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His responsibilities at NFPA include management of the Marine Chemist Training and Certification Program and NFPA activities dealing with marine fire protection. He also serves as Staff Liaison to committees dealing with safeguards at dust hazard process locations, explosives, industrial fire brigades, explosion protection systems including venting of deflagrations, and pyrotechnics and special effects.

He developed and instructs NFPA's confined space safety training courses offered to both the maritime and general industry. He serves as the Executive Secretary to the Industrial Fire Protection Section of the NFPA. He has served on Department of Transportation and Department of Labor-OSHA advisory committees representing NFPA.

Before starting work with NFPA, Guy served as an officer in the US Coast Guard. His assignments include service aboard ship, in research and development and in the Coast Guard's Eighth District (Gulf Coast). He developed a service-wide confined space safety program and an occupational safety and health program for Coast Guard marine safety personnel in the Eighth District.

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NFPA 704 and Flammability Hazards Overview

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Overview

- NFPA 704 – What is it?
 - Scope and Purpose
 - Objectives
 - Application
- Flammability hazard characteristics
- Hazard Identification
 - Classification and Hazard Rating System
- Questions and comments

NFPA 704 Scope and Purpose

- Scope – addresses the health, flammability, instability, and related hazards presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies
- Purpose – provide a simple, readily recognized and easily understood system of markings that provides a general idea of the hazards and severity as they relate to emergency response

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NFPA 704 Objectives

- Provide an appropriate signal or alert
- Assist in planning for effective fire and emergency control operations, including cleanup
- Assist designated personnel in hazard evaluation
- Provide basic information to emergency response personnel essential to decisions on evacuation and emergency control procedures, including fire-fighting tactics

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NFPA 704 Application

- Applies to industrial, commercial, and institutional facilities that manufacture, process, use, or store hazardous materials
- Does not apply to transportation or use by the general public
- Does not apply to occupational exposure
- Does not apply to explosives and blasting agents
- Does not apply to only chronic hazards
- Does not apply to teratogens, mutagens, oncagens

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NFPA 704 Placard



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Classification System Objectives

- Identifies the hazards of materials under emergency conditions
- Establishes a relative hazard severity scale
- Utilizes a widely accepted system
- Identifies hazards uniformly and in simple, readily recognized format

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Hazard Categories - Brief

- Health
 - Acute not chronic
 - LC₅₀ and LD₅₀ data give quantitative basis
- Flammability
 - Flash point and boiling point
- Instability
 - Previously “reactivity”
- Special Hazards
 - Only two are recognized – ~~W~~ and OX
 - Others incorporated by users

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Flammability Hazard Characteristics

- Flash Point
- Boiling Point
- Flammability limits
 - Lower flammability limit (LFL)
 - Upper flammability limit (UFL)

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Flash Point

- The minimum temperature at which a liquid or a solid emits vapor sufficient to form an ignitable mixture with air near the surface of the liquid or the solid.
 - A direct measure of a liquid's volatility, its tendency to vaporize
 - The lower the flash point, the greater the volatility and the greater the risk of fire

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Boiling Point

- The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure.
 - For purposes of defining the boiling point, atmospheric pressure shall be considered to be 14.7 psia (760 mm Hg).
 - For mixtures that do not have a constant boiling point, the 20 percent evaporated point of a distillation performed in accordance with ASTM D 86, Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure, shall be considered to be the boiling point.

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Flammable Limits

- The minimum and maximum concentration of fuel vapor or gas in a fuel vapor or gas/gaseous oxidant mixture (usually expressed as percent by volume) defining the concentration range (flammable or explosive range) over which propagation of flame will occur on contact with an ignition source.
 - The minimum concentration is known as the lower flammable limit (LFL) or the lower explosive limit (LEL).
 - The maximum concentration is known as the upper flammable limit (UFL) or the upper explosive limit (UEL).

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Variables Affecting Characteristics

- Oxygen-enriched atmosphere
 - Properties based upon normal air
 - Flash point and flammable limits change when oxygen concentrations increase above normal
- Release occurs under pressure
 - Tendency to produce mists or aerosols, which exhibit different flammability behavior
- Mixtures

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Flammability Hazards – Video Clip



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Fire at Gasoline Pump

- **Charge Generation**
 - Girl slides across car seat, pulls on sweater.
- **Charge Accumulation**
 - Charge accumulates on girl's body.
- **Static Electricity Discharge**
 - Girl touches metal handle of gas pump filling nozzle.
- **100% LEL Atmosphere**
 - Area around fueling point is in flammable range.



