and exits. The list of materials that were flame tested was based on items that were identified from information gathered from the literature review, ARP questionnaires, and personal observations as part of the decorations documented within schools or churches in Clinton, MS. The materials most frequently used were identified as:

- Burlap (both untreated and treated with a flame resistant treatment)
- Butcher Paper
- Construction paper
- Copy paper

- Crepe paper (flame resistant)
- Felt
- Foam rubber sheets
- Laminated paper
- Newsprint paper
- Poster board

All materials tested with the exception of the Flame Resistant Crepe paper and the treated Burlap burned immediately. The ignition of the materials occurred as soon as the match came into contact with the sample. The paper products burned the fastest and released the most energy. The field testing of the paper products correlated with the literature by DeHaan. DeHaan explained about the burning characteristics of paper (DeHaan, 2002):

Paper ignites easily...its surface temperature goes up rapidly, and it is thermally thin, allowing rapid heat saturation of its entire thickness...If exposed as a single sheet rather than a compressed in a stack, its large surface area promotes rapid burning, and a high, but brief heat release rate (HRR)...paper is easy to ignite and quickly raises the temperature of nearby combustibles to their ignition points and thus initiates a fast moving, very destructive fire.

During the test, the felt and foam rubber samples both burned slower than paper, but with great intensity. Both samples also dripped burning, molten material to the base of the tester. The residue that fell to the base of the tester continued burning until being extinguished by the researcher. The burlap product that was treated by the researcher with an over-the-counter flame proofing product did not ignite. The flame resistant crepe paper did char but would not sustain

combustion. A Test Results Sheet was created to record the events of the sample. To view the complete field test results of identified materials see (Appendix F).

Results of the Live Fire Demonstration

The materials purchased from the JPSTRC were used to test the flammability of the materials using the NFPA 705 standard and to recreate a specific tree display (configuration) that was found in a school classroom which was used in the live fire demonstration.

On July 29, 2008 the researcher conducted the live fire test at the Mississippi Fire Academy in the Drill Tower. The results of the live-fire test were convincing to the fire fighting professionals that were observing. The display was fully involved with fire within fifteen seconds. The display was entirely consumed in sixty seconds. Flames consumed the display and extended vertically to the ten-foot ceilings and then extended horizontally approximately four to six feet during the fire's greatest intensity. The debris from the fire fell to the floor with residual burning from the materials for nearly five minutes. The butcher paper backing attached to the wall remained burning for several minutes; the burn rate of the paper on the wall was slower due to the limited surface area exposed only one side to oxygen. The display was placed approximately two feet from an exit; the results revealed that the fire would prevent any possible evacuation towards the exit door for the students or teachers. In addition, it should be recognized that in a typical classroom, the adjacent combustible materials would have been ignited thus extending the vertical and horizontal flame spread. As DeHaan explained, "A pile of loosely crumpled sheets of paper is not only easy to ignite, but quickly raises the temperature of nearby combustibles to their ignition points and thus initiates a fast moving, very destructive fire." Dehaan described the free-burning stage that was similar to that observed during the live fire test by the researcher, "...as the point of the fire that the fire grows in intensity as more fuel in

involved...convection and radiation force the flames upward and outward igniting the surrounding fuels to begin to burn...as the fire grows and more products are ignited, it contributes a quantity of heat to the room at a rate influenced by the fuel present, its configuration, and how it was ignited.”

The results of this ARP’s live fire testing have proven that certain decorations if ignited may be devastating to a classroom of children and adults if this scenario actually occurred. The literature review included several large loss fires relating to the same possible scenario that indicate what could happen if certain circumstances exist. The actual video of the live fire test is available at the YouTube™ website <http://www.youtube.com/watch?v=ZEwrM-polkA>. The video is narrated by the researcher of this ARP.

LIMITATIONS OF THE APPLIED RESEARCH PROJECT

The field match test does not incorporate the more rigorous laboratory testing methods incorporated into the small- or large-scale testing such as conditioning of specimen, reproducibility, and repeatability. (NFPA 705, Recommended Practice for a Field Flame Test for Textiles and Films, 2003 Edition). Additional testing is recommended because financially, it is not feasible for a small fire department such as CFD to conduct such large scale tests to determine the (HRR) of decoration materials. CFD was limited in that we did not have the facilities or the technical measuring devices to scientifically study the classroom decorations fire.

