ARKANSAS BIOSCIENCES INSTITUTE

SAFETY INFORMATION

BINDER 2: COMPLEMENT

October 2014.

ABI Shelter

(Strong Storm or Tornado)

When the tornado sirens sound or if you feel threatened by stormy weather while being at ABI, the designated safest place in the building is located on the first floor: hallway between **CATALYST** and **Room 129**.

The blue arrows show the pathway to this shelter in **page 2**.

ABI Emergency Evacuation Routes

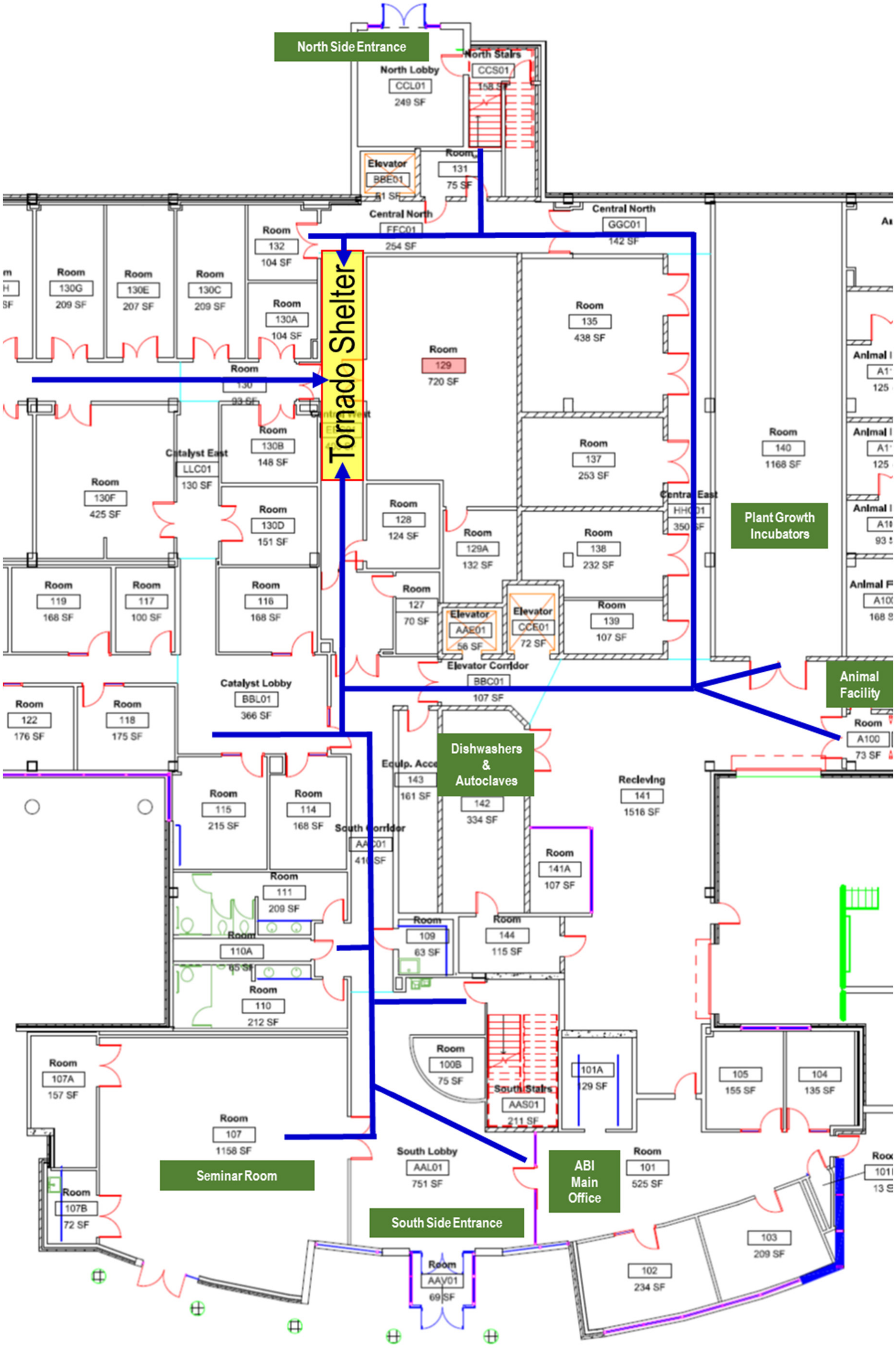
1. All ABI members must be familiar with the evacuation routes in the building. These are indicated in **pages 3-6**.

2. In an emergency, avoid taking the elevators but following the exit signs and using the stairs instead.

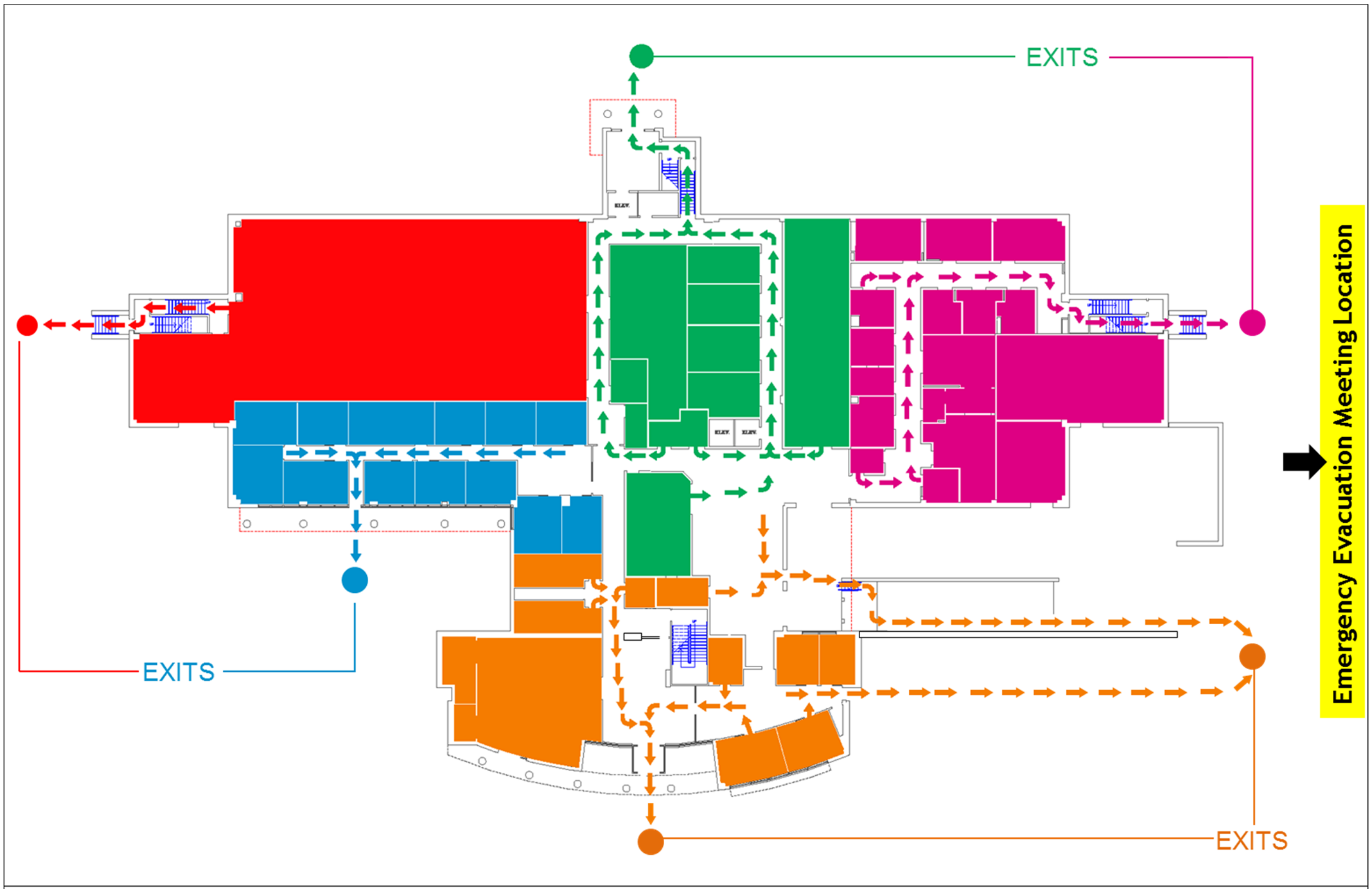
3. After evacuating the building, the d**esignated meeting point is located on the East Parking Lot S-9C**, at a distance of one and a half times the height of the building; this is the minimal distance the emergency officials will need to work (see **page 3**).

ABI, October 14th, 2014.

ABI First Floor: Stormy Weather Shelter



ABI First Floor Evacuation Plan



Arkansas Biosciences Institute Building

First Floor Evacuation Plan

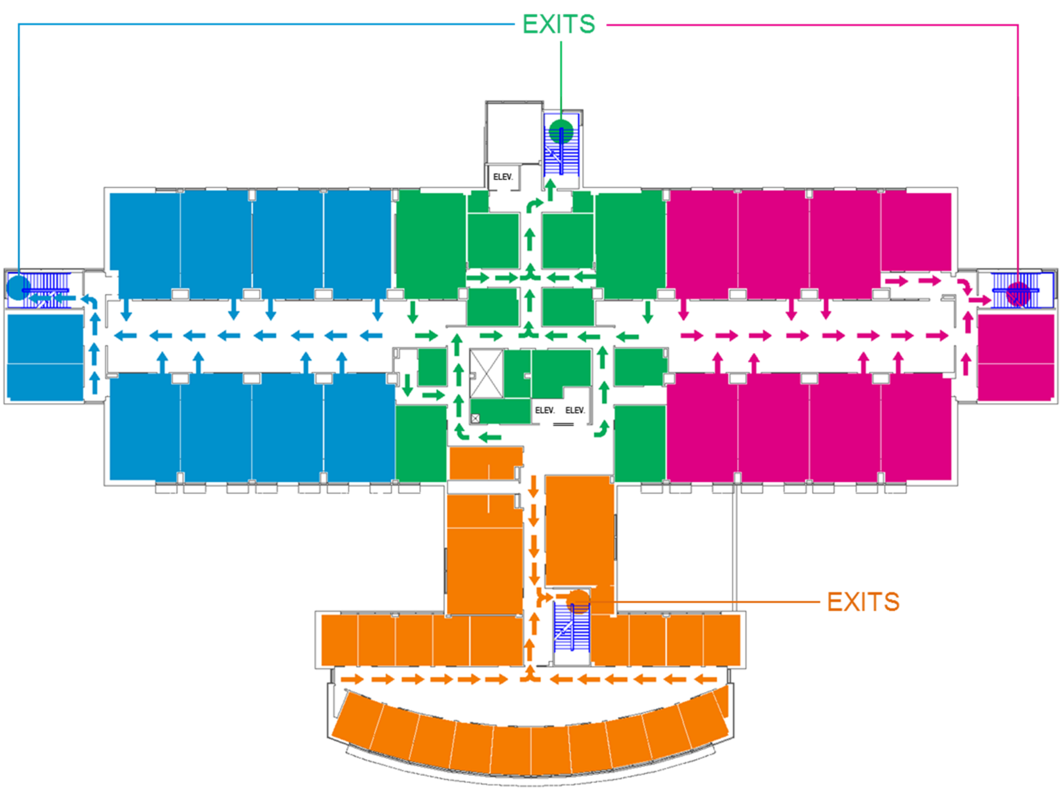
504 University Loop East, Jonesboro, AR 72401

Emergency Evacuation Meeting Location: East Parking Lot S-9C

ARKANSAS STATE
UNIVERSITY

January 2014.

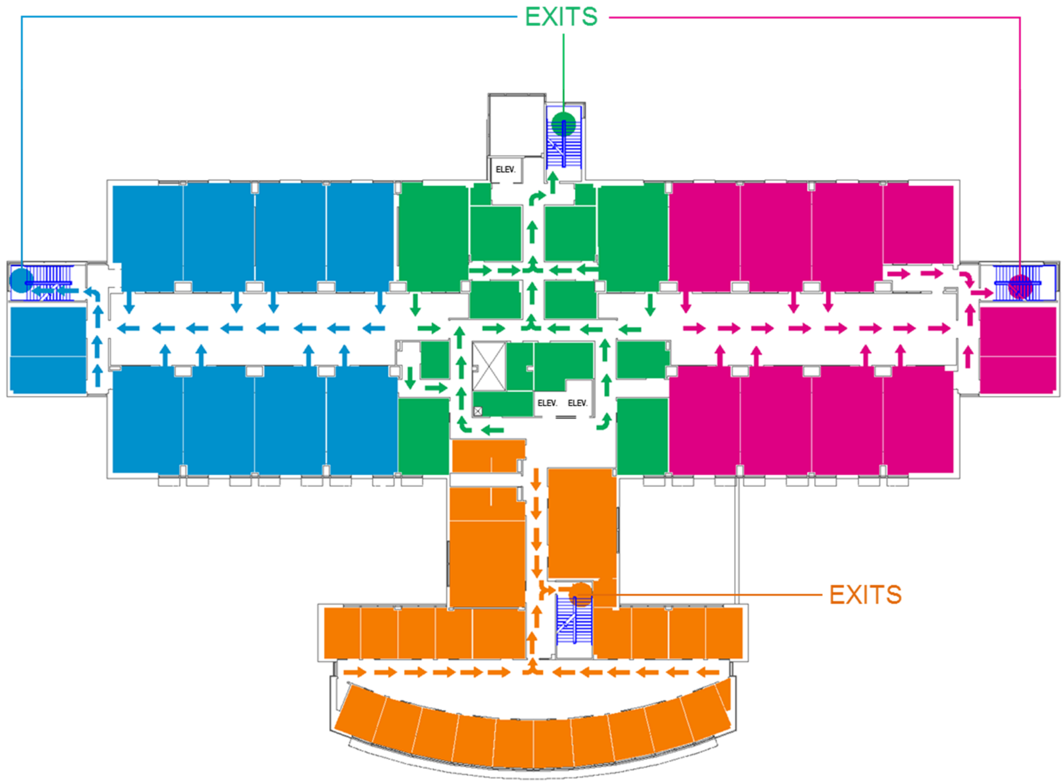
ABI Second Floor Evacuation Plan



Arkansas Biosciences Institute Building
Second Floor Evacuation Plan
504 University Loop East, Jonesboro, AR 72401
Emergency Evacuation Meeting Location: East Parking Lot S-9C

January 2014.

ABI Third Floor Evacuation Plan



Arkansas Biosciences Institute Building
Third Floor Evacuation Plan

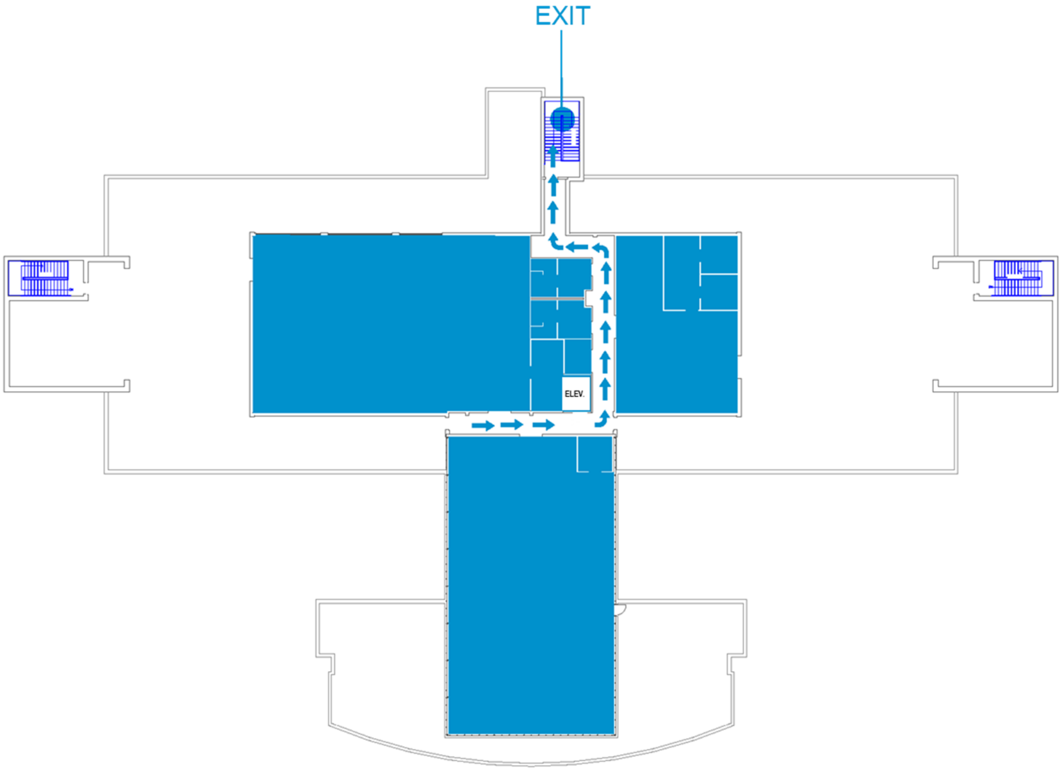
504 University Loop East, Jonesboro, AR 72401

Emergency Evacuation Meeting Location: East Parking Lot S-9C

ARKANSAS STATE UNIVERSITY

January 2014.

