

Flammable Liquids: What you don't know could get you burned!

The background of the slide is a composite image. On the left, there are several glass test tubes or vials containing liquids, illuminated by a warm, orange-red light. On the right, there is a grayscale chromatogram or spectral plot showing a sharp peak. The text is overlaid on the bottom right portion of the image.

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Key Topics

- International Fire Code (IFC)
Hazardous Materials Table
- Efforts to reduce flammable liquids



Wake Forest University Health Sciences

- 22 buildings
 - 3 lab buildings in dispute
 - Over 500 rooms used as labs
 - Roughly equal numbers of researchers on each floor
 - Two buildings had sprinklers and one did not

Summary of Buildings Containing Hazardous Materials

Building Description	1	2	3
Maximum Gross Footprint Area (sq ft)	33,700	22,000	20,000
Total Building Area (sq ft)	209,200	246,600	205,800
Height (stories)	7	12 (excluding penthouse)	12
First Story Above Grade	E Level	M Level	M Level
Automatic Sprinkler Protection	No	Yes	Yes

Background

- 2002 North Carolina adopted the International Code Council's (ICC) 2000 *International Fire Code* (IFC)
- 2003-2004 Local Fire Marshall's begin enforcement of IFC.

More Background

- Late 2003 – early 2004 Winston-Salem Fire Department inspects Wake Forest University Health Sciences after 7 year hiatus.
- Over 500 items of non-compliance three of which have to do with storage of flammable liquids

Citation

- Basically said you got too much flammable liquids in 3 lab buildings [How did they know – Labs had flammable liquids outside of cabinets]
- Count it and tell us how much
- Control to limits of table 2703.1.1(1) and Table 2703.8.3.2

TABLE 2703.1.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA
OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD §J.m

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible liquid ^{a,i}	II	H-2 or H-3	Not Applicable	120 ^{d,e}	Not Applicable	Not Applicable	120 ^d	Not Applicable	Not Applicable	30 ^d
	IIIA IIIB	H-2 or H-3		330 ^{d,e} 13,200 ^{d,f}			330 ^d 13,200 ^{d,f}			80 ^d 3,300 ^d
Combustible fiber	Loose	H-3	(100)	Not Applicable	Not Applicable	(100)	Not Applicable	Not Applicable	(20)	Not Applicable
	Baled		(1,000)			(1,000)			(200)	
Cryogenic, Flammable	Not Applicable	H-2	Not Applicable	45 ^d	Not Applicable	Not Applicable	45 ^d	Not Applicable	Not Applicable	10 ^d
Consumer Fireworks (Class C Common)	1.4G	H-3	125 ^{d,e,i}	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Cryogenic Oxidizing	Not Applicable	H-3	Not Applicable	45 ^d	Not Applicable	Not Applicable	45 ^d	Not Applicable	Not Applicable	10 ^d

Flammable liquid	IA	H-2	Not Applicable	30..	Not Applicable	Not Applicable	30.	Not Applicable	Not Applicable	10.
	IB	or		60..			60.			15.
	IC	H-3		90..			90.			20.
Combination Flammable Liquid (IA, IB, IC)	Not Applicable	H-2 or H-3	Not Applicable	120... 	Not Applicable	Not Applicable	120..	Not Applicable	Not Applicable	30..

**TABLE 2703.8.3.2
DESIGN AND NUMBER OF CONTROL AREAS**

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL CONTROL AREA ^a	NUMBER OF CONTROL AREA AREAS PER FLOOR ^b	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS HOURS ^c
Above grade	Higher than 9	5	1	0
	7-9	5	2	0
	6	12.5	2	0
	5	12.5	2	0
	4	12.5	2	0
	3	50	2	1
	2	75	3	1
1	100	4	1	
Below grade	1	75	3	1
	2	50	2	1
	Lower than 2	Not Applicable	Not Applicable	Not Applicable

Allowable Quantities without sprinklers

120 GA 120 GA 120 GA 120 GA

1st
Floor



Add Flammable Cabinets –
Double allowable quantities

↑ 2x

				12 GA	10 th Floor and up
			12 GA	12 GA	7 th – 9 th Floor
		30 GA	30 GA	30 GA	4 th – 6 th Floors
		120 GA	120 GA	120 GA	3 rd Floor
	180 GA	180 GA	180 GA	180 GA	2 nd Floor
240 GA	240 GA	240 GA	240 GA	240 GA	1 st Floor

e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets, or exhausted enclosures. Where Note d also applies, the increase for both notes shall be applied accumulatively.

Add Sprinklers to the Flammable Cabinets – Double allowable quantities

↑ 2x

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

			24 GA	10 th Floor and up
		24 GA	24 GA	7 th – 9 th Floor
		60 GA	60 GA	4 th – 6 th Floors
			240 GA	3 rd Floor
	360 GA	360 GA	360 GA	2 nd Floor
480 GA	480 GA	480 GA	480 GA	1 st Floor

Building 1 Exceeded IFC

- Class I flammable liquids (4th, 5th, 6th, and 7th Floors),
- Class II combustible liquids (4th and 5th Floors),
- Compressed oxidizing gases (Ground, 5th, 6th, and 7th Floors), and
- Flammable solids (6th and 7th Floors).

Building 1 facts

- Built in three sections
- Heavy concrete construction
- Low ceilings
- HVAC below ceiling in each space
- Upper floors had microbiology labs and anatomical sciences (i.e., lots of flammable liquids)

Mid 2004

- Hire Fire Protection Engineer
- Conduct Inventory of Flammable Liquids
- FPE develops alternate compliance strategy utilizing NFPA 45 (Standard on Fire Protection for Laboratories Using Chemicals)
- Still have to reduce flammable liquids to meet NFPA 45

Spring 2005

- Ask Authority Having Jurisdiction for a waiver utilizing NFPA 45
- Fire Department would only accept a solution that met the levels specified in NC Fire Code (IFC) tables
- Fire department wants systems to limit amount of flammable liquids.

Summer 2005

- Attempt to reduce flammable liquids using a voluntary amnesty – No success
- Start working with vendors to define a material control system.
- Ask researchers to complete weekly flammable liquids usage form

Fall 2005

- WS Fire Marshall loses patience. Sends letter to WFUHS threatening to change classification of lab buildings to hazard class.
- Corporate Law Department says if you can't meet NC Fire Code meet NFPA 45 until you can get into compliance
- Present alternatives to WFUHS leadership

Late 2005

- Enforced Amnesty
- All labs
 - Reduce amount of flammable in each lab to 4 gallons
 - Provide safety cans for chemical waste
- Labs without flammable cabinets:
 - Provide labs with 4 gallon flammable cabinets
- Labs with flammable cabinets:
 - Reduce quantities
- Recount as reduce flammable liquids
 - Still over limits on upper floors



2006

- Define scope of project
- Decide on chemical inventory software
 - Monitor limits by floor and PI
 - Calculate floor loading for flammables
 - Notify by email when limits are breached
 - Count empty bottles as waste
- Contract for business functions to manage flammable liquids
 - Storeroom function
 - Inventory function
 - Discipline
- Redefine scope of project

Where are they now

- According Robert Owens (WS Fire Marshall) “ The University hired a company to manage flammable liquids”
- Further details – David A. Brown, Director EH&S WFUHS