DISCUSSION

From personal observations, the researcher determined the duty of regulating displays and decorations within the classroom is often a very difficult, emotional and unpopular situation for fire personnel, educators and other stakeholders. Teachers spend a great deal of personal time and money in an effort to brighten up the classroom only to find out that their intentions

lead to fire code violations and therefore are ordered to be removed. Fire personnel are burdened with the stigma of stifling creativity and education by enforcing fire code regulations. As Lackney (2008), commented, “It is unfortunate that student works and hands-on projects are considered fire hazards as doing so severely hampers the ability of teachers to teach using more innovative project-based and hands-on learning strategies.” (Lackney, personal communication, June 24, 2008).

Clinton Fire Department (CFD) has faced difficulty in enforcing fire codes that limit or prevent certain decorations and their configurations in the classrooms. This ARP helped determine specific problems that stood in the way of regulating the amount of decorations and displays in classrooms, corridors, and exits.

Three specific obstacles were identified through this ARP:

1. Teachers are trained and encouraged to promote student learning through interaction and enrichment activities in which decorations play a major part (Pattemore, 1974; Heyman, 1978; Wolff, 2008). Student learning is also encouraged through developing within the child a sense of ownership and synergy within the classroom. Oppenheim stated, “Such displays...including children’s work at different times [of the year], let children know that their artwork is valued and, in turn, create in them a sense of pride in their ways of expressing themselves” (Oppenheim, 1989). Fire personnel should be aware of an educator’s determination to maintain a creative learning environment. It will be a challenging for all fire chiefs and fire prevention officers to find a resolution addressing this issue.
2. Teachers and administrators of schools often do not understand the implications of flammable decorations displayed in the schools (Wolff, personal communication, May 14, 2008). The research from the teacher’s questionnaire indicated that the majority of teachers

are not aware that decorations often serve as fire hazards in classrooms. When the participants were asked if they were aware of any fire hazards presented by using decorations or furniture in the classroom, nearly 48% of the participants were not sure concerning the possible fire hazards presented in the items, 34% answered “No”, 9% answered “Maybe”, and 9% answered “Yes. The research thus indicates only 9% were aware that the decorations and displays in their classrooms may serve as fire hazards. This indicates that the majority of teachers are not aware of fire safety issues regarding decorations and displays.

3. Fire codes are not specifically clear concerning the location, type, quantity, and configurations allowed for the decorations or furnishings. Both fire service professionals and educators have a great deal of pressure to meet the expectations of city officials, administrators, parents, and students. As evidenced by the results from the questionnaire addressing fire marshals and fire chiefs, often they (fire personnel) don't see decorations and displays as an immediate hazard. Only when the fire protection devices are compromised, such as an obstructed pull station, do they feel that immediate action should be taken. It is often very frustrating and confusing on the teacher's behalf to experience the fire prevention authorities regulating what is or is not placed in their classroom. The research revealed through the questionnaire that most teachers do not understand the physical properties regarding the flammability of the materials used in decorations especially when the materials are excessive. Even though percentages of maximum materials on the wall of corridors are included in the fire codes reviewed; the configurations of decorations are not discussed. This is considered by the researcher as a critical component standing in the way of safety for the children and adults that occupy the classrooms.

Education

CFD must address the issues that prevent fire prevention methods from occurring. The fire service must recognize that educators have a responsibility to educate their students in the most efficient and safe manner. The literature review clearly indicates a shift from the “institutionalized” classroom setting to a “creative learning” setting (Heyman, 1978). Teachers are compelled to create areas within classrooms that contradict the traditional classroom...to a newer learning environment that offers relevancy and excitement (Wolff, 2008). Pattemore (1974) said that young children react to their surroundings, and that their attention span and awareness will be determined by the atmosphere of the classroom. Deighton appropriately addressed the problem of creating an environment conducive to needs of a child hungry for knowledge, while providing also for her a safe and healthy surrounding. “The physical environment is a highly significant factor in the child’s development.” “At the same time that appropriateness and adequacy of space receive major attention; unnecessary and preventable hazards [must be] anticipated and eliminated (Deighton, 1971).”