ABI Fourth Floor Evacuation Plan



Arkansas Biosciences Institute Building
Fourth Floor Evacuation Plan
504 University Loop East, Jonesboro, AR 72401
Emergency Evacuation Meeting Location: East Parking Lot S-9C

ARKANSAS STATE UNIVERSITY

January 2014.

Hazardous Materials Spill Kit

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1. This kit is available in each laboratory at ABI.

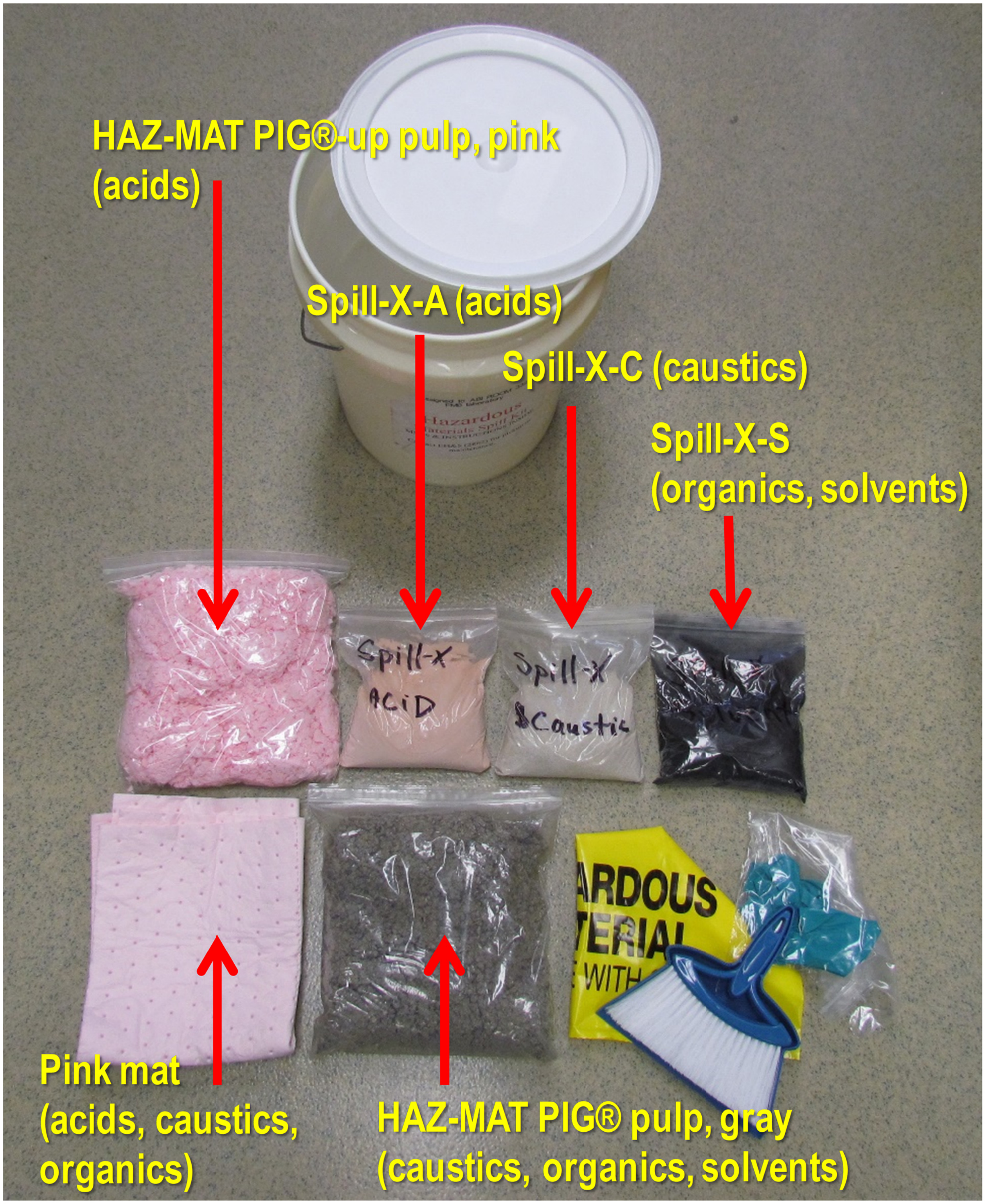
2. The container is located under the bench closest to the laboratory door next to the offices area.

3. Instructions on how to use it as well as Material Safety Data Sheets (MSDS) of the materials contained in this kit are in the following pages.

4. Summarized content:

    a. **Pink pulp** (HAZ-MAT PIG®-up pulp). Absorbs a wide range of acids, (e.g., 98% sulfuric acid).
    b. **Pink powder** (ANSUL® Spill-X-**A**®). For mineral and organic acid spills (acids including sulfuric, hydrochloric, acetic, nitric, phosphoric, perchloric, formic, hydrofluoric, adipic).
    c. **Gray/tan powder** (ANSUL® Spill-X-**C**®). For caustic and organic bases (caustics chemicals such as sodium hydroxide, ammonium hydroxide, potassium hydroxide, hydrazine).
    d. **Black powder** (ANSUL® Spill-X-**S**®). For hydrocarbon solvents and fuel spills.
    e. **Pink mat**. For acids, caustics, and organics.
    f. **Gray pulp** (HAZ-MAT PIG® pulp gray). For caustic, organic/solvent spills.

ABI, October 14th, 2014.



HAZ-MAT PIG®-up pulp, pink (acids)

Spill-X-A (acids)

Spill-X-C (caustics)

Spill-X-S (organics, solvents)

Pink mat (acids, caustics, organics)

HAZ-MAT PIG® pulp, gray (caustics, organics, solvents)

Hazardous Materials Spill Kit Instructions:

Read all instructions prior to use!

Always use appropriate personal protective equipment when using this kit. This kit is for small manageable laboratory Spills. Refer to MSDS of spilled product for more information. Refer to MSDS (included with kit) for spill agents. **Call 3803 for elemental mercury spills. For each type of spill choose one application.**

For Acid Spills: **Spill-X-A (pink powder)** Mixture of Magnesium Oxide, Sodium Carbonate & Clay**, Haz-Mat-Pig Pulp (pink), or Pink Mats**

- **Spill-X-A**: Cover spilled acid with Spill-X-A (pink) powder. This neutralizes the acid. A reaction will occur. When the reaction stops, scrape up damp powder and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Haz-Mat-Pig Pulp**: Cover spilled acid with pink pulp. This neutralizes the acid. Scrape up damp pulp and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Pink Mats**: Place pink mat over spilled acid. This neutralizes the acid. Scrape up damp powder and place in hazardous materials bag. Call EH&C (3803) for pickup.

For Caustic Spills: **Spill-X-C (gray powder) Mixture of Fumaric Acid & Clay, Pig Pulp (gray), or Pink Mats**

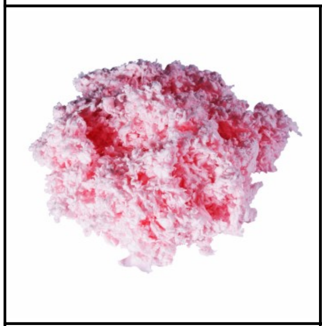
- **Spill-X-C**: Cover spilled liquid caustic with Spill-X-C gray powder. This neutralizes the base. A reaction will occur. When reaction stops, scrape up damp powder and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Pig Pulp**: Cover spilled liquid caustic with gray pulp. Scrape up damp pulp and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Pink Mats**: Place pink mat over spilled caustic liquids. Pick up damp mats and place in hazardous materials bag. Call EH&C (3803) for pickup.

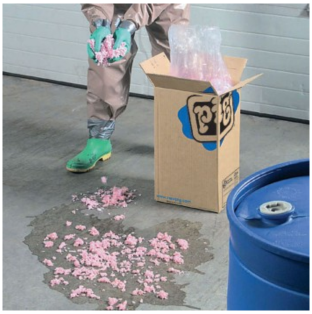
For Organic/Solvent Spills: **Spill-X-S (black) Activated Charcoal, Pig Pulp (gray) or Pink Mats**

- **Spill-X-S:** Circle spilled organic/solvent with Spill-X-S Black powder. Then cover spill with Spill-X-S Black powder. **Do not use with ORGANIC PEROXIDES OR HYDRAZINE COMPOUNDS!** Scrape up damp powder and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Pig Pulp**: Cover spilled organic/solvent with gray pulp. A reaction may occur. When reaction stops, scrape up damp pulp and place in hazardous materials bag. Call EH&C (3803) for pickup.
- **Pink Mats**: Place pink mat over spilled organic/solvent. Pick up damp mats and place in hazardous materials bag. Call EH&C (3803) for pickup.

PIG® HazMat Chemical Absorbent Pulp

#HA8010 - Absorbs Acids, Bases & Unknowns • 1 - 5 lb. Bag





Loose absorbent can be sprinkled onto spills or spread into tight spaces for versatile cleanup of acids, bases and unknown liquids.

- Packing the power of PIG HazMat in a loose absorbent, this pulp can be used in a variety of applications
- Absorbs the widest range of acids, bases and unknown liquids, even those with high concentrations like 98% sulfuric acid and 30% sodium hydroxide
- Chemical-resistant pulp won't degrade or cause a dangerous reaction upon contact with corrosive spills
- Ideal for difficult to reach spaces or final cleanup
- Absorbs and retains most acids, bases and unknown liquids
- Pink color is easily distinguishable to assure workers use the correct pulp during a spill emergency
- Can be incinerated after use to reduce waste

Always in stock. Ships within 24 hours.

Pricing (based on quantity)

1-4	5-11	12+
$55.00	$52.00	$49.00

HA8010 Specifications

Color:	Pink
Fluids Absorbed:	Acids, Bases & Unknowns
Absorbency:	Up to 6.5 gal. per box
Absorbency per:	Up to 6.5 gal. per bag
Volume:	5 lb. Bag
Sold as:	1 bag per box
Weight:	5 lbs.
# per Pallet:	36
Composition:	Polypropylene pulp
UNSPSC:	47131902

HA8010 Metric Equivalent

Absorbency:	Up to 24.6 L per box
Absorbency per:	Up to 24.6 L per bag
Weight:	2.3 kg

Technical Information

Warnings & Restrictions:
HAZ-MAT Notice
To ensure effectiveness and your safety, we recommend that you conduct compatibility and absorption testing of your chemicals with PIG® HAZ-MAT products prior to purchase. If you have any questions or need samples to test, please call Technical Services.

Technical Documents:
(Available at **newpig.com**)
- Product Data Sheet (PDS)
- Material Safety Data Sheet (MSDS)
- Chemical Compatibility (CCG)

EXCLUSIVE!

PIG® Absorbent Mat Pulp

#PLP205 - Absorbs Oils, Coolants, Solvents & Water • 1 - 25 lb. Bag

Shredded PIG Mat is super-light for fast, easy spill cleanup.
Pound-for-pound, it's the most absorbent loose we offer!

- Packing the power of PIG Mat in a loose absorbent, this pulp can be used in a variety of applications - from everyday cleanup to 5-gallon spills
- Fast-wicking PIG Mat material cleans up spills fast, reducing the risk of environmental contamination
- Non-abrasive composition will not harm floors or expensive machinery
- Silica-free composition does not pose the health hazards associated with breathing in clay dust
- Weighs just 17 lb. per box; light-weight, safe to handle and easy to clean up
- Absorbs and retains oils, coolants, solvents and water
- Can be incinerated after use to reduce waste or for fuels blending

Always in stock. Ships within 24 hours.

Pricing (based on quantity)

1+
$52.00

PLP205 Specifications

Color:	Gray
Fluids Absorbed:	Oils, Coolants, Solvents & Water
Absorbency:	Up to 16.5 gal. per box
Absorbency per:	Up to 16.5 gal. per bag
Volume:	25 lb. Bag
Sold as:	1 bag per box
Weight:	16 lbs.
# per Pallet:	16
Composition:	100% Polypropylene
UNSPSC:	47131902

PLP205 Metric Equivalent

Absorbency:	Up to 62.5 L per box
Absorbency per:	Up to 62.5 L per bag
Weight:	7.3 kg

Technical Information

Warnings & Restrictions:
There are no known warnings and restrictions for this product.

Regulations and Compliance:
29 CFR 1910.22(a)(2) - Floors in the workplace should be, "maintained in a clean and, so far as possible, a dry condition."

Technical Documents:
(Available at **newpig.com**)
- Product Data Sheet (PDS)
- Material Safety Data Sheet (MSDS)
- Chemical Compatibility (CCG)

EXCLUSIVE!

PLP205 Accessories

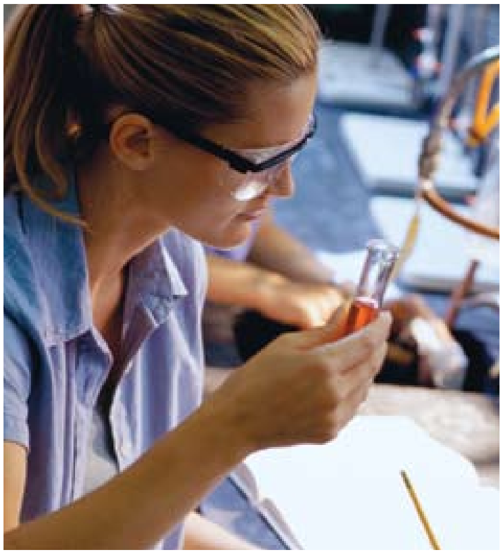
You might like...		Item Number
	Spill Cleanup Station	PAK200

A STABLE SOLUTION

SPILL-X® Chemical Spill Control Products

ANSUL®

tyco
Fire Suppression
& Building Products



TAKE CONTROL WITH A NATURAL CHOICE

ANSUL® products are the result of extensive experience, cutting-edge R&D, and a culture of advancement. A legend in fire suppression since 1939, ANSUL innovative spill control solutions have been protecting people, property, and the environment since 1986. A network of authorized distributors stretches across the globe, and experts continue to innovate here at home. Choose advanced SPILL-X® chemical spill control agents.

IN AN INSTANT, A CHEMICAL BECOMES "HAZARDOUS WASTE"

Spills happen ... and immediately become a hazardous waste situation to handle. With the disposal of hazardous waste in the spotlight like never before; a quick, safe, and cost-effective treatment is needed. That's why the SPILL-X product line features a series of agents specifically formulated to treat acid, caustic, solvent, and formaldehyde spills. Here's your response to environmental mandates and the liability associated with managing hazardous waste.

REDUCES DOWNTIME/DISPOSAL COSTS ■ MULTIPLE SIZES AND FORMULATIONS

NEUTRALIZES AND SOLIDIFIES ACIDS/CAUSTICS

SUPPRESSES FORMALDEHYDE VAPORS ■ ADSORBS SOLVENTS

SMART SOLUTIONS FOR DEMANDING SITUATIONS

ANSUL SPILL-X products are free-flowing dry chemicals formulated to treat spills by neutralizing, solidifying, and/or adsorbing. For example, an organic solvent or inorganic acid chemically and physically changes to a neutral solid that can be disposed of easily and properly. Typical absorbents don't have this ability, and other neutralizers require 2-3 times more product, which means more time and labor to clean up and more waste to remove.

FOUR AGENTS FORMULATED FOR VARIOUS NEEDS

SPILL-X-A® Acid Neutralizer/Solidifier — For mineral and organic acid spills, SPILL-X-A agent can both neutralize and solidify the spilled material when properly applied. A magnesium oxide-based agent, its red color differentiates it from other agents.

SPILL-X-C® Caustic Neutralizer/Solidifier — For caustic and organic bases, SPILL-X-C agent can both neutralize and solidify the spilled material when properly applied. A citric acid-based agent, its tan color differentiates it from other agents.