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Chapter 4 – Assignment of Ratings

- Limiting factors
 - Ratings may differ for same material in different forms
- Rating process where more than one chemical is present
 - Composite method
 - Individual method
 - Composite-Individual Combined Method

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Chapter 6 – Flammability Hazards

- Hazard degree
 - 4 represents materials that rapidly or completely vaporize or that burn readily
 - 3 represents liquids and solids that can be ignited under almost all conditions
 - 2 represents materials that must be moderately heated or exposed to high temperatures before ignition can occur
 - 1 represents materials that must be preheated before ignition can occur
 - 0 represents materials that will not burn under typical fire conditions

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Flammable Liquid

- A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further divided into a group of Class I liquids.
 - Class IA. Liquids having a closed cup flash point below 73°F (23°C) and having a boiling point below 100°F (38°C)
 - Class IB. Liquids having a closed cup flash point below 73°F (23°C) and having a boiling point above 100°F (38°C)
 - Class IC. Liquids having a closed cup flash point at or above 73°F (23°C) and below 100°F (38°C)

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Combustible Liquid

- A liquid having a closed cup flash point at or above 100°F (38°C).
 - Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C)
 - Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C)
 - Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C)

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NFPA 30 & NFPA 704 Correlation

NFPA 30 Class	Description	NFPA 704 Rating
IA	FP < 73°F and BP < 100°F	4
IB	FP < 73°F and BP > 100°F	3
IC	FP ≥ 73°F and < 100°F	3
II	FP ≥ 100°F and < 140°F	2
IIIA	FP ≥ 140°F and < 200°F	2
IIIB	FP ≥ 200°F	1

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NFPA 704 Flammability Rating 4

Degree of hazard	Criteria
Materials that rapidly or completely vaporize	Flammable gases
Readily dispersed in air and burn readily	Flammable cryogenic materials
	Liquid with flash point below 73 F and boiling point below 100 F
	Materials that ignite spontaneously when exposed to air
	Solids containing greater than 0.5% by weight of solvent are rated by closed cup flash point of the solvent

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NFPA 704 Flammability Rating 3

Degree of hazard	Criteria
Liquids and solids that can be readily ignited under almost all temperature conditions	Liquids with flash point below 73 F and boiling point at or above 100 F and liquids with flash point at or above 73 F but below 100 F
	Finely divided solids, typically less than 75 microns; elevated risk
	Materials that burn with extreme rapidity due to self-contained oxygen (organic peroxides)
	Solids containing greater than 0.5% by weight of solvent are rated by closed cup flash point of the solvent

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NFPA 704 Flammability Rating 2

Degree of hazard	Criteria
Materials that must be moderately heated or exposed to relatively high ambient temperatures	Liquids having a flash point at or above 100 F and below 200F
	Finely divided solids less than 420 microns; ordinary risk of dust cloud formation
	Solid materials in a flake, fibrous, or shredded form – flash fire
	Solids and semisolids that readily give off flammable vapors
	Solids containing greater than 0.5% by weight of solvent are rated by closed cup flash point of the solvent

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NFPA 704 Flammability Rating 1

Degree of hazard	Criteria
Materials that must be preheated before ignition can occur	Materials that will burn in air when exposed to temperature of 1500 F for period of 5 minutes
	Liquids, solids, and semisolids with flash point at or above 200 F
	Combustible pellets, powders, or granules greater than 420 microns
	Most ordinary combustible materials
	Solids containing greater than 0.5% by weight of solvent are rated by closed cup flash point of the solvent

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NFPA 704 Flammability Rating 0

Degree of hazard	Criteria
Materials that will not burn under typical fire conditions	Materials that will not burn in air when exposed to temperature of 1500 F for period of 5 minutes

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NFPA 704 Flammability Ratings

- Gases
 - Acetylene
 - Ethylene
 - Hydrogen
 - Methane
 - Propane
- All flammability rating of 4
- NFPA 30 Class 1A Liquids, NFPA 704 "4"
 - N-Butane
 - Ethylene Oxide
 - Propylene Oxide
- NFPA 30 Class 1B Liquids, NFPA 704 "3"
 - Cyclohexane
 - Gasoline, 100 octane
- NFPA 30 Class II, IIIA Liquids, NFPA 704 "2"
 - Jet Fuel, JP-5

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Summary

- NFPA 704 incorporates key flammability properties into hazard assessment tool
 - Primary audience is emergency responder
 - Used extensively in hazard assessment and training for emergency planning
 - Used in fire and building codes to establish hazard thresholds for additional protection
- Flammability properties can change in actual scenarios
- Hazard ratings only provide relative hazard severity

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Any Questions ?



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