The discussion for this ARP is clear: Society is challenged to provide the best education for the students and at the same time provide the safest environment possible for them as well. Educators will need to understand the implications of the act of loading their classrooms with combustible and flammable materials. The laws of physics and fire dynamics are not going to cease in the classrooms, corridors, and exits because teachers want to decorate their rooms. Denying that a fire could occur in a classroom involving the decorations and displays is irresponsible. The research indicates that many current educational buildings today have the same dangers as they did in the past century, only three of the eleven schools in the City of Clinton, MS, 27%, contain automatic sprinkler systems. Fortunately, in 1998, Mayor Rosemary Aultman and the Board of Alderman passed an ordinance requiring automatic sprinkler systems

in all educational facilities. However, it will take decades to obtain full compliance with the sprinkler ordinance. This will occur as schools are closed down and new facilities are built.

This research indicates that prevention efforts in the form of frequent awareness programs will be necessary to combat this emerging issue.

The fire load within the schools has increased because of the shift from the institutional setting to the creative setting. This is evident when one considers the materials identified from the teacher's questionnaire. Plastic, pine straw, Christmas trees, hay, butcher paper, shower curtains, foam, etc., are increasingly being used to decorate the classrooms.

One should not discount the risk of fires being initiated by the children. There is an increased potential for fire in kindergarten and elementary schools involving children playing with or deliberately setting fires. There are nearly 14,700 fires reported annually on school property (USFA, 2007). Of these fires, 55% occur between the hours of 8 a.m. and 5 p.m.; the time frame that students occupy the schools. Data from NFIRS indicate that 25% of the fires in kindergarten and elementary schools are incendiary. In 2002 an estimated 13,900 structure fires were reported that were started by "children playing with fire" and items ignited by the children were mattresses, bedding, clothing, upholstery, furniture, trash, and paper (Hall, 2005). The U.S. Consumer Product Safety Commission claimed that children under five years old playing with lighters cause more than 5,000 residential fires a year resulting in over 150 deaths and more than 1,000 injuries (Consumer Product Safety Commission, n.d.). This ARP indicates that fires often occur in schools and many of the fires are the result of children playing with lighters.

The problem of allowing excessive flammable decorations in the classrooms, corridors and exits compounded with the high tendency of children to set fires will continue to go unnoticed until a tragedy occurs in one of our schools similar to The Our Lady of Angels Fire,

The Coconut Grove Fire, The Rhythm Night Club Fire and The Station Night Club Fire. Wolff, (2008) aptly stated, “Unless flammability issues are stressed in teacher education programs...the understanding of harm...will lay somewhat latent unless a situation brings the consequences to bear.”

RECOMMENDATIONS

Recommendations based on this ARP can be made to fire prevention personnel, teachers and administrators to encourage a safer classroom environment:

1. In determining what types, quantities, and configurations of decorations in classrooms, corridors, and exits are acceptable to meet fire code standards, the research has provided that:
 - (a) decorations should be made of flame resistant paper or be treated with an approved flame retardant;
 - (b) quantities should be limited to 20% of wall space in corridors according to the IFC 2006, and it is recommended that the classrooms are limited to 20% of wall space; and
 - (c) exits should remain clear with a minimum of a three to five feet clearance from all paper decorations. This will provide adequate space for sudden evacuation in case the decorations on the walls were ignited.
2. Administrators and educators should follow fire code regulations that address displays and decorations in classrooms, corridors, and exits. Furthermore, local authorities have the ability to provide guidance for local schools interpreting the local and national codes. Inspections should occur more frequently than only once a year.
3. More research should be performed concerning the subject of decorations and displays in schools. The percentages that are set forth within the fire codes should be researched to determine if the maximum allowed quantities are stringent enough to prevent a large loss of life and property.

4. The AHJ should encourage the installation of automatic sprinkler systems in all new and existing schools regardless of size and should support legislation that promotes sprinkler ordinances. The International Fire Code allows decorations in corridors to be increased from 20% for non-sprinkled buildings to 50% when the building is equipped with a fully automatic sprinkler system.
5. Stakeholders should work with architects and designers to explore ways to design flexible spaces, infrastructure, and materials such that teachers can create excitement in a learning area without compromising safety (P. Wolff, personal communication, May 14, 2008).
6. Innovative methods of teaching should be explored that bring “life” into the classroom experience while at the same time promote “fire-safe schools”. Examples are flame resistant paper and flame resistant applications for textiles. Purchasing departments, when available, should purchase only art rolls, crepe paper, and similar project materials that are certified to be non-flammable or fire resistive by the manufacturer (ASCIP, 2006). Fire retardant materials for use in displaying student work and decorations should be economically feasible possibly through grants, discounts, and donations from manufacturers.
7. Explore methods of decorating that are permanent or long lasting such as: (a) Painting walls instead of lining them with rolled butcher paper to change the color; (b) using plywood for decorations such as for trees, shrubs, and clouds; and (c) employing the use of creative lighting methods to change the colors of walls in rooms instead of using butcher paper to line the classroom walls.
8. School programs should be developed encouraging recognition or a designation for fire safety efforts, for example: “A Fire Safe School” designation. The designation is received

when the school meets certain fire safety criteria developed by a fire safety coalition (USFA, *Leading Community risk Reduction*, 2007).