SPILL-X-S® Solvent Adsorbent — For common hydrocarbon solvents and fuel spills, SPILL-X-S agent can adsorb, contain, and reduce vapors from the spilled material when properly applied. A carbon-based agent, its black color differentiates it from other agents.

SPILL-X-FP® Formaldehyde Polymerizer — This agent polymerizes formaldehyde spills and suppresses the vapor. Superior to other methods (clay, sand, absorbents), SPILL-X-FP agent is urea-based, and its green color differentiates it from other agents.

SPILL-X-A Agent

Typical Hazards	Research laboratories found in healthcare and higher education, chemical process areas, water treatment plants, boiler areas, storage areas
Types of Spills	Acids: sulfuric, hydrochloric, nitric, phosphoric, perchloric, formic, hydrofluoric, acetic, adipic

SPILL-X-C Agent

Typical Hazards	Research laboratories found in healthcare and higher education, chemical process areas, water treatment plants, boiler areas, storage areas
Types of Spills	Caustics: sodium hydroxide, ammonium hydroxide, aniline, diethylamine, potassium hydroxide, morpholine, hydrazine

SPILL-X-S Agent

Typical Hazards	Research laboratories found in healthcare and higher education, chemical process areas, small manufacturing facilities
Types of Spills	Hydrocarbon solvents, reagents or other organic materials such as peroxides or hydrazine compounds

SPILL-X-FP Agent

Typical Hazards	Research laboratories found in healthcare and higher education, chemical, medical, agricultural, wood products, plastics, metal finishing industries
Types of Spills	Formaldehyde and other aldehydes such as glutaraldehyde

APPLICATION OPTIONS TO MEET YOUR NEEDS

TREATMENT KIT (SHAKERS)

An economical way to treat small spills (laboratory environment), the SPILL-X Treatment Kit provides easy access to the proper spill control agent for a particular chemical spill. Six polypropylene containers (two each of SPILL-X-A, SPILL-X-C, SPILL-X-S) allow for either pouring or shaking. Each container treats up to a 1/2-gallon (1.9 L) spill, or approximately 15 to 20 ft^2 (1.4 to 1.9 m^2).

SPILL-GUN APPLICATOR

SPILL-GUN® applicators are rugged, easy to use, and can be recharged in the field. The SC-30 SPILL-GUN applicator (for use with SPILL-X-A, SPILL-X-C, SPILL-X-S agents) applies agent from a distance of 10 to 12 feet (3 to 3.7 m) and can treat up to a 3-gallon (11.4 L) spill, or 100 ft^2 (9.3 m^2).

PAIL

Each 50 lb. (23 kg) pail of SPILL-X-A or SPILL-X-C agent treats 4 to 6 gallons (15.1 to 22.7 L) of acid or caustic, and a 50 lb. (23 kg) pail of SPILL-X-S agent treats up to a 3-gallon (11.4 L) spill of solvent, or 150 ft^2 (13.9 m^2).

LARGER SPILLS

Each 168 lb. (76.2 kg) **fiber drum** of SPILL-X-A, SPILL-X-C, or SPILL-X-S agent treats up to a 20-gallon (75.7 L) spill or 600 ft^2 (55.7 m^2). ANSUL SPILL-X agents are also available in **skid units** for 50- to 300-gallon (189.3 to 1,135.6 L) spills or 1,500 to 9,000 ft^2 (139.4 to 836.1 m^2).

WHEN THE ENVIRONMENT IS A CONCERN

With their ability to quickly neutralize chemical spills and dispose of the solid in a landfill,* SPILL-X agents are environmentally sound. Across the country, safety administrators and lab managers are discovering the benefits of ANSUL SPILL-X agents and the minimal impact they have on our natural environment.

*Disposal in landfills varies by state. Consult your local environmental officials for verification.

SMART SPILL CLEAN UP

Environmental mandates. Local ordinances. Liability. The focus on hazardous waste disposal appears to be long-term. With the assurance of decades of experience, however, you won't have to worry. Enjoy the quick, safe, and cost-effective benefits of ANSUL SPILL-X agents.

PROTECT RESPONSIBLY™ PROTECT RESPONSIBLY™

One Stanton Street
Marinette, WI 54143-2542
USA

800-862-6785 (United States, Canada)
715-735-7411 (International)
www.ansul.com

Safety Data Sheet

1. Product And Company Identification

Product Identifier: Haz-Mat PIG Mat (MSD-015)
General Use: Haz-Mat PIG Absorbents are designed for clean-up of a broad range of chemicals. Specifically Acids, Bases, and Oxidizers. They absorb water-based liquids, petroleum products, and solvents.
Product Description: The absorbents are provided in many forms.
Specific Product Identifier: Haz-Mat PIG Mat, Pink Pig Haz-Mat Handy Pads and Haz-Mat Pig-Up Pulp, Haz-Mat Pig Pillow, Haz-Mat Pig Sock, Haz-Mat Pig Dike.

COMPANY PROFILE:	**EMERGENCY TELEPHONE:**
New Pig Corporation	INFOTRAC
One Pork Avenue	200 North Palmetto Street
Tipton, PA 16684-0304	Leesburg, FL 34748
Information Number	24 hrs, 7 days/week
1-800-468-4647	1-800-535-5053

Website: www.newpig.com, **Email:** hothogs@newpig.com

2. Hazards Identification

GHS Classification: Not a dangerous substance according to GHS

POTENTIAL HEALTH EFFECTS:
Eye Contact: May cause irritation
Ingestion: No hazard in normal use of product
Inhalation: No hazard in normal use of product
Skin Contact: Not applicable
Chronic: Not applicable

3. Composition/Information on Ingredients

CAS: 9003-07-0	Polypropylene	>99.7%
CAS: None	Pink pigment	<0.3%

4. First Aid Measures

Eye Contact: Flush with water for 15 minutes. Consult a physician.
Ingestion: Not applicable
Inhalation: Not applicable
Skin Contact: Not applicable

5. Fire Fighting Measures

Extinguishing Media: Unused form: Not applicable
Used form: that which is compatible to liquid(s) absorbed.
Special Fire Fighting Procedures: Wear a self-contained breathing apparatus and refer to absorbed liquid(s) MSDS(s).
Hazardous Combustion Products: When heated above the melting point: carbon monoxide, carbon dioxide, acrolein, ketones, aldehydes and other unidentified organic compounds.
Unusual Hazards: Refer to absorbed liquid(s) MSDS(s). The Haz-Mat PIG Absorbents do not render liquids nonflammable, neutral or less hazardous.

6. Accidental Release Measures

Spill or Leak Procedures: If material is unused, sweep or pick up and dispose of as a non-hazardous material.

7. Handling and Storage

Handling Precautions: None
Storage Precautions: Store in a cool, dry place. Shelf Life: Indefinitely - as long as product is kept in a clean, dry place away from direct sunlight.
General: Refer to absorbed liquid(s) MSDS(s). The container can be hazardous when empty. Follow label cautions even after the container is empty. Do not re-use empty containers for food, clothing or products for human or animal consumption, or where skin contact can occur.

8. Exposure Controls/Personal Protection

Engineering Controls: None required
PERSONAL PROTECTION
Eyes: Safety glasses with side shields is a good industrial practice
Respirator: Not required
Gloves: Not normally required. However, use of cloth, canvas or leather gloves is a good industrial practice.
Other: None required.
OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):

	EXPOSURE LIMITS 8 hrs. TWA (ppm)	
	OSHA PEL	ACGIH TLV
None		

9. Physical and Chemical Properties

Appearance: Pink sheets, rolls or pulp
Odor: No odor **Odor Threshold:** Not applicable
pH: Not applicable
MELTING POINT/Freezing Point**:** >320° F (>160° C)
Initial Boiling Point and Range: Not applicable
Flash Point: Not applicable **Method:** Not applicable
Evaporation Rate: Not applicable
Flammable Limits: Not applicable
Conditions of Flammability: Not established
Explosive Properties: Not applicable
Vapor Pressure: Not applicable
Vapor Density: Not applicable
Relative Density (H_2O = 1): 0.9
Solubility in Water: Insoluble
Auto Ignition Temperature: 675° F (357° C)
Coefficient of Water/Oil Distribution: Not available

10. Stability and Reactivity

General: This is a stable material.
Conditions of Reactivity: Not established
Incompatible Materials: Strong oxidizing agents may degrade product over an extended period of time.
Conditions to Avoid: Not applicable
Hazardous Decomposition: When heated, it may emit toxic fumes.
Hazardous Polymerization: Will not occur

11. Toxicological Information

LD50: Not available
LC50: Not available
Carcinogenicity: IARC: Not established
National Toxicology Program: Not established
OSHA: Not established
California Prop 65: No listed ingredient
Reproduction Toxicity: Not available
Teratogenicity: Not available
Mutagenicity: Not available
Synergistic Products: Not available
Irritancy of Product: See Section 2.
Sensitization to Product: Not available

12. Ecological Information

No data available

13. Disposal Considerations

Waste Disposal Method: If unused, no special precautions are necessary. Dispose of in accordance with federal, state and local regulations. In certain types of cleanup applications the nature of the material recovered will classify the resulting spent material as a hazardous component. In such instances the material should be disposed of via an approved hazardous waste disposal service and the appropriate manifesting obtained.

14. Transport Information

DOT (Department of Transportation):
Proper Shipping Name: Not regulated
Hazard Class: Not regulated
Identification Number: Not applicable

15. Regulatory Information

CERCLA (Comprehensive Environmental Response Compensation and Liability Act): No Reportable Quantity
OSHA Hazard Communication Standard, 29 CFR 1910.1200: No listed ingredient
SARA Title III (Superfund Amendments and Reauthorization Act): No listed ingredient
TSCA (Toxic Substances Control Act): Ingredients of this product are on the Inventory list.

16. Other Information

NFPA Hazard Ratings:	**Health -** 0
none → extreme	**Fire -** 1
0 → 4	**Reactivity -** 0

Reason for Issue: Reviewed, changes to Sections 7 & 16. GHS changes to Sections 2 & 3.
Prepared by: Dale Gatehouse, Entreprises Krenda Inc.
Approved by: Lisa Baxter, New Pig Corporation
Previous Date of Issue: 03/06/2012
Revised Date: 03/18/2013
MSDS Number: MSD-015

Safety Data Sheet

1. Product And Company Identification

Product Identifier: Universal PIG Absorbents (MSD-014)
General Use: Universal PIG Absorbents are designed to confine and absorb leaks, drips, over-spray and spills of a broad range of chemicals, which include oil, water, coolants and solvents.
Specific Product Identifier: PIG Absorbent Mat; PIG Fat Mat Absorbent Mat; PIG Rip-Fit Absorbent Mat; PIG Extra-Duty Absorbent Mat; PIG 4-in-1 Absorbent Mat; PIG Chat Mat Absorbent Mat; PIG Yellow Absorbent Mat; PIG Elephant Absorbent Mat; PIG BubbleZorb Anti-Fatigue Absorbent Mat; PIG Barrel Top Absorbent Mat; PIG Yellow Barrel Top Absorbent Mat; PIG Absorbent Diaper Mat; PIG Absorbent Drip Pad; Over-The-Spill Absorbent Pad; PIG Ham-O Absorbent Mat; PIG Rhino Absorbent Mat; PIG Absorbent Drip Pan.
Product Description: These multi-colored absorbents come in a variety of shapes and sizes as mats, pads, rolls, wipes, socks, pillows and pulp. Pan & socks may contain a variety of colored absorbent material.

COMPANY PROFILE:	**EMERGENCY TELEPHONE:**
New Pig Corporation	INFOTRAC
One Pork Avenue	200 North Palmetto Street
Tipton, PA 16684-0304	Leesburg, FL 34748
Information Number	24 hrs, 7 days/week
1-800-468-4647	1-800-535-5053

Website: www.newpig.com, **Email:** hothogs@newpig.com

2. Hazards Identification

GHS Classification: Not a dangerous substance according to GHS

POTENTIAL HEALTH EFFECTS:
Eye Contact: May cause irritation
Ingestion: No hazard in normal use of product
Inhalation: No hazard in normal use of product
Skin Contact: Not applicable
Chronic: Not applicable

3. Composition/Information on Ingredients

Contains recycled material – Visit www.newpig.com for more information on recycled content.

CAS: 9003-07-0	Polypropylene mat	>97%
CAS: None	Gray or yellow pigment	<0.3%

May contain one or more of the following:

Double Faced Acrylic Adhesive Strip
Pan

CAS: 9002-88-4	High Density Polyethylene
CAS: 9002-86-2	PVC
CAS: 9003-07-0	Polypropylene Mesh or Film
CAS: 25038-59-9	Polyester Yarn, Fleece or Mesh
CAS: 9002-88-4	Polyethylene Film

3. Composition/Information on Ingredients (Cont'd)

Ink

CAS: 1336-21-6 EC: 215-647-6	Aqua Ammonia	1-1.5%
CAS: 108-01-0 EC: 203-542-8	Dimethylethanolamine	1-1.5%

4. First Aid Measures

Eye Contact: Flush with water for 15 minutes. Consult a physician.
Ingestion: Not applicable
Inhalation: Not applicable
Skin Contact: Not applicable

5. Fire Fighting Measures

Extinguishing Media: Unused form: Not applicable Used form: that which is compatible to liquid(s) absorbed.
Special Fire Fighting Procedures: Wear a self-contained breathing apparatus and refer to absorbed liquid(s) MSDS(s).
Hazardous Combustion Products: When heated above the melting point: carbon monoxide, carbon dioxide, acrolein, ketones, aldehydes and other unidentified organic compounds.
Unusual Hazards: Refer to absorbed liquid(s) MSDS(s). The Universal PIG Absorbents do not render liquids nonflammable, neutral or less hazardous.

6. Accidental Release Measures

Spill or Leak Procedures: If material is unused, sweep or pick up and dispose of as a non-hazardous material.

7. Handling and Storage

Handling Precautions: None
Storage Precautions: Store in a cool, dry place. Shelf Life: Indefinitely - as long as product is kept in a clean, dry place away from direct sunlight.
General: Refer to absorbed liquid(s) MSDS(s). The container can be hazardous when empty. Follow label cautions even after the container is empty. Do not re-use empty containers for food, clothing or products for human or animal consumption, or where skin contact can occur.

8. Exposure Controls/Personal Protection

Engineering Controls: None required
PERSONAL PROTECTION
Eyes: Safety glasses with side shields is a good industrial practice
Respirator: Not required.
Gloves: Not normally required. However, use of cloth, canvas or leather gloves is a good industrial practice.
Other: None required.

8. Exposure Controls/Personal Protection (Cont'd)

OSHA HAZARDOUS COMPONENTS (29 CFR 1910.1200):

	EXPOSURE LIMITS 8 hrs. TWA (ppm)	
	OSHA PEL	ACGIH TLV

None

9. Physical and Chemical Properties

Appearance: Solid, available in various colors and shapes, some inside a black pan. May contain a variety of colored absorbent material.
Odor: No odor **Odor Threshold:** Not applicable
pH: Not applicable
MELTING POINT/Freezing Point**:** >320° F (>160° C)
Initial Boiling Point and Range: Not applicable
Flash Point: Not applicable **Method:** Not applicable
Evaporation Rate: Not applicable
Flammable Limits: Not applicable
Conditions of Flammability: Not established
Explosive Properties: Not applicable
Vapor Pressure: Not applicable
Vapor Density: Not applicable
Relative Density (H_20 = 1): 0.9
Solubility in Water: Insoluble
Auto Ignition Temperature: >675° F (>357° C)
Coefficient of Water/Oil Distribution: Not available

10. Stability and Reactivity

General: This is a stable material.
Conditions of Reactivity: Not established
Incompatible Materials: Strong oxidizing agents may degrade product over an extended period of time.
Conditions to Avoid: Not applicable
Hazardous Decomposition: When heated, it may emit toxic fumes.
Hazardous Polymerization: Will not occur

11. Toxicological Information

LD50: Not available
LC50: Not available
Carcinogenicity: IARC: Not established
National Toxicology Program: Not established
OSHA: Not established
California Prop 65: No listed ingredient
Reproduction Toxicity: Not available
Teratogenicity: Not available
Mutagenicity: Not available
Synergistic Products: Not available

11. Toxicological Information (Cont'd)

Irritancy of Product: See Section 2.
Sensitization to Product: Not available

12. Ecological Information

No data available

13. Disposal Considerations

Waste Disposal Method: If unused, no special precautions are necessary. Dispose of in accordance with federal, state and local regulations. In certain types of cleanup applications the nature of the material recovered will classify the resulting spent material as a hazardous component. In such instances the material should be disposed of via an approved hazardous waste disposal service and the appropriate manifesting obtained.

14. Transport Information

DOT (Department of Transportation):
Proper Shipping Name: Not regulated
Hazard Class: Not regulated
Identification Number: Not applicable

15. Regulatory Information

CERCLA (Comprehensive Environmental Response Compensation and Liability Act): No Reportable Quantity
OSHA Hazard Communication Standard, 29 CFR 1910.1200: No listed ingredient
SARA Title III (Superfund Amendments and Reauthorization Act): No listed ingredient
TSCA (Toxic Substances Control Act): Ingredients of this product are on the Inventory list.

16. Other Information

NFPA Hazard Ratings:	**Health -** 0
none → extreme	**Fire -** 1
0 → 4	**Reactivity -** 0

Reason for Issue: Reviewed, changes to Sections 1, 7, 9 & 16. GHS changes to Sections 2 & 3.
Prepared by: Dale Gatehouse, Entreprises Krenda Inc.
Approved by: Lisa Baxter, New Pig Corporation
Previous Date of Issue: 03/06/2012
Revised Date: 02/15/2013
MSDS Number: MSD-014

ANSUL®
ANSUL INCORPORATED
MARINETTE, WI 54143-2542

SPILL-X-A® MATERIAL SAFETY DATA SHEET

CONFORMS TO DIRECTIVE 2001/58/EC

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the preparation

Product Name: "SPILL-X-A Agent"
Chemical Name: N/A – This is a mixture/preparation.
CAS No.: N/A – This is a mixture/preparation.
Chemical Formula: N/A – This is a mixture/preparation.
EINECS Number: N/A – This is a mixture/preparation.

1.2. Use of the preparation

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP ACID SPILLS.

1.3. Company identification

Manufacturer/Supplier: ANSUL INCORPORATED
Address: One Stanton Street, Marinette, WI 54143-2542
Prepared by: Safety and Health Department
Phone: 715-735-7411
Internet/Home Page: http://www.ansul.com
Date of Issue: September, 2009

1.4. Emergency telephone

CHEMTREC 800-424-9300 or 703-527-3887

2. COMPOSITION/INFORMATION ON INGREDIENTS

2.1. Ingredient Name: Magnesium Oxide.
Chemical Formula: MgO.
CAS No.: 1309-48-4.
EINECS Number: 215-171-9.
Concentration, Wt %: 75-80 %.
Hazard Identification: See Heading 3.

Ingredient Name: Magnesium Aluminum Silicate (Attapulgite Clay or Fuller's Earth).
Chemical Formula: $Mg_xAl_y(SiO4)_z$.
CAS No.: 8031-18-3.
EINECS Number: (b).
Concentration, Wt %: 11-13 %.
Hazard Identification: See Heading 3.

Proprietary Mixture of:

Ingredient Name: Sodium Carbonate.
Chemical Formula: Na_2CO_3.
CAS No.: 497-19-8.
EINECS Number: 207-838-8.
Concentration, Wt %: <10 %.
Hazard Identification: See Heading 3.

Ingredient Name: Petro AGS.
Chemical Formula: Sodium alkylnaphthalenesulfonate.
CAS No.: Not available.
EINECS Number: (a).
Concentration, Wt %: <1.0 %.
Hazard Identification: See Heading 3.

Ingredient Name: Red Pigment.
Chemical Formula: $(C_{20}H_{14}N_2O_4S)_2Ba$.
CAS No.: 1103-38-4.
EINECS Number: 214-160-6.
Concentration, Wt %: <0.1 %.
Hazard Identification: See Heading 3.

(a) EINICS does not include synthetic polymers (These are registered in EINICS under their building blocks, monomers.). See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

(b) EINICS does not include most naturally occurring raw materials. See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

NOTE: Unless a component presents a severe hazard, it does not need to be considered in the MSDS if the concentration is less than 1%. [According to Directive 1999/45/EC.]

3. HAZARDS IDENTIFICATION

FOR HUMANS:

Product:		
EU Classification:	Xi.	Irritant,
R Phrases:	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	2	Keep out of the reach of children.
	22	Do not breathe dust.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Components:		
Sodium Carbonate:		
EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	22	Do not breathe dust.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Magnesium Oxide:		
EU Classification:	Xi.	Irritant,
R Phrases:	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Threshold Limit Values:		
Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Magnesium Oxide; Dust limit:		
	OES (UK):	16.5 mg/m^3.
	MAC (NL):	10 mg/m^3.
	VME FRANCE:	6 mg/m^3, for fraction <5 um.
	MAK (DE):	6 mg/m^3.
Short term exposure:		
	MAK (DE):	24 mg/m^3, 4 times for 15 minutes.
Sodium Carbonate; Dust limit:		
	OES (UK):	10 mg/m^3 , 8 hour.

Neither this preparation nor the substances contained in it have been listed as carcinogenic by National Toxicology Program, I.A.R.C., or OSHA.

AS PART OF GOOD INDUSTRIAL AND PERSONAL HYGIENE AND SAFETY PROCEDURE, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes, and clothing.

SIGNS AND SYMPTOMS:

Acute Exposure:	
Eye Contact:	Irritating to the eyes. Tissue damage can occur if left untreated.
Skin Contact:	May be mildly irritating to the skin.
Inhalation:	Irritating to nasal and respiratory passages.
Ingestion:	May cause gastrointestinal distress and irritation of the mouth and stomach. If untreated, local tissue destruction may occur.
Chronic Overexposure:	Cough or sputum production indistinguishable from that which occurs with cigarette smoking. May produce chronic ulcers of skin or mucosa.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Reactive airway.

FOR ENVIRONMENT:
No data available.

4. FIRST AID MEASURES

Eye Contact:	Flush with large amounts of water for minimum of 15 minutes whild holding lids open. Get medical attention.
Skin Contact:	Wash with soap and water. Remove contaminated clothing. If irritation persists, get medical attention.
Inhalation:	Remove victim to fresh air. Seek medical attention if discomfort continues.
Ingestion:	If patient is conscious, give large amounts of water to drink. DO NOT INDUCE VOMITING. Seek medical attention.

5. FIRE-FIGHTING MEASURES

This preparation is not flammable.

There are NO extinguishing media which must not be used for safety reasons.

NO special protective equipment is needed for fire-fighters.

6. ACCIDENTAL RELEASE MEASURES

For personal protection: Prevent skin and eye contact, see Heading 8.

Clean up: Sweep up and recover for reuse if not contaminated, otherwise store in a closed vessel until it can be disposed of, see Heading 13.

NO harm to the environment is expected from an accidental release of this preparation.

7. HANDLING AND STORAGE

7.1. Handling

Do not mix with other Spill Control Agents.

Care should be taken in handling all chemical substances and preparations.

See incompatibility information in HEADING 10.

7.2. Storage

NO special conditions are needed for safe storage.

Store in original container or SPILL-GUN applicator. Keep tightly closed until used.

See incompatibility information in HEADING 10.

There is minimal danger to the environment from a storage release.

7.3. Specific use

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP ACID SPILLS.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Exposure limit values

Threshold Limit Values:

Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Magnesium Oxide; Dust limit:		
	OES (UK):	16.5 mg/m^3.
	MAC (NL):	10 mg/m^3.
	VME FRANCE:	6 mg/m^3, for fraction <5 um.
	MAK (DE):	6 mg/m^3.
Short term exposure:		
	MAK (DE):	24 mg/m^3, 4 times for 15 minutes.
Sodium Carbonate; Dust limit:		
	OES (UK):	10 mg/m^3 , 8 hour.

8.2. Exposure controls

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

Mechanical ventilation is recommended. Dust mask where dustiness is prevalent, or TLV is exceeded. Use mechanical filter respirator if exposure is prolonged.

8.2.1.2. Hand protection

Use chemical resistant gloves when handling the preparation.

8.2.1.3. Eye protection

Chemical goggles are recommended.

8.2.1.4. Skin protection

Use long sleeved work clothes.

8.2.2. Environmental exposure controls

Keep from entering surface water. For harm to the environment see Heading 12.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information

Appearance:	Red powder.
Odor:	None.

9.2. Important health, safety, and environmental information

pH:	Not determined.
Boiling point/boiling range:	Not applicable.
Flash point:	None.
Flammability (solid/gas):	Not flammable.
Explosive properties:	Not explosive.
Oxidizing properties:	Not an oxidizer.
Vapor Pressure:	Not applicable.
Relative Density (Water = 1):	Not applicable.
Solubility:	
– Water solubility:	Slightly less than 9 %.
– Fat solubility:	Not soluble.
Partition coefficient, n-octanol/water:	Not determined.
Viscosity:	Not applicable.
Vapor density (Air = 1):	Not applicable.
Evaporation rate:	Not applicable.

9.3. Other information

Auto-ignition temperature:	Does not ignite.

10. STABILITY AND REACTIVITY

10.1. Conditions to avoid

There are NO known conditions such as temperature, pressure, light, shock, etc., which may cause a dangerous reaction.

10.2. Materials to avoid

Interhalogens, phosphorous pentachloride, chlorine trifluoride.

10.3. Hazardous decomposition products

Normally stable.
Hazardous polymerization will NOT occur.
Combustion or decomposition products have not been determined.

11. TOXICOLOGICAL INFORMATION

Product:
This product has not been tested for toxicological effects.

Components:

Magnesium Oxide:

Toxicity Data:	No data was found.	
Irritation Data:	Skin (human)	Slightly irritating.
	Eye (human)	Slightly irritating.

Sodium Carbonate:

Irritation Data:	Skin (rabbit)	500 mg/24 hours Mild.
	Eye (rabbit)	50 mg. Severe.
Toxicity Data:	Oral (rat) LD_{50}	4090 mg/kg.
	Inhalation (rat) LC_{50}	2300 mg/m^3/2 hrs
Target Organs:	Gastrointestinal.	

Magnesium Aluminum Silicate (Attapulgite Clay or Fuller's Earth):
Irritating to eyes, skin, mucous membranes.
Target Organs: Lungs.

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Magnesium Oxide:
No data was found.

Sodium Carbonate:

Acute Toxicity:		
Fish:	Gambusia affinis:	LC50 (96 hrs) = 740 mg/L.
	Lapomis macrochirus:	LC50 (96 hrs) = 300 mg/L.
Invertibrates:	Daphnia magna:	LC50 (24 hrs) = 196 mg/L.
	Dugesia sp.	LC50 (48 hrs) = 360 mg/L.
Algae:	Nitzschia sp.	LC50 (5 day) = 1050 mg/L.
Chronic Toxicity:		
Fish:	Oncorhynchus sp.	LC100 (5 day) = 68-70 mg/L.
	Salmo clarki	LC100 (5 day) = 80 mg/L.

12.2. Mobility

Not determined.

12.3. Persistence and degradability

Not determined.

12.4. Bioaccumulative potential

Not determined.

12.5. Other adverse effects

Ozone depletion potential:	None.
Photochemical ozone creation potential:	None
Global warming potential:	Carbon dioxide, from decomposition or reaction of the sodium carbonate, is a global warming gas.

13. DISPOSAL CONSIDERATIONS

No harm to the environment is expected from this preparation. See Heading 12.

Dispose of in compliance with national, regional, and local provisions that may be in force.

14. TRANSPORT INFORMATION

Hazard Class or Division: Not a hazardous substance

For additional transport information, contact Ansul Incorporated.

No harm to the environment is expected from this preparation.

15. REGULATORY INFORMATION

Product:

EU Classification:	Xi.	Irritant,
R Phrases:	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	2	Keep out of the reach of children.
	22	Do not breathe dust.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Threshold Limit Values:

Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Magnesium Oxide; Dust limit:		
	OES (UK):	16.5 mg/m^3.
	MAC (NL):	0 mg/m^3.
	VME FRANCE:	6 mg/m^3, for fraction <5 um.
	MAK (DE):	6 mg/m^3.
Short term exposure:		
	MAK (DE):	24 mg/m^3, 4 times for 15 minutes.
Sodium Carbonate; Dust limit:		
	OES (UK):	10 mg/m^3 , 8 hour.

EINECS Status: All components are included in EINECS inventories or are exempt from listing.
EPA TSCA Status: All components are included in TSCA inventories or are exempt from listing.
Canadian DSL (Domestic Substances List): All components are included in the DSL or are exempt from listing.

Environmental restrictions: None are known.
Restrictions on Marketing and Use: None are known.
Refer to any other national measures that may be relevant.

16. OTHER INFORMATION

(HMIS) HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

HEALTH:	1	4. Severe Hazard
FLAMMABILITY:	0	3. Serious Hazard
REACTIVITY:	0	2. Moderate Hazard
		1. Slight Hazard
		0. Minimal Hazard

(WHMIS) CANADIAN WORKPLACE HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:
This product is rated: **D2B – Irritating to eyes and skin.**

Format is from directive 2001/58/EC.
EINECS data is from http://exb.jrc.it/existing-chemicals/
Data used to compile the data sheet is from Ansul Material Safety Data Sheet, May, 2000.

The EU Classification has been changed in accordance with Directive 1999/45/EC and information in the EINICS ESIS files (Existing Substances Information System).

Toxicological information added from the EINICS ESIS (Existing Substances Information System).

A rating under WHMIS has been added, following the Canadian guidelines.

17. DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT, BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ANSUL SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT.

MSDS available at http://www.ansul.com

ANSUL® ANSUL INCORPORATED
MARINETTE, WI 54143-2542

SPILL-X-C® MATERIAL SAFETY DATA SHEET
CONFORMS TO DIRECTIVE 2001/58/EC

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the preparation

Product Name:	"SPILL-X-C Agent"
Chemical Name:	N/A – This is a mixture/preparation.
CAS No.:	N/A – This is a mixture/preparation.
Chemical Formula:	N/A – This is a mixture/preparation.
EINECS Number:	N/A – This is a mixture/preparation.

1.2. Use of the preparation

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP CAUSTIC SPILLS.

1.3. Company identification

Manufacturer/Supplier:	ANSUL INCORPORATED
Address:	One Stanton Street, Marinette, WI 54143-2542
Prepared by:	Safety and Health Department
Phone:	715-735-7411
Internet/Home Page:	http://www.ansul.com
Date of Issue:	September, 2009

1.4. Emergency telephone

CHEMTREC 800-424-9300 or 703-527-3887

2. COMPOSITION/INFORMATION ON INGREDIENTS

2.1.

Ingredient Name:	Citric Acid.
Chemical Formula:	$C_6H_8O_7$.
CAS No.:	77-92-9.
EINECS Number:	201-069-1.
Concentration, Wt %:	55-65 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Fumaric Acid.
Chemical Formula:	$C_4H_4O_4$.
CAS No.:	110-17-8.
EINECS Number:	203-743-0.
Concentration, Wt %:	15-20 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Magnesium Aluminum Silicate (Attapulgite Clay or Fuller's Earth).
Chemical Formula:	$Mg_xAl_y(SiO4)_z$.
CAS No.:	8031-18-3.
EINECS Number:	(b).
Concentration, Wt %:	15-20 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	J550 Water Lock Polymer.
Chemical Formula:	Acrylate polymer.
CAS No.:	Not available.
EINECS Number:	(a).
Concentration, Wt %:	2-4 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Petro AGS.
Chemical Formula:	Sodium alkylnaphthalenesulfonate.
CAS No.:	Not available.
EINECS Number:	(a).
Concentration, Wt %:	<1 %.
Hazard Identification:	See Heading 3.

(a) EINICS does not include synthetic polymers (these are registered in EINICS under their building blocks, monomers.). See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

(b) EINICS does not include most naturally occurring raw materials. See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

NOTE: Unless a component presents a severe hazard, it does not need to be considered in the MSDS if the concentration is less than 1%. [According to Directive 1999/45/EC.]

3. HAZARDS IDENTIFICATION

FOR HUMANS:

Product:

EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Components:

Citric Acid:		
EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Fumaric Acid:		
EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
J550 Water Lock Polymer:		
EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Limit Values for Exposure:

Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Fumaric Acid: Dust limit:		
	MAK (DE):	6 mg/m^3.

Neither this preparation nor the substances contained in it have been listed as carcinogenic by National Toxicology Program, I.A.R.C., or OSHA.

AS PART OF GOOD INDUSTRIAL AND PERSONAL HYGIENE AND SAFETY PROCEDURE, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes, and clothing.

SIGNS AND SYMPTOMS:

Acute Exposure:	
Eye Contact:	Irritating to the eyes.
Skin Contact:	May cause irritation.
Inhalation:	Irritating to nasal and respiratory passages.
Ingestion:	May cause gastrointestinal irritation.
Chronic Overexposure:	Prolonged and continuous exposure to dust may result in cough and sputum production indistinguishable from that which occurs with cigarette smoking.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Reactive airway.