9. The National Fire Academy and other leading authorities should focus on how to support new teaching and learning strategies while supporting fire safety issues so that fire departments across the country can work with and not against successful education methods.
10. Nationally recognized fire testing laboratories should research the implications of the various materials and configurations applied in the schools. The research indicated that often after a tragedy, there seems to be a “knee-jerk”, after-the-fact pattern of response to determine “what went wrong and how can it be prevented?” The Station Night Club Fire should be a reminder that a tragedy can still occur in the United States even in modern times. It would be a tragedy, if a fire broke out in one of Americas schools. The Our Lady of Angels Fire should be the catalyst to begin a campaign to prevent school fires.
11. Clinton Fire Department should develop a program designed for teachers that is presented while they are obtaining their education degree at the university level. This program could be based on research from the ARP and the video that was made of the live fire demonstration. A video addressing the decorations and displays for the schools in the community of Clinton should be similar to the video created for this ARP demonstrating the live fire scenario of classroom decorations ignited near an exit. The ARP video is located on the *YouTube Broadcast Yourself*TM web site at <http://www.youtube.com/watch?v=ZEwrM-polkA> . The video was made during the live fire demonstration for this ARP. This video along with an informational lesson plan should be made available to administrators and educators throughout the State each year before the beginning of school in the fall. The researcher believes that educators are not aware of the magnitude of a fire occurring within a

classroom. Perhaps, the video demonstration will serve as an appropriate method to encourage fire safety methods in the schools (S. Wolff, personal communication, 2008).

12. The Mississippi Department of Education should be included as a stakeholder as recommended by the *Leading Community Risk Reduction* Curriculum (NFPA, 2007; R. Washington, personal communication, Aug. 6, 2008).

13. A formal fire safety program for educators that could be formatted for the entire nation may serve as a future ARP.

In Summary this project focused on saving lives and preventing injuries in schools by addressing issues that are just beginning to surface in Clinton, MS. The results of this ARP support the USFA's operational objectives by reducing loss of life for people in the age group 14 years and below and for the age group of 65 and older. By reducing the risk of fires in schools, a reduction in the loss of firefighters, children, and adults can be realized. This project promotes within communities a comprehensive risk reduction plan by reducing the risks of fire in schools. The researcher designed this ARP based on the goals of the EFO course: *Leading Community Risk Reduction* at the National Fire Academy.

Recommendations are made to encourage future Executive Fire Officers to address the issues involving school fire safety. It is encouraging that some of the risk reduction issues regarding decorations are already addressed in some areas of the United States such as Denver, CO and Gwinnet County, GA, to name only a few. Unfortunately, there are many jurisdictions that fail to address the problem of decorations and displays in schools and, more than likely, will not until a large loss of life occurs.

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APPENDIX A

Illustration of the NFPA 705 Flammability Field Tester built to test the flammability of materials used in decorations and displays for the Applied Research Project