FOR ENVIRONMENT:

Keep from entering surface water. For harm to the environment, see Heading 12.

4. FIRST AID MEASURES

Eye Contact:	Flush with large amounts of water for minimum of 15 minutes while holding lids open. Seek medical attention.
Skin Contact:	Wash exposed areas with soap and water. Remove contaminated clothing and launder before re-use. If irritation persists, seek medical attention.
Inhalation:	Remove from exposure. If irritation persists, seek medical attention.
Ingestion:	If individual is conscious, give large amounts of water and induce vomiting. Immediately seek medical attention.

5. FIRE-FIGHTING MEASURES

There are NO extinguishing media which must not be used for safety reasons.

NO special protective equipment is needed for fire-fighters.

6. ACCIDENTAL RELEASE MEASURES

For personal protection: Prevent skin and eye contact, see Heading 8.

Clean up: Sweep up, the product can be recovered if it is not contaminated. If it is contaminated, place in closed containers for disposal. See Heading 13.

Keep from entering surface water. For harm to the environment see Heading 12.

7. HANDLING AND STORAGE

7.1. Handling

Care should be taken in handling all chemical substances and preparations.

Do not mix with other Spill Control Agents.

See incompatibility information in Heading 10.

7.2. Storage

NO special conditions are needed for safe storage.

See incompatibility information in Heading 10.

Store in original container or SPILL-GUN applicator. Keep tightly closed until used.

Keep from entering surface water. For harm to the environment see Heading 12.

7.3. Specific use

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP CAUSTIC SPILLS.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Exposure limit values

Limit Values for Exposure:

Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Fumaric Acid: Dust limit:		
	MAK (DE):	6 mg/m^3.

8.2. Exposure controls

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

Mechanical ventilation is recommended. Dust mask where dustiness is prevalent. Use mechanical filter respirator if exposure is prolonged.

8.2.1.2. Hand protection

Use chemical resistant gloves when handling the preparation.

8.2.1.3. Eye protection

Chemical goggles are recommended.

8.2.1.4. Skin protection

Use long sleeved work clothes.

8.2.2. Environmental exposure controls

Keep from entering surface water. For harm to the environment, see Heading 12.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information

Appearance:	White to tan powder.
Odor:	None.

9.2. Important health, safety, and environmental information

pH:	Not determined.
Boiling point/boiling range:	Not applicable.
Flash point:	None to boiling.
Flammability (solid/gas):	Not flammable.
Explosive properties:	Not explosive.
Oxidizing properties:	Not an oxidizer.
Vapor Pressure:	Not applicable.
Relative Density (Water = 1):	Not applicable.
Solubility:	
– Water solubility:	Less than 75 %.
– Fat solubility:	Not soluble.
Partition coefficient, n-octanol/water:	Not determined.
Viscosity:	Not applicable.
Vapor density (Air = 1):	Not applicable.
Evaporation rate:	Not applicable.

9.3. Other information

Auto-ignition temperature:	Does not ignite.

10. STABILITY AND REACTIVITY

10.1. Conditions to avoid

There are NO known conditions such as temperature, pressure, light, shock, etc., which may cause a dangerous reaction.

10.2. Materials to avoid

Avoid strong bases, particularly in closed systems.

10.3. Hazardous decomposition products

Normally stable.
Hazardous polymerization will NOT occur.
Combustion or decomposition products include Carbon monoxide and carbon dioxide in fire conditions..

11. TOXICOLOGICAL INFORMATION

Product:
This product has not been tested for toxicological effects.

Components:

Citric Acid:

Irritation Data:	Skin (rabbit)	500 mg/24 hrs	Mild
	Eye (rabbit)	750 ug/24 hrs	Severe
Toxicity Data:	Oral (rat) LD_{50}	3 g/kg.	
	Oral (rat) LD_{50}	12 g/kg. [EINICS]	
	Oral (mouse) LD_{50}	5040 mg/kg.	
Ames Test:	Negative. [EINICS]		
Reproduction:	At 600 mg/kg/day, no effects were detected. [EINICS]		
Developmental/Teratogenicity:	At >241 mg/kg/day, no adverse effects were noted. [EINICS]		
Target Organs:	Lungs and gastrointestinal.		

Fumaric Acid:

Irritation Data:	Skin (rabbit)	500 mg/24 hrs	Mild
	Eye (rabbit)	100 mg/24 hrs	Moderate.
Toxicity Data:	Oral (rat) LD_{50}	9300 mg/kg.	
	Oral (rat) LD_{50}	10000 mg/kg. [EINICS]	
	Dermal (rabbit) LD_{50}	>20000 mg/kg. [EINICS]	
Ames Test:	Negative. [EINICS]		
Reproduction:	At 400 mg/kg/day, no effects were detected. [EINICS] effects were noted. [EINICS]		
Target Organs:	Gastrointestinal, liver, blood.		

J550 Water Lock Polymer:

Toxicity Data: Oral (rat) LD_{50} 11,000 mg/kg.

Manufacturer warns about eye, nasal, and bronchial irritation.

Magnesium Aluminum Silicate (Attapulgite Clay or Fuller's Earth):

Irritation Data: Irritating to eyes, skin, mucous membranes.

Target Organs: Lungs.

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Citric Acid:

Acute Toxicity:

Fish:	Leuciscus idus:	LC50 (96 hrs) = >440-760 mg/L.
	Lapomis macrochirus:	LC50 (96 hrs) = 1516 mg/L.
Invertibrates:	Daphnia magna:	EC50 (72 hrs) = about 120 mg/L.
Algae:	Scenedeamus quadricauda:	EC3 (7 day) = 640 mg/L.

12.2. Mobility

Not determined.

12.3. Persistence and degradability

Citric acid:

Biodegradation in sewage was 84 % in 24 hours.

BOD5: 526 mgO_2/L.

COD: 728 mg/g substance.

Fumaric acid:

Photodegradation: 50 % after 6.5 days.

Biodegradation in sewage was 98 % in 21 days.

BOD5: 0.57 mgO_2/L.

12.4. Bioaccumulative potential

Not determined.

12.5. Other adverse effects

Ozone depletion potential:	None.
Photochemical ozone creation potential:	None
Global warming potential:	None

13. DISPOSAL CONSIDERATIONS

Keep from entering surface water. For harm to the environment, see Heading 12.

Dispose of in compliance with national, regional, and local provisions that may be in force.

14. TRANSPORT INFORMATION

Hazard Class or Division: Not a hazardous substance.

For additional transport information, contact Ansul Incorporated.

Keep from entering surface water. For harm to the environment, see Heading 12.

15. REGULATORY INFORMATION

Product:

EU Classification:	Xi	Irritant.
R Phrases:	36	Irritating to eyes.
S Phrases:	2	Keep out of the reach of children.
	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Limit Values for Exposure:

Nuisance dust limit:	OSHA TWA:	15 mg/m^3.
	ACGIH TLV-TWA:	10 mg/m^3.
Fumaric Acid: Dust limit:		
	MAK (DE):	6 mg/m^3.

EINECS Status: All components are included in EINECS inventories or are exempt from listing.
EPA TSCA Status: All components are included in TSCA inventories or are exempt from listing.
Canadian DSL (Domestic Substances List): All components are included in the DSL or are exempt from listing.

Environmental restrictions: None are known.
Restrictions on Marketing and Use: None are known.
Refer to any other national measures that may be relevant.

16. OTHER INFORMATION

(HMIS) HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

HEALTH:	1	4. Severe Hazard
FLAMMABILITY:	0	3. Serious Hazard
REACTIVITY:	0	2. Moderate Hazard
		1. Slight Hazard
		0. Minimal Hazard

(WHMIS) CANADIAN WORKPLACE HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:
This product is rated: **D2B – Irritating to eyes.**

Format is from directive 2001/58/EC.
EINECS data is from http://exb.jrc.it/existing-chemicals/
Data used to compile the data sheet is from Ansul Material Safety Data Sheet, June, 2000.

The EU Classification has been changed in accordance with Directive 1999/45/EC and information in the EINICS ESIS files (Existing Substances Information System).
Toxicological information added from the EINICS ESIS (Existing Substances Information System).
A rating under WHMIS has been added, following the Canadian guidelines.

17. DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT, BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ANSUL SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT.

MSDS available at http://www.ansul.com

ANSUL® ANSUL INCORPORATED
MARINETTE, WI 54143-2542

SPILL-X-S® MATERIAL SAFETY DATA SHEET

CONFORMS TO DIRECTIVE 2001/58/EC

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the preparation

Product Name: "SPILL-X-S Agent"
Chemical Name: Carbon, Activated
CAS No.: 7440-44-0
Chemical Formula: C
EINECS Number: 231-153-3

1.2. Use of the preparation

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP SPILLS.

1.3. Company identification

Manufacturer/Supplier: ANSUL INCORPORATED
Address: One Stanton Street, Marinette, WI 54143-2542
Prepared by: Safety and Health Department
Phone: 715-735-7411
Internet/Home Page: http://www.ansul.com
Date of Issue: September, 2009

1.4. Emergency telephone

CHEMTREC 800-424-9300 or 703-527-3887

2. COMPOSITION/INFORMATION ON INGREDIENTS

2.1. Ingredient Name: Carbon, Activated.
Chemical Formula: C.
CAS No.: 7440-44-0.
EINECS Number: 231-153-3.
Concentration, Wt %: 100 %.
Hazard Identification: See Heading 3.

2.2. (i) There are NO substances presenting a health or environmental hazard within the meaning of Directive 67/548/EEC, in concentrations equal to or greater than those laid down in the table set out in Article 3(3)of Directive 1999/45/EC, nor with lower limits given in Annex I to Directive 67/548/EEC or in Annexes II, III or V to Directive 1999/45/EC.

(ii) There are NO substances for which there are Community workplace exposure limits, which are not already included in (i) above.

NOTE: Unless a component presents a severe hazard, it does not need to be considered in the MSDS if the concentration is less than 1%. [According to Directive 1999/45/EC.]

3. HAZARDS IDENTIFICATION

FOR HUMANS:
Product:
EU Classification: Not hazardous.
Threshold Limit Values:

Carbon, activated	OSHA PEL, TWA	15 mg/m^3, total dust.
	OSHA PEL, TWA	5 mg/m^3, respirable fraction.
	MAK (DE)	6 mg/m^3. (a)
	MAC (NL)	2 mg/m^3. (a)

(a) The value given is applicable to inconvenient dust.

Neither this preparation nor the substances contained in it have been listed as carcinogenic by National Toxicology Program, I.A.R.C., or OSHA.

AS PART OF GOOD INDUSTRIAL AND PERSONAL HYGIENE AND SAFETY PROCEDURE, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes, and clothing.

SIGNS AND SYMPTOMS:
Acute Exposure:

Eye Contact:	Physical nature of the product (particulate solid) may cause irritation.
Skin Contact:	Non-toxic and not a primary skin irritant. Skin irritation index (rabbit) is 0.
Inhalation:	Non-toxic and not expected to be a problem.
Ingestion:	Non-toxic through ingestion.
Chronic Overexposure:	Not determined.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: None known.

FOR ENVIRONMENT:
Not expected to be a problem.

4. FIRST AID MEASURES

Eye Contact:	Wash with water for a minimum of 15 minutes. If irritation persists seek medical attention.
Skin Contact:	Wash affected area with soap and water. If irritation persists seek medical attention.
Inhalation:	Remove from exposure. If irritation persists seek medical attention.
Ingestion:	No treatment indicated.

5. FIRE-FIGHTING MEASURES

There are NO extinguishing media which must not be used for safety reasons.

NO special protective equipment is needed for fire-fighters. Wear protective equipment appropriate for the fire conditions.

6. ACCIDENTAL RELEASE MEASURES

For personal protection: Prevent skin and eye contact, see Heading 8.

Clean up: Sweep up, and recover if not contaminated. If contaminated store in a closed vessel until disposed. See Heading 13.

NO harm to the environment is expected from an accidental release of this preparation.

7. HANDLING AND STORAGE

7.1. Handling

Care should be taken in handling all chemical substances and preparations.

See incompatibility information in Heading 10.

7.2. Storage

NO special conditions are needed for safe storage.

See incompatibility information in Heading 10.

Store in original container or SPILL-GUN applicator. Keep tightly closed until used.

There is minimal danger to the environment from a storage release.

7.3. Specific use

The intended or recommended use of this preparation is as an AID IN CONTROLLING AND CLEANING UP SPILLS.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Exposure limit values

Threshold Limit Values:

Carbon, activated:	OSHA PEL, TWA	15 mg/m^3, total dust.
	OSHA PEL, TWA	5 mg/m^3, respirable fraction.
	MAK (DE)	6 mg/m^3. (a)
	MAC (NL)	2 mg/m^3. (a)

(a) The value given is applicable to inconvenient dust.

8.2. Exposure controls

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

Mechanical ventilation is recommended.
Dust mask where dustiness is prevalent.
Use mechanical filter respirator if exposure is prolonged.

8.2.1.2. Hand protection

Use chemical resistant gloves when handling the preparation.

8.2.1.3. Eye protection

Chemical goggles are recommended.

8.2.1.4. Skin protection

Use long sleeved work clothes.

8.2.2. Environmental exposure controls

Mechanical ventilation is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information

Appearance:	Black particulate solid.
Odor:	None.

9.2. Important health, safety, and environmental information

pH:	Not determined.
Boiling point/boiling range:	Not applicable.
Flash point:	None.
Flammability (solid/gas):	Not flammable.
Explosive properties:	Not explosive.
Oxidizing properties:	Not an oxidizer.
Vapor Pressure:	Not applicable.
Relative Density (Water = 1):	0.48.
Solubility:	
– Water solubility:	Not soluble.
– Fat solubility:	Not soluble.
Partition coefficient, n-octanol/water:	Not applicable.
Viscosity:	Not applicable.
Vapor density (Air = 1):	Not applicable.
Evaporation rate:	Not applicable.

9.3. Other information

Auto-ignition temperature:	Does not ignite.

10. STABILITY AND REACTIVITY

10.1. Conditions to avoid

There are NO known conditions such as temperature, pressure, light, shock, etc., which may cause a dangerous reaction.

10.2. Materials to avoid

Strong oxidizers such as ozone, liquid oxygen, chlorine, and permanganate.

10.3. Hazardous decomposition products

Normally stable.
Hazardous polymerization will NOT occur.
Carbon monoxide and carbon dioxide may be generated in a fire.

11. TOXICOLOGICAL INFORMATION

Toxicity Data:	Oral LD_{50} (rat)	>10 g/kg.
	Inhalation LC_{50} (rat)	> 64.4 mg/L.
Irritation Data:	Skin:	Not a primary skin irritant.
	Eye:	Not irritating.

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Not determined.

12.2. Mobility

Not determined.

12.3. Persistence and degradability

BOD5: About 2 mgO_2/L.
COD: 2,000 mg/g substance.

12.4. Bioaccumulative potential

Not determined.

12.5. Other adverse effects

Ozone depletion potential: None.
Photochemical ozone creation potential: None
Global warming potential: None

13. DISPOSAL CONSIDERATIONS

No harm to the environment is expected from this preparation.

Dispose of in compliance with national, regional, and local provisions that may be in force.

14. TRANSPORT INFORMATION

Hazard Class or Division: Not a hazardous substance.

For additional transport information, contact Ansul Incorporated.

No harm to the environment is expected from this preparation.

15. REGULATORY INFORMATION

EU Classification: Not hazardous

Threshold Limit Values:

Carbon, activated:	OSHA PEL, TWA	15 mg/m^3, total dust.
	OSHA PEL, TWA	5 mg/m^3, respirable fraction.
	MAK (DE)	6 mg/m^3. (a)
	MAC (NL)	2 mg/m^3. (a)

(a) The value given is applicable to inconvenient dust.

EINECS Status: All components are included in EINECS inventories or are exempt from listing.
EPA TSCA Status: All components are included in TSCA inventories or are exempt from listing.
Canadian DSL (Domestic Substances List): All components are included in the DSL or are exempt from listing.

Environmental restrictions: None are known.
Restrictions on Marketing and Use: None are known.
Refer to any other national measures that may be relevant.

16. OTHER INFORMATION

(HMIS) HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

HEALTH:	0	4. Severe Hazard
FLAMMABILITY:	0	3. Serious Hazard
REACTIVITY:	0	2. Moderate Hazard
		1. Slight Hazard
		0. Minimal Hazard

(WHMIS) CANADIAN WORKPLACE HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

This product is rated: **Not rated hazardous.**

Format is from directive 2001/58/EC.
EINECS data is from http://exb.jrc.it/existing-chemicals/
Data used to compile the data sheet is from Ansul Material Safety Data Sheet, February, 2002.

The EU Classification has been changed in accordance with Directive 1999/45/EC and information in the EINICS ESIS files (Existing Substances Information System).
Toxicological information added from the EINICS ESIS (Existing Substances Information System).
A rating under WHMIS has been added, following the Canadian guidelines.

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N/A = Not Applicable

NDA = No Data Available

MSDS available at http://www.ansul.com

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NFPA® 704 Labeling Guide

National Fire Protection Association
The authority on fire, electrical, and building safety

"The National Fire Protection Association (NFPA) is an international nonprofit organization established in 1896. The company's mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education."

NFPA publishes 300 codes and standards to establish criteria to minimize the risk and effects of fire in the United States as well as in many other countries.

Some of the most widely used NFPA codes and standards are:

- **NFPA 1, Fire Code**. Provides requirements to establish a reasonable level of fire safety and property protection.
- **NFPA 54, National Fuel Gas Code**. The safety benchmark for fuel gas installations.
- **NFPA 70, National Electric Code**. The world's most widely used and accepted code for electrical installations.
- **NFPA 101, Life Safety Code**. Establishes minimum requirements to protect building occupants from fire, smoke, and toxic fumes.
- **NFPA 704.** Standard System maintained by the US-based NFPA for the Identification of the Hazards of Materials for Emergency Response.

  NFPA 704 *"standard presents a simple, readily recognized, and easily understood system of markings (commonly referred to as the "**NFPA hazard diamond**") that provides an immediate general sense of the **hazards of a material and the severity of these hazards as they relate to emergency response**.*

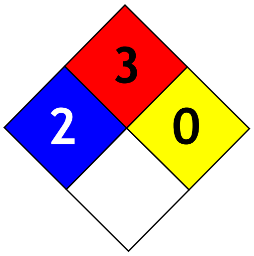
  *NFPA 704 provides **criteria for assessing the health*** (blue color)***, flammability*** (red color)***, instability*** (yellow color)***, and related hazards*** (white color) *that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. **A number rating system of 0-4 is provided to rate each of the four hazards** (…)."*

NFPA® 704 Labeling Guide

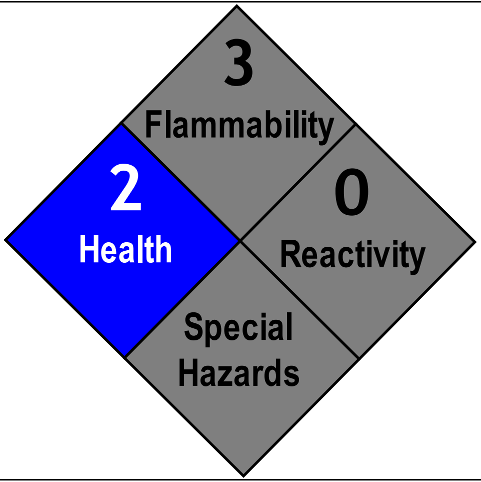
Example

Product name	**Ethanol solution**
Product number	02877
Brand	Fluka
Supplier	Sigma-Aldrich, St. Louis, MO 63103, USA
Synonym	Ethyl alcohol
Formula	C_2H_6O
Molecular weight	46.07 g/mol
CAS number	64-17-5
Flash point	22 °C (72 °F)
OSHA hazards	Flammable liquid, target organ effect, carcinogen
Target organs	Nerves, liver, heart
GHS classification	Flammable liquids (Category 2), skin irritation (Category 2), eye irritation (Category 2B), specific target organ toxicity-Single exposure (Category 3)
NFPA rating	Health hazard (2), fire (3), reactivity hazard (0)
Potential health effects	Inhalation (may be harmful if inhaled; causes respiratory tract irritation), skin (may be harmful if absorbed through skin; causes skin irritation); eyes (causes eye irritation); ingestion (may be harmful if swallowed)
Stability & Reactivity	Vapors may form explosive mixture with air. Avoid heat, flames, sparks, extremes of temperature and direct sunlight. Avoid contact with alkali metals, ammonia, oxidizing agents, peroxides.

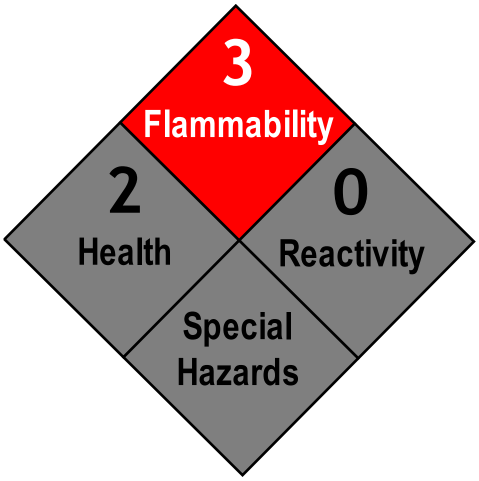
NFPA® 704 symbol:



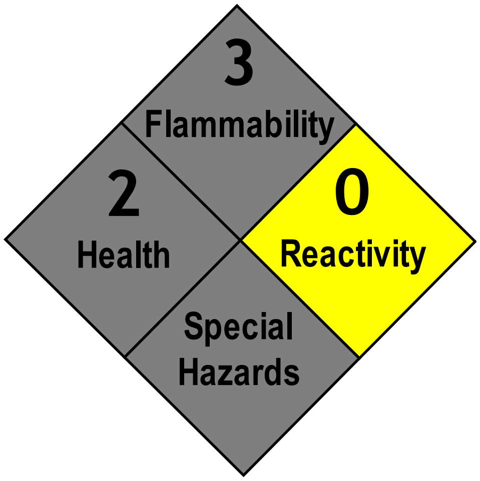
Description of the symbol and ratings



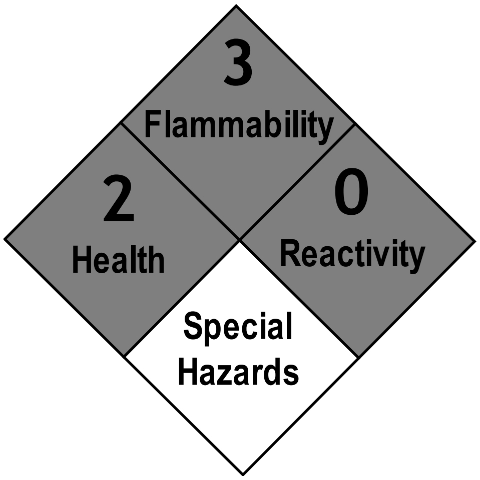
	Health Hazard
	Color Code: Blue **Type of Possible Injury**
	Materials that, under emergency conditions …
4	… can be lethal
3	… can cause serious or permanent injury
2	… can cause temporary incapacitation or residual injury
1	… can cause significant irritation
0	… would offer no hazard beyond that of ordinary combustible materials



	Flammability
	Color Code: Red **Susceptibility of Materials to Burning**
4	Materials that rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and burn readily
3	Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions
2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air
1	Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur
0	Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand



	Instability (Reactivity)
	Color Code: Yellow **Susceptibility to Release of Energy**
4	Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures
3	Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction but that require a strong initiating source or must be heated under confinement before initiation
2	Materials that readily undergo violent chemical change at elevated temperatures and pressures
1	Materials that in themselves are normally stable but that can become unstable at elevated temperatures and pressures
0	Materials that in themselves are normally stable, even under fire conditions



	Special Hazards
	Color Code: White **Special Hazards**
OX	Materials that possess oxidizing properties. Oxygen will support combustion. Reacts to oxidize fuels or combustibles
~~W~~	Reacts violently or in a dangerous manne3r with water
SA	Simple asphyxiant gasses (limited to: N, He, Ne, Ar, Kr, Xe)
NON-STANDARD SYMBOLS (not part of the NFPA 704 standard, but their use is permitted by some authorities such as fire departments):	
COR	Corrosive. Strong acid, alkali or other materials that will cause severe damage to living tissues (e.g., sulfuric acid, sodium hydroxide)
BIO ☣	Biological hazard
RAD ☢	Materials possessing radioactivity hazard
POI	Poisonous
CRYO	Cryogenic (e.g., liquid nitrogen)

NFPA® 704 ratings for frequently used chemicals/ materials in ABI laboratories

Chemicals	CAS number	Health (Blue)	Flammability (Red)	Reactivity (Yellow)	Special (White)
Acetic acid	64-19-7	3	2	0	
Acetone	67-64-1	2	3	0	
Acetonitrile	75-05-8	2	3	0	
Acetylene	35121-31-4	0	4	0	
Agarose	9012-36-6	0	0	0	
Ammonia, anhydrous	7664-41-7	3	0	0	
Ammonium acetate	631-61-8	0	0	0	
Ammonium hydroxide solution (50-70%)	1336-21-6	3	0	0	
Ammonium persulfate (APS; Ammonium peroxydisulfate; Ammonium peroxodisulfate)	7727-54-0	3	0	3	
Ammonium sulfate	7783-20-2	0	0	0	
p-Anisaldehyde (4-Methoxybenzaldehyde)	123-11-5	0	0	0	
Argon (gas)	7440-37-1	0	0	0	SA
Ethylene glycol (1,2-ethanediol)	107-21-1	2	1	0	
Boric acid	10043-35-3	0	0	0	
Butane	106-97-8	0	4	0	
1-Butanol (Butyl alcohol; n-Butanol)	71-36-3	2	3	0	
Calcium chloride (90-100%)	10043-52-4	2	0	0	
Calcium oxide (lime; quicklime)	1305-78-8	3	0	0	
Calcium hypochlorite	7778-54-3	3	0	2	OX
Carbon dioxide (gas; CO_2)	124-38-9	0	0	0	
Charcoal, activated	7440-44-0	0	0	0	
Chlorine gas	7782-50-5	4	0	0	OX
Chloroform	67-66-3	2	0	0	
Citric acid	77-92-9	2	0	0	
Colchicine	64-86-8	4	0	0	
CTAB (Hexadecyltrimethylammonium bromide)	57-09-0	2	1	0	
Dichloromethane	75-09-2	2	0	0	
Diesel fuel	68334-30-5	2	2	0	
Dimethyl sulfoxide (DMSO)	67-68-5	0	2	0	
Ethanol (ethyl alcohol)	64-17-5	2	3	0	
Ethyl acetate	141-78-6	2	3	1	
Ethyl ether	60-29-7	1	4	1	
Diethyl ether	60-29-7	2	4	0	

Chemicals	CAS number	Health (Blue)	Flammability (Red)	Reactivity (Yellow)	Special (White)
Ethyl vinyl ether	109-92-2	2	4	0	
Ethyl formate	109-94-4	2	3	0	
Ethylenediaminetetraacetic acid (EDTA)	60-00-4	2	0	0	
Ethidium bromide	1239-45-8	4	0	0	
Formic acid	64-18-6	3	2	0	
Formaldehyde solution (36.5-38%)	50-00-0	3	2	0	
GPA, natural gas	74-82-8	2	4	0	
Gasoline, aviation	67-56-1	2	3	0	
Gasoline, premium unleaded	67-56-1	2	0	0	
Glucose [Dextrose; D-(+)-Glucose]	50-99-7	0	0	0	
Glycerol (glycerin; 1,2,3-propanetriol)	56-81-5	0	1	0	
Helium (gas)	7440-59-7	0	0	0	SA
Hexane (n-Hexane)	110-54-3	2	3	0	
Hydrofluoric acid	7664-39-3	4	0	0	
Hydrochloric acid (HCl, muriatic acid)	7647-01-0	3	0	0	
Hydrogen peroxide (30-50%)	7722-84-1	3	0	2	OX
Isoamyl alcohol (isopentyl alcohol)	123-51-3	2	2	0	
Isopropanol (2-propanol; isopropyl alcohol)	67-63-0	2	3	0	
Kerosene	8008-20-6	2	2	0	
Lithium chloride (90-100%)	7447-41-8	2	0	0	
Luria broth base, Miller (LB medium)	See: agar, tryptone, yeast extract, sodium chloride	1	0	0	
D-Mannitol (Mannite)	69-65-8	0	0	0	
2-mercaptoethanol (beta-mercaptoethanol; thioethylene glycol)	60-24-2	3	0	0	
Methanesulfonic acid	75-75-2	3	1	0	
Methanol (methyl alcohol)	67-56-1	2	3	0	
2-Butanone (methyl ethyl ketone; ethyl methyl ketone)	78-93-3	2	3	0	
Nitric Acid (50-70%)	7697-37-2	3	0	2	OX
Nitric Acid (90-100%)	7697-37-2	4	0	3	OX
Nitrogen, refrigerated liquid (boiling: -195.79 °C = -320.4 °F)	7727-37-9	3	0	0	SA
Nitrogen, compressed gas	7727-37-9	0	0	0	SA
Oil, motor (waste; 90-100%)	75-09-2	2	0	0	
Oxygen, refrigerated liquid	7782-44-7	3	0	0	OX
Oxygen, compressed gas	7782-44-7	0	0	0	OX

Chemicals	**CAS number**	**Health (Blue)**	**Flammability (Red)**	**Reactivity (Yellow)**	**Special (White)**
Phenol	108-95-2	3	2	0	
Phosphoric Acid (85%)	7664-38-2	3	0	0	
Phytagel®	71010-52-1 (Gellam Gum)	1	0	0	
Polyethylene glycol solution (PEG, 50-70%)	25322-68-3	0	0	0	
Polyvinylpyrrolidone (PVP; Polyvidone; Povidone; 1-Ethenyl-2-pyrrolidinone homopolymer)	9003-39-8	0	0	0	
Potassium hydroxide	1310-58-3	3	0	0	
Potassium nitrate	7757-79-1	0	0	1	OX
Potassium phosphate dibasic	7758-11-4	0	0	0	
Potassium phosphate monobasic (Monopotassium phosphate; Potassium dihydrogen phosphate)	7778-77-0	0	0	0	
Propane	74-98-6	0	4	0	
Propyl bromide (1-Bromopropane)	106-94-5	2	0	0	
Pyrene	129-00-0	0	1	0	
Sodium acetate (anhydrous)	127-09-3	1	1	0	
Sodium acetate trihydrate	6131-90-4	0	0	0	
Sodium bicarbonate	144-55-8	0	0	0	
Sodium carbonate	497-19-8	2	0	0	
Sodium chloride	7647-14-5	1	0	0	
Sodium citrate dibasic sesquihydrate (Citric acid disodium salt)	6132-05-4	0	0	1	
Sodium citrate dihydrate	6132-04-3	0	0	0	
Sodium citrate monobasic	18996-35-5	0	0	0	
Sodium dodecyl sulfate (SDS; sodium lauryl sulfate; lauryl sulfate sodium salt)	151-21-3	2	3	1	
Sodium hydroxide	1310-73-2	3	0	0	
Sodium hypochlorite solution (1-30%)	7681-52-9	3	0	0	OX
Sodium phosphate	7601-54-9	2	0	0	
Sodium phosphate dibasic	7558-79-4	0	0	0	
Sodium phosphate monobasic (Monosodium phosphate; Sodium dihydrogen phosphate)	7558-80-7	0	0	0	
D-Sorbitol (D-Glucitol)	50-70-4	0	0	0	
Sucrose [D(+)-Saccharose;, "Sugar"; α-D-Glucopyranosyl β-D-fructofuranoside; β-D-Fructofuranosyl-α-D-glucopyranoside]	57-50-1	0	0	0	
Sulfuric acid (90-100%)	7664-93-9	3	0	2	W
Toluene	108-88-3	2	3	0	

Chemicals	CAS number	Health (Blue)	Flammability (Red)	Reactivity (Yellow)	Special (White)
Trichloroacetic acid (≤ 100%; TCA)	76-03-9	3	1	0	
Trichloroethylene (TCE)	79-01-6	2	0	0	
Trifluoroacetic acid (TFA)	76-05-1	3	0	1	
Tris-HCl [2-Amino-2-(hydroxymethyl) propane-1,3-diol hydrochloride]	1185-53-1	0	0	0	
Triton™ X-100	9002-93-1	2	1	0	
Trizma® base [2-Amino-2-(hydroxymethyl)-1,3-propanediol; Tris base; Tris(hydroxymethyl)aminomethane]	77-86-1	0	0	0	
Tryptone	91079-40-2	0	0	0	
Tween®-20	9005-64-5	0	0	0	
Urea	57-13-6	0	0	0	
Water	7732-18-5	0	0	0	
Yeast extract	8013-01-2	0	0	0	

References:

1. NFPA® web-site www.nfpa.org/about-nfpa/overview. Visited on January 30th, 2014.

2. NFPA® 704, Standard System for the Identification of the Hazards of Materials for Emergency Response, 2007 Edition. NFPA®, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101. United States of America.