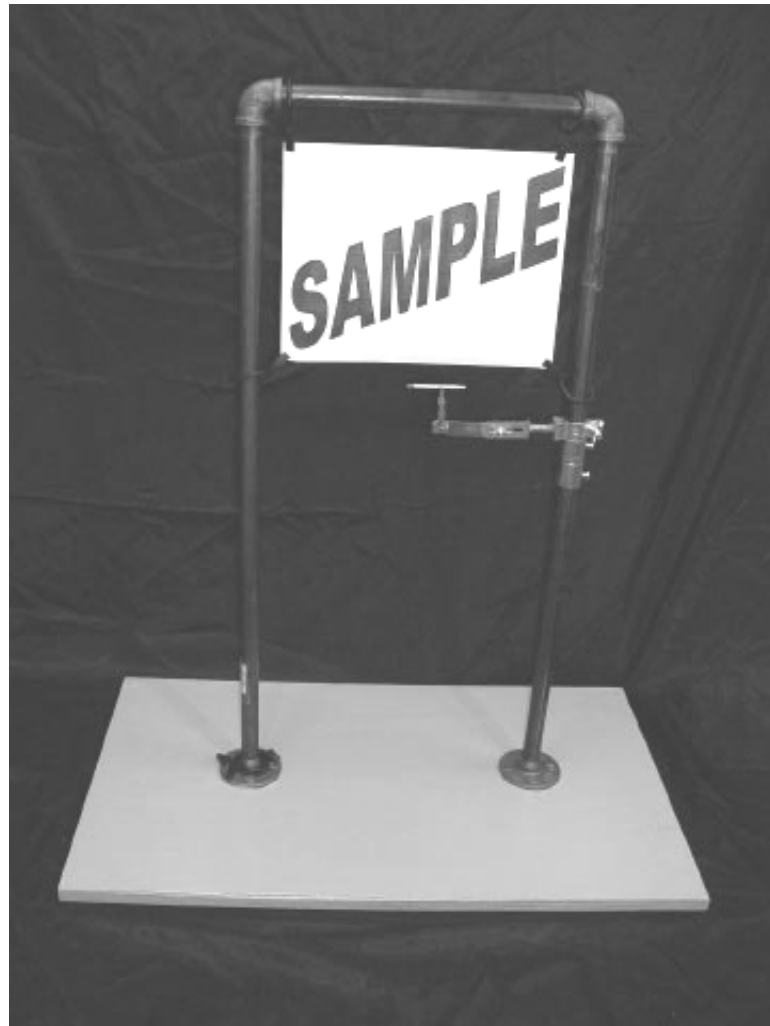


Figure 1.

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Format changes have been made to facilitate reproduction. While these research projects have been selected as outstanding, other NFA EFOP and APA format, style, and procedural issues may exist.

APPENDIX C

May 10, 2008

To Whom It May Concern:

I am working on an applied research project for the National Fire Academy as an Executive Fire Officer Candidate. The purpose of my research is to determine if the temporary holiday decorations that are used to encourage learning serve as a fire hazard. For instance, when a teacher designs and builds a tree made out of paper, cotton, plastic, burlap, etc., and then places this in the classroom, the fire load in the room has increased and may be a recipe for disaster if a fire should occur. We have established that this is not safe. Have you any information or comments on the heat release rates (HRR) for example to help me better understand the dangers with these decorations placed in the classroom. Will they overwhelm the sprinkler system? What will happen if these decorations are placed around the exits of the classrooms?

I will attach my research questions in order that you may better understand my goals.

The problem is that classroom decorations and furnishings in the classrooms have not been compared to fire safety code standards and therefore may serve as a fire hazard threatening the lives of children and adults due to the flammability of the decorative materials placed in classroom, exits, and corridors.

The purpose of this research is to compare classroom decorations in the Clinton Public Schools to fire safety code standards to determine compliance and to identify what implications exist when the codes are not in compliance. When this research is complete, Clinton Fire Department may have a better understanding concerning the safety of the decorations used in classrooms which may provide guidance for school teachers, administration, and parents on the use of acceptable materials and their configurations for the purpose of decorating the classroom, thus providing a safer classroom environment.

The research questions are (a) what are the materials that make up the decorations in the classrooms and their configurations, (b) what are the heat release rate (HRR) & flammability range ratings for the materials in the classrooms, (c) what standards apply to the decorations and configurations, (d) what are elementary school teachers taught with respect to fire safety in the classroom, (e) what are the attitudes of students, teachers, parents and administrators towards fire safety in the classroom, (f) why do teachers feel compelled to create areas within their classrooms that contradict the traditional classroom setting (g) how are the fire codes enforced in other jurisdictions concerning fire safety in the classroom, (h) what are the implications when classroom decorations do not meet the fire code?

In summary:

My research includes determining the heat release rate (HRR) or other information for the following items that I have found to be in classrooms for the purpose of decorating:

- Paper, butcher paper, crepe paper, streamers, etc
- Glue, Elmer's Glue®, paste, etc.
- Plastic shower curtains, cotton sheets and burlap material
- Masking tape, tape.
- Hay bails, pine straw (these are used during Halloween)
- Canvas,
- Carpet squares.
- Artwork configurations
- Other

Can you offer up to me any suggestions on obtaining the above listed items as to its HRR characteristics? This research may help me to determine if classroom decorations that are located in schools are a fire hazard and pose a risk to students and teachers. I would appreciate any information that you could supply. Thank you for your time.