All **NFPA® 704 ratings and CAS Registry Numbers (Chemical Abstracts Service, American Chemical Society)** for the chemicals/materials shown above were taken from their corresponding MSDS (Material Safety Data Sheets) from Sigma-Aldrich, except those for oxygen and nitrogen –gas and liquid– (Airgas Inc.), as well as those ones for ethyl ether (Fisher Scientific).

3. Sigma-Aldrich Co. LLC. 3050 Spruce Street, Saint Louis, MO 63103. United States of America. www.sigmaaldrich.com

4. Airgas Inc. 259 North Radnor-Chester Road, Suite 100. Radnor, PA 19087-5283. United States of America. www.airgas.com

5. Fisher Scientific. 300 Industry Drive, Pittsburgh, PA 15275. United States of America www.fishersci.com

ABI, January 30th, 2014.

704

NFPA® 704
Standard System for the Identification of the Hazards of Materials for Emergency Response
2007 Edition

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NFPA 704

Standard System for the

Identification of the Hazards of Materials for Emergency Response

2007 Edition

This edition of NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, was prepared by the Technical Committee on Classification and Properties of Hazardous Chemical Data. It was issued by the Standards Council on July 28, 2006, with an effective date of August 17, 2006, and supersedes all previous editions.

This edition of NFPA 704 was approved as an American National Standard on August 17, 2006.

Origin and Development of NFPA 704

Work on this standard originated in 1957; a great deal of the development work had been done by the NFPA Sectional Committee on Classification, Labeling, and Properties of Flammable Liquids starting in 1952. Background data were published by the Association in its quarterly magazine in 1954, 1956, and 1958. The material in its present form was first tentatively adopted in 1960. Official adoption was secured in 1961, and revisions were adopted in 1964, 1966, 1969, 1975, 1980, and 1985. In the 1987 and 1990 editions, the Committee on Fire Hazards of Materials introduced quantitative guidelines for assigning the Health Hazard and Reactivity Hazard Ratings. The 1996 edition introduced additional quantitative guidelines and an amended definition for the Instability Hazard Rating, formerly the Reactivity Hazard Rating.

The 2001 edition clarified numerous topics, including the following: rating of mixtures; three options of how to rate areas with multiple chemical storage and use; location of signs; more quantitative criteria for flammability ratings for solids; and quantitative criteria for a flammability rating of zero, including introduction of a new test method. Guidance material was added for quantifying the degree of water reactivity. An annex was added to cover water reactivity and identification criteria, as well as additional information on flash point test methods.

This 2007 edition clarifies numerous topics, including the special hazards quadrant, placement and hierarchy of symbols, and the new Simple Asphyxiant (SA) designation and other optional symbols. Requirements have been added for the classification of flammability rating for dusts.

Technical Committee on Classification and Properties of Hazardous Chemical Data

Gary Robinson, *Chair*
Liberty Mutual Group, IL [I]
Rep. Property Casualty Insurers Association of America

Robert A. Michaels, *Secretary*
RAM TRAC Corporation, NY [SE]

Laurence G. Britton, Neolytica, WV [SE]
Lance Edwards, National Paint & Coatings Association, DC [M]
Richard Gowland, European Process Safety Centre, United Kingdom [U]
Ronald Keefer, Menlo Park Fire Protection District, CA [E]
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Amy B. Spencer, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the classification of the relative hazards of all chemical solids, liquids, and gases and to compile data on the hazard properties of these hazardous chemicals.

Contents

NFPA 704

Standard System for the

Identification of the Hazards of Materials for Emergency Response

2007 Edition

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Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex G. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex G.

Chapter 1 Administration

1.1 Scope. This standard shall address the health, flammability, instability, and related hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies.

1.2 Purpose.

1.2.1 This standard shall provide a simple, readily recognized, and easily understood system of markings that provides a general idea of the hazards of a material and the severity of these hazards as they relate to emergency response.

1.2.2 The objectives of the system shall be as follows:

(1) To provide an appropriate signal or alert and on-the-spot information to safeguard the lives of both public and private emergency response personnel
(2) To assist in planning for effective fire and emergency control operations, including cleanup
(3) To assist all designated personnel, engineers, and plant and safety personnel in evaluating hazards

1.2.3 This system shall provide basic information to firefighting, emergency, and other personnel, enabling them to easily decide whether to evacuate the area or to commence emergency control procedures.

1.2.4 This system also shall provide those personnel with information to assist in selecting fire-fighting tactics and emergency procedures.

1.2.5 Local conditions can have a bearing on evaluation of hazards; therefore, discussion shall be kept in general terms.

1.3 Application.

1.3.1 This standard shall apply to industrial, commercial, and institutional facilities that manufacture, process, use, or store hazardous materials.

1.3.2* This standard shall not apply to transportation or use by the general public and is not intended to address the following:

(1) Occupational exposure
(2) Explosive and blasting agents, including commercial explosive material as defined in NFPA 495, *Explosive Materials Code*
(3) Chemicals whose only hazard is one of chronic health hazards
(4) Teratogens, mutagens, oncogens, etiologic agents, and other similar hazards

1.4 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.4.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction and only where it is clearly evident that a reasonable degree of safety is provided.

1.5 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 70, *National Electrical Code*®, 2005 edition.
NFPA 495, *Explosive Materials Code*, 2006 edition.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D 86, *Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure,* 2001.

ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup,* 1998.

ASTM D 6668, *Standard Test Method for the Discrimination Between Flammibility Ratings of F = 0 and F = 1,* 2001.

2.3.2 UN Publications. United Nations, UN Plaza, New York, NY 10017.

Manual of Tests and Criteria, 3rd revised edition.

Recommendations on the Transport of Dangerous Goods, Model Regulations, 11th revised edition.

2.3.3 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 49, Code of Federal Regulations, "Method of Testing for Sustained Combustibility," Part 173, Appendix H.

2.3.4 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Uniform Fire Code™,* 2006 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2003 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Shall. Indicates a mandatory requirement.

3.3 General Definitions.

3.3.1* 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. [**30,** 2003]

3.3.2 Fire Point. The lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame in accordance with ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup.*

3.3.3* Flash Point. The minimum temperature at which a liquid or a solid emits vapor sufficient to form an ignitible mixture with air near the surface of the liquid or the solid.

3.3.4* Frostbite. Frostbite is a localized condition that occurs when the layers of the skin and deeper tissue freeze.

3.3.5 Materials.

3.3.5.1 *Stable Materials.* Those materials that normally have the capacity to resist changes in their chemical composition, despite exposure to air, water, and heat as encountered in fire emergencies.

3.3.5.2 *Unstable Materials.* A material that, in the pure state or as commercially produced, will vigorously polymerize, decompose or condense, become self-reactive, or otherwise undergo a violent chemical change under conditions of shock, pressure, or temperature.

3.3.6 Simple Asphyxiant Gas. A gas that does not provide sufficient oxygen to support life and that has none of the other physical or health hazards. [**1,** 2006]

Chapter 4 General

4.1 Description.

4.1.1 This system of markings shall identify the hazards of a material in terms of the following three principal categories:

(1) Health
(2) Flammability
(3) Instability

4.1.2 The system shall indicate the degree of severity by a numerical rating that ranges from four, indicating severe hazard, to zero, indicating minimal hazard.

4.1.3 The information shall be presented by a spatial arrangement of numerical ratings, with the health rating always at the nine o'clock position, the flammability rating always at the twelve o'clock position, and the instability rating always at the three o'clock position.

4.1.4* Each rating shall be located in a square-on-point field (commonly referred to as a diamond), each of which is assigned a color as follows:

(1) Blue for health hazard
(2) Red for flammability hazard
(3) Yellow for instability hazard

4.1.5 Alternatively, the square-on-point field shall be permitted to be any convenient contrasting color and the numbers themselves shall be permitted to be colored. *(See Figure 9.1(a) through Figure 9.1(c) for examples of the spatial arrangements.)*

4.1.6 The fourth quadrant, at the six o'clock position, shall be reserved for indicating special hazards and shall be in accordance with Chapter 8. No special color is associated with this quadrant.

4.2 Assignment of Ratings.

4.2.1 The hazard evaluation required to determine the correct hazard ratings for a specific material shall be performed by persons who are technically competent and experienced in the interpretation of the hazard criteria set forth in this standard.

4.2.2* Assignment of ratings shall be based on factors that encompass a knowledge of the inherent hazards of the material, including the extent of change in behavior to be anticipated under conditions of exposure to fire or fire control procedures.

4.2.3 The system shall be based on relative rather than absolute values, requiring considerable judgment be exercised.

4.2.3.1 Based on professional judgment, the hazard rating shall be permitted to be either increased or decreased to more accurately assess the likely degree of hazard that will be encountered.

4.2.3.2* It shall be anticipated that different physical forms of the material or conditions of storage and use could result in different ratings being assigned to the same material.

4.2.3.3* Where more than one chemical is present in a building or specific area, professional judgment shall be exercised to indicate ratings using the following methods:

(1) *Composite Method.* Where many chemicals are present, a single sign shall summarize the maximum ratings contributed by the material(s) in each category and the special hazard category for the building and/or the area.
(2) *Individual Method.* Where only a few chemicals are present or where only a few chemicals are of concern to emergency responders (taking into account factors including physical form, hazard rating, and quantity), individual signs shall be displayed. The chemical name shall be displayed below each sign.
(3) *Composite–Individual Combined Method.* A single sign shall be used to summarize the ratings via the Composite Method for buildings or other areas containing numerous chemicals. Signs based on the Individual Method shall be used for rooms or smaller areas within the building containing small numbers of chemicals.

4.2.3.4* When mixtures of chemicals are being rated, actual data on the mixture itself shall be used to obtain the ratings for health, flammability, and instability.

4.3* Location of Signs. Signs shall be in locations approved by the authority having jurisdiction and as a minimum shall be posted at the following locations:

(1) Two exterior walls or enclosures containing a means of access to a building or facility
(2) Each access to a room or area
(3) Each principal means of access to an exterior storage area

Chapter 5 Health Hazards

5.1 General.

5.1.1* This chapter shall address the capability of a material to cause personal injury due to contact with or entry into the body via inhalation, skin contact, eye contact, or ingestion.

5.1.2 Injury resulting from the heat of a fire or from the force of an explosion shall not be considered.

5.1.3* Health hazards that can result from chronic or repeated long-term exposure to low concentrations of a hazardous material shall not be considered.

5.1.4* If the oral toxicity values indicate a health hazard rating that is significantly different from other, more likely routes of exposure or if the oral toxicity values would tend to either exaggerate or minimize the hazards likely to be encountered, then professional judgment shall be exercised in assigning the health hazard rating.

5.1.5* For purposes of assigning the health hazard rating, only the inherent physical and toxic properties of the material shall be considered. However, if the combustion or decomposition products are known, are generated in significant quantities, and present a significantly greater degree of risk, they shall be rated accordingly.

5.1.6 The degree of hazard shall indicate to fire-fighting and emergency response personnel one of the following:

(1) They can work safely in the area only with specialized protective equipment.
(2) They can work safely in the area with suitable respiratory protective equipment.
(3) They can work safely in the area with ordinary clothing.

5.2* Degrees of Hazard. The degrees of health hazard shall be ranked according to the probable severity of the effects of exposure to emergency response personnel detailed in Table 5.2.

5.2.1 Data from all routes of exposure shall be considered when applying professional judgment to assign a health hazard rating.

Table 5.2 Degrees of Health Hazards

Degree of Hazard*	Criteria[†]
4 — Materials that, under emergency conditions, can be lethal	Gases whose LC_{50} for acute inhalation toxicity is less than or equal to 1000 parts per million (ppm)
	Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than 10 times its LC_{50} for acute inhalation toxicity, if its LC_{50} is less than or equal to 1000 ppm
	Dusts and mists whose LC_{50} for acute inhalation toxicity is less than or equal to 0.5 milligram per liter (mg/L)
	Materials whose LD_{50} for acute dermal toxicity is less than or equal to 40 milligrams per kilogram (mg/kg)
	Materials whose LD_{50} for acute oral toxicity is less than or equal to 5 mg/kg

Table 5.2 ***Continued***

Degree of Hazard*	Criteria†
3 — Materials that, under emergency conditions, can cause serious or permanent injury	Gases whose LC_{50} for acute inhalation toxicity is greater than 1000 ppm but less than or equal to 3000 ppm Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than its LC_{50} for acute inhalation toxicity, if its LC_{50} is less than or equal to 3000 ppm, and that does not meet the criteria for degree of hazard 4 Dusts and mists whose LC_{50} for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L Materials whose LD_{50} for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg Materials that are corrosive to the respiratory tract Materials that are corrosive to the eye or cause irreversible corneal opacity Materials that are corrosive to skin Cryogenic gases that cause frostbite and irreversible tissue damage Compressed liquefied gases with boiling points at or below −55°C (−66.5°F) that cause frostbite and irreversible tissue damage Materials whose LD_{50} for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg
2 — Materials that, under emergency conditions, can cause temporary incapacitation or residual injury	Gases whose LC_{50} for acute inhalation toxicity is greater than 3000 ppm but less than or equal to 5000 ppm Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC_{50} for acute inhalation toxicity, if its LC_{50} is less than or equal to 5000 ppm, and that does not meet the criteria for either degree of hazard 3 or degree of hazard 4 Dusts and mists whose LC_{50} for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L Materials whose LD_{50} for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg Compressed liquefied gases with boiling points between −30°C (−22°F) and −55°C (−66.5°F) that can cause severe tissue damage, depending on duration of exposure Materials that are respiratory irritants Materials that cause severe but reversible irritation to the eyes or lacrimators Materials that are primary skin irritants or sensitizers Materials whose LD_{50} for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg
1 — Materials that, under emergency conditions, can cause significant irritation	Gases and vapors whose LC_{50} for acute inhalation toxicity is greater than 5000 ppm but less than or equal to 10,000 ppm Dusts and mists whose LC_{50} for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L Materials whose LD_{50} for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg Materials that cause slight to moderate irritation to the respiratory tract, eyes, and skin Materials whose LD_{50} for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg
0 — Materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials	Gases and vapors whose LC_{50} for acute inhalation toxicity is greater than 10,000 ppm Dusts and mists whose LC_{50} for acute inhalation toxicity is greater than 200 mg/L Materials whose LD_{50} for acute dermal toxicity is greater than 2000 mg/kg Materials whose LD_{50} for acute oral toxicity is greater than 2000 mg/kg Materials that are essentially nonirritating to the respiratory tract, eyes, and skin

*For each degree of hazard, the criteria are listed in a priority order based on the likelihood of exposure.
†See Section B.3 for definitions of LC_{50} and LD_{50}.

Chapter 6 Flammability Hazards

6.1 General.

6.1.1 This chapter shall address the degree of susceptibility of materials to burning.

6.1.2* Because many materials will burn under one set of conditions but will not burn under others, the form or condition of the material shall be considered, along with its inherent properties.

6.2* Degrees of Hazard. The degrees of flammability hazard shall be ranked according to the susceptibility of materials to burning detailed in Table 6.2.

Table 6.2 Degrees of Flammability Hazards

Degree of Hazard	Criteria
4 — Materials that rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and burn readily	Flammable gases Flammable cryogenic materials Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e., Class IA liquids) Materials that ignite spontaneously when exposed to air Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.
3 — Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions.	Liquids having a flash point below 22.8°C (73°F) and a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (100°F) (i.e., Class IB and Class IC liquids) Finely divided solids, typically less than 75 micrometers (μm) (200 mesh), that present an elevated risk of forming an ignitible dust cloud, such as finely divided sulfur, *National Electrical Code* Group E dusts (e.g., aluminum, zirconium, and titanium), and bis-phenol A Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g., dry nitrocellulose and many organic peroxides) Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.
2 — Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air.	Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e., Class II and Class IIIA liquids) Finely divided solids less than 420 μm (40 mesh) that present an ordinary risk of forming an ignitible dust cloud Solid materials in a flake, fibrous, or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal, and hemp Solids and semisolids that readily give off flammable vapors Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

Table 6.2 *Continued*

Degree of Hazard	Criteria
1 — Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur.	Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes in accordance with ASTM D 6668, *Standard Test Method for the Discrimination Between Flammability Ratings of F = 0 and F = 1* Liquids, solids, and semisolids having a flash point at or above 93.4°C (200°F) (i.e., Class IIIB liquids) Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the "Method of Testing for Sustained Combustibility," per 49 CFR 173, Appendix H, or the UN publications *Recommendations on the Transport of Dangerous Goods, Model Regulations* and *Manual of Tests and Criteria* Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water noncombustible liquid/solid content of more than 85 percent by weight Liquids that have no fire point when tested by ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup*, up to the boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change Combustible pellets, powders, or granules greater than 420 μm (40 mesh) Finely divided solids less than 420 μm that are nonexplosible in air at ambient conditions, such as low volatile carbon black and polyvinylchloride (PVC) Most ordinary combustible materials Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.
0 — Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand	Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with ASTM D 6668, *Standard Test Method for the Discrimination Between Flammability Ratings of F = 0 and F = 1*

Chapter 7 Instability Hazards

7.1 General.

7.1.1* This chapter shall address the degree of intrinsic susceptibility of materials to release energy.