Respectfully,

Barry Burnside, Fire Chief
Clinton Fire Department
Clinton, MS 39056
bburnside@clintonms.org

APPENDIX D

Procedures as defined by NFPA 705 (NFPA, 2003):

- Specimens should be samples removed from existing material. (Sec. 4.1.1.)
- Specimens should be dry and should be a minimum of 12.7 mm x 101.6 mm (1/2 in. x 4 in.) (Sec.4.1.2).
 1. Open Flame. The fire exposure should be from a common wood kitchen match or source with equivalent flame properties
 2. The flame should be applied for 12 seconds (Sec. 4.2.1).

Methods as defined by NFPA 705:

- The test should be performed in a draft-free and safe location free of other combustibles (Sec.4.3.1).
- The sample should be suspended (preferably by means of a spring clip, tongs, or similar device) with the long axis vertical, the flame supplied to the center of the bottom edge, and the bottom edge 12.7 mm (1/2 in.) above the bottom of the flame (Sec. 4.3.2).
- After 12 seconds of exposure, the match is to be removed gently away from the sample (Sec 4.3.3).
- Requirements. During the exposure, flaming should not spread over the complete length of the sample or, in the case of larger samples, in excess of 101.6 mm (4 in.) from the bottom of the sample (Sec 4.4).
- There should be not more than 2 seconds of after flame (Sec. 4.4.1).
- Materials that break or drip flaming particles should be rejected if the materials continue to burn after they reach the floor (Sec 4.4.2).

Format changes have been made to facilitate reproduction. While these research projects have been selected as outstanding, other NFA EFOP and APA format, style, and procedural issues may exist.

APPENDIX E

Questionnaire Responses by AHJ when fire safety issues are discovered in classrooms.				
Item Found in Classroom	(a) Not a problem (no comment, no hazard)	(b) May be an issue; for example: It depends on the age of the students (comment made to teacher or principal)	(c) Important (warning to remove due to potential hazard)	(d) Extremely important (remove hazard immediately)
Halogen lamp	0.0% (0)	58.3% (7)	33.3% (4)	8.3% (1)
Christmas trees (live)	8.3% (1)	16.7% (2)	41.7% (5)	33.3% (4)
Candles	0.0% (0)	8.3% (1)	33.3% (4)	58.3% (7)
Decorations (i.e., a room configured as a rain forest with vines and leaves made of butcher paper suspended from the ceiling throughout the room)	0.0% (0)	36.4% (4)	45.5% (5)	18.2% (2)
Excessive artwork in the hallways	0.0% (0)	33.3% (4)	66.7% (8)	0.0% (0)
Decorations on the door consisting of thin paper	8.3% (1)	58.3% (7)	33.3% (4)	0.0% (0)
Decorations on and around the door made of paper with cotton stuffing to simulate puffy clouds	0.0% (0)	50.0% (6)	41.7% (5)	8.3% (1)
Decorations covering a pull station for a fire alarm	0.0% (0)	0.0% (0)	8.3% (1)	91.7% (11)

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APPENDIX F

NFPA 701 Field Flammability Test for Materials Found in Schools

	<u>Material</u>	<u>Time (s) to ignition</u>	<u>Time (s) to full combustion</u>	<u>Pass/Fail</u>
1.	Burlap (TFR) ¹	NA	WNSC	Pass
2.	Butcher Paper	1<	10	Fail
3.	Const. Paper	1<	12	Fail
4.	Copy Paper	1	12	Fail
5.	Burlap	3	90	Fail
6.	Felt	3	90	Fail
7.	Foam Rubber sheets	4	120	Fail
8.	Laminated Paper	4	45	Fail
9.	Newsprint Paper	1<	10	Fail
10.	Poster Board	2	20	Fail
11.	Crepe Paper (FR) ²	NA	WNSC	Pass

Abbreviations:

(s) Seconds

(FR) Flame Resistant

(TFR) Treated with Fire Guard™

(WNSC) Will Not Sustain Combustion

¹Burlap (TFR) sample was treated with a commercial flame retardant fabric coating Fire Guard™ that meets NFPA 705 Standards.

²Crepe Paper (FR) sample was pretreated by the manufacturer and was packaged as a flame resistant product