7.1.1.1 This chapter shall apply to those materials capable of rapidly releasing energy by themselves, through self-reaction or polymerization.

7.1.1.2 Water reactivity shall be assessed in accordance with Chapter 8.

7.1.1.3* In the evaluation of the hazards of organic peroxides, additional factors shall be taken into account.

7.1.2* Because of the wide variations of unintentional combinations possible in fire or other emergencies, these extraneous hazard factors (except for the effect of water) shall not be applied to a general numerical rating of hazards. Where large quantities of materials are stored together, inadvertent mixing shall be considered in order to establish appropriate separation or isolation.

7.1.3 The degree of instability hazard shall indicate to firefighting and emergency personnel whether the area shall be evacuated, whether a fire shall be fought from a protected location, whether caution shall be used in approaching a spill or fire to apply extinguishing agents, or whether a fire can be fought using normal procedures.

7.2 Degrees of Hazard. The degrees of hazard shall be ranked according to ease, rate, and quantity of energy release of the material in pure or commercial form detailed in Table 7.2.

Table 7.2 Degrees of Instability Hazards

Degree of Hazard	Criteria
4 — Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures	Materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) of 1000 watts per milliliter (W/mL) or greater
3 — Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction but that require a strong initiating source or must be heated under confinement before initiation	Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 100 W/mL and below 1000 W/mL Materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures
2 — Materials that readily undergo violent chemical change at elevated temperatures and pressures	Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 10 W/mL and below 100 W/mL
1 — Materials that in themselves are normally stable but that can become unstable at elevated temperatures and pressures	Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 0.01 W/mL and below 10 W/mL
0 — Materials that in themselves are normally stable, even under fire conditions	Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) below 0.01 W/mL Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C (932°F) when tested by differential scanning calorimetry

Chapter 8 Special Hazards

8.1 General.

8.1.1* This chapter shall address water reactivity and oxidizing properties of the materials that cause special problems or require special fire-fighting techniques.

8.1.2 Special hazard symbols shall be shown in the fourth space of the sign or immediately above or below the entire sign.

8.2 Symbols. Special hazards shall be represented by a spatial arrangement denoted by symbols always at the six o'clock position.

8.2.1* Materials that react violently or explosively with water (i.e., water reactivity rating 2 or 3) shall be identified by the letter "W" with a horizontal line through the center (₩).

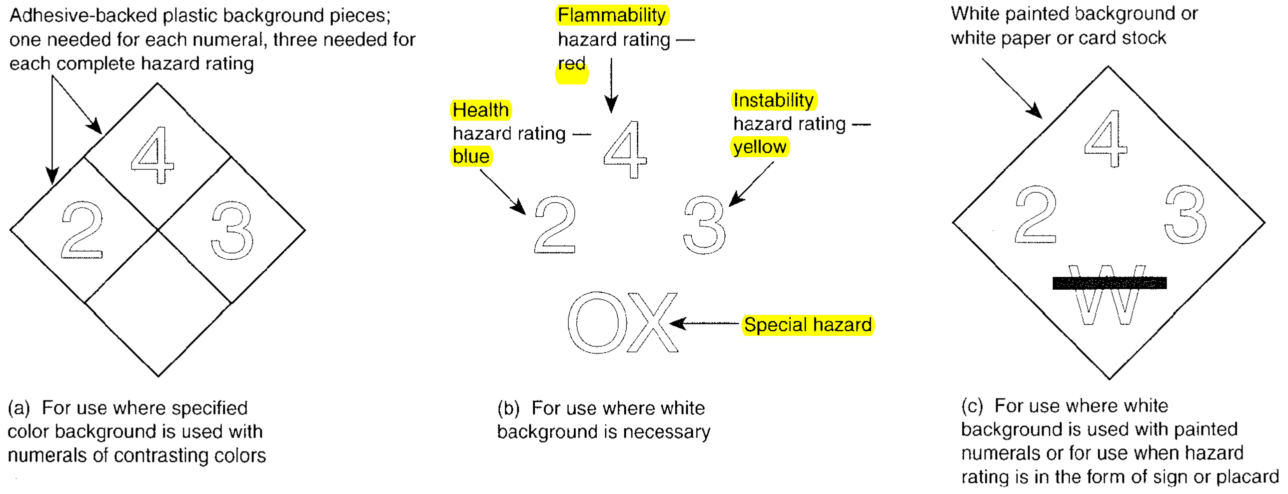
8.2.2* Materials that possess oxidizing properties shall be identified by the letters "OX."

8.2.3* For chemicals requiring both "special hazard" symbols (i.e., ₩ and OX), the ₩ shall be displayed inside the special hazards quadrant, and the OX shall be displayed directly below or adjacent to the special hazards quadrant.

8.2.4* Materials that are simple asphyxiant gases shall be permitted to be identified with the letters "SA" and shall be limited to the following gases: nitrogen, helium, neon, argon, krypton, and xenon.

Chapter 9 Identification of Materials by Hazard Rating System

9.1 Symbol Arrangement. One of the systems delineated in Figure 9.1(a), Figure 9.1(b), or Figure 9.1(c) shall be used for the implementation of this standard.

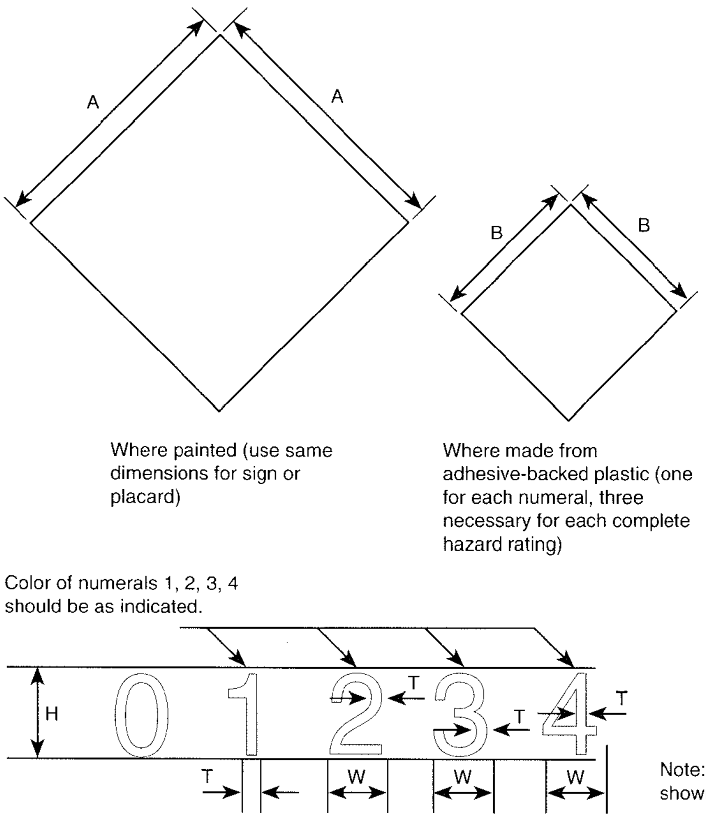


(a) For use where specified color background is used with numerals of contrasting colors

(b) For use where white background is necessary

(c) For use where white background is used with painted numerals or for use when hazard rating is in the form of sign or placard

FIGURE 9.1 (a) Alternative Arrangements for Display of NFPA 704 Hazard Identification System.



Where painted (use same dimensions for sign or placard)

Where made from adhesive-backed plastic (one for each numeral, three necessary for each complete hazard rating)

Color of numerals 1, 2, 3, 4 should be as indicated.

Note: Style of numerals shown is optional.

Minimum dimensions of white background for hazard ratings (white background is optional)

Size of hazard ratings H	W	T	A	B
25 (1)	18 (0.7)	4 (5/32)	64 (2½)	32 (1¼)
51 (2)	36 (1.4)	8 (5/16)	127 (5)	64 (2½)
76 (3)	53 (2.1)	12 (15/32)	191 (7½)	95 (3¾)
102 (4)	71 (2.8)	16 (5/8)	254 (10)	127 (5)
152 (6)	107 (4.2)	24 (15/16)	381 (15)	191 (7½)

All dimensions given in mm (in.)

Exception: For containers with a capacity of 3.78 L (1 gal) or less, symbols can be reduced in size, provided the following:
(1) The reduction is proportionate.
(2) The color coding is retained.
(3) The vertical and horizontal dimensions of the diamond are not less than 25 mm (1 in.).
(4) The individual numbers are no smaller than 3.2 mm (1/8 in.) tall.

FIGURE 9.1 (b) Dimensions of NFPA 704 Placard and Numerals.

Arrangement and order of hazard ratings optional form of application

Distance at which hazard ratings are legible	Minimum size of hazard ratings required
15.24 m (50 ft)	25 mm (1 in.)
22.86 m (75 ft)	51 mm (2 in.)
30.48 m (100 ft)	76 mm (3 in.)
60.96 m (200 ft)	102 mm (4 in.)
91.44 m (300 ft)	152 mm (6 in.)

Note: This shows the correct spatial arrangement and order of hazard ratings used for identification of materials by hazard.

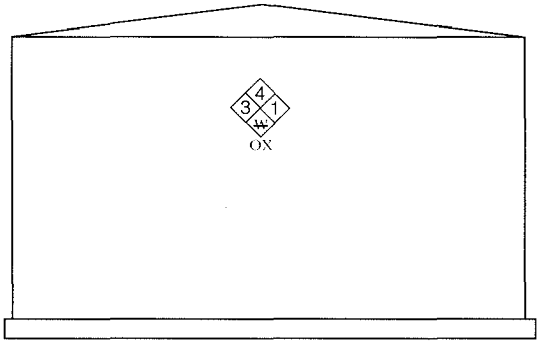


FIGURE 9.1(c) Minimum Size of Numerals for Legibility at Distance.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.3.2 The Technical Committee on Classification and Properties of Hazardous Chemical Data recognizes that the potential exists for certain materials to cause a carcinogenic or teratogenic effect from acute exposure(s). However, sufficient data are not available to this committee to allow for the development of numerical ratings based on carcinogenic or teratogenic potential.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.3.1 Boiling Point. For single-component liquids at the boiling point, the surrounding atmospheric pressure can no longer hold the liquid in the liquid state and the liquid boils. A low boiling point is indicative of a high vapor pressure and a high rate of evaporation.

Where an accurate boiling point is unavailable for the material in question or for mixtures that do not have a constant boiling point, for purposes of this standard the 20 percent point of a distillation performed in accordance with ASTM D 86, *Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure*, can be used as the boiling point of the liquid. The user is warned that this definition of boiling point is inconsistent with that given in other flammability classification systems that generally use the initial boiling point of the distillation curve. Therefore, boiling points assigned for mixtures by these different classification systems are not interchangeable. For more information, see Britton.

A.3.3.3 Flash Point. Flash point is 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. Flash point is determined using one of several different test procedures and apparatus that are specified.

A.3.3.4 Frostbite. Frostbite causes the skin to have a pale waxy-white appearance, and the tissue becomes numb and hard. The blood vessels in the affected area constrict and decrease circulation. Ice crystals then form in the tissue and cause structural damage with death of the affected cells.

In mild cases where ice crystal formation has not yet occurred or is very limited, recovery is usually complete, and circulation and tissue will revert to their normal state. Depending on the depth at which the tissue freezes, four degrees of severity can be distinguished. The first and second degrees of severity are limited to the top layers of skin where circulation is impaired. The second degree of severity results in blistering of the skin. Both the first- and second-degree levels do not extend beyond the top layers of the skin, and tissue death is limited. The third degree of severity involves tissue death below the skin layers. The fourth and most severe degree results in deep-tissue death that involves the muscle, tendon, and bone.

When exposure to cold is prolonged or extremely low temperatures are encountered as in the case of unprotected contact with liquefied cryogenic gases, irreversible tissue damage generally occurs. In the more severe cases of frostbite, tissue viability is affected, resulting in tissue death. Depending on the severity of tissue damage and the location affected, surgical removal or amputation of affected tissue or extremity can be necessary.

A.4.1.4 No specific color shade is recommended, but the blue, red, and yellow used must provide adequate contrast so that the rating numbers are easily identified. Many environmental conditions can affect the stability of the colors.

A.4.2.2 The NFPA 704 ratings are applied to numerous chemicals in the NFPA *Fire Protection Guide to Hazardous Materials*, which contains withdrawn standards NFPA 49, *Hazardous*

Chemicals Data, and NFPA 325, *Guide to Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.* These were withdrawn as NFPA standards (and are therefore no longer published in the *National Fire Codes*®). However, they are maintained by NFPA staff in a database that will be available to the public electronically in the future and in updates of the NFPA *Fire Protection Guide to Hazardous Materials.* The Committee wishes to note that those documents were withdrawn solely for expediency in updating the data, which was not possible in a 3- to 5-year revision cycle.

A.4.2.3.2 Due to the large number of variables, the requirements and guidance presented in this standard are general in nature and are limited to the most important and common factors. For example, although flash point is the primary criterion for assigning the flammability rating, other criteria could be of equal importance. For example, autoignition temperature, flammability limits, and susceptibility of a container to failure due to fire exposure also should be considered. For instability, the emphasis is on the ease by which an energy-releasing reaction is triggered. These factors should all be considered when calling on one's judgment during the assignment of ratings.

A.4.2.3.3 The purpose of the Composite Method is to characterize the hazards as simply as possible where many chemicals are present. The sign reflects the rating for the area, not for individual chemicals. For example, say a building contains materials with individual chemical ratings of 1-2-1 OX, 1-2-2 ~~W~~, 3-1-2, and 2-3-4, and a specific area of the building contains individual chemicals with ratings of 1-2-1 OX and 2-3-4. This situation would result in the following:

(1) The building would be placarded as 3-3-4 OX ~~W~~.
(2) This specific area would be placarded as 2-3-4 OX.

Using the Individual Method for the same building containing the same chemicals, there would be four signs with the following ratings: 1-2-1 OX, 1-2-2 ~~W~~, 3-1-2, and 2-3-4. Each sign would include the chemical name below the sign.

The specific area of the building would have two signs with the ratings of 1-2-1 OX and 2-3-4, each of which would include the chemical name below the sign. It should be recognized that the purpose of the standard is for recognition of hazards in an emergency; therefore, the number of signs displayed in a single place generally should not exceed five.

The Composite–Individual Combined Method allows users to utilize the best features of the other two methods. The outside of the building, enclosure, or area is posted with a single Composite sign for quick recognition of the overall hazards. Areas or rooms within the building are posted using either the Individual Method or the Composite Method, depending on the number of chemicals they contain.

A.4.2.3.4 In the absence of data on the specific mixture, the most conservative rating (numerically highest) for each component of the mixture for health and instability should be used, with adjustment for professional judgment in accordance with 4.2.3. The synergistic effects or reactions of the components of the mixture should also be considered when assigning the ratings.

When different materials are mixed together, the instability hazard of the mixture can be entirely different from those of the individual components. An example discussed by Stull is the unrecognized mixing of a reducing agent with an oxidizing agent. This compares directly to mixing a fuel with an oxidizer. In this example, a green pigment was manufactured by mixing the yellow pigment lead chromate with the blue pigment ferric ferrocyanide. During fine grinding in a hammer mill, the mixture ignited and deflagrated, resulting in a severe fire. Chemists recognize lead chromate as an oxidizing agent and ferric ferrocyanide as a reducing agent. In the NFPA rating system, although lead chromate should be labeled an oxidizer (OX) in the special hazards quadrant, there is no corresponding provision for labeling reducing agents, such as ferric ferrocyanide. While the individual components involved both have NFPA instability ratings of 0 or 1, the mixture could have a higher instability rating up to 3, depending on the ratio of the components and the intimacy of mixing.

Flammability ratings should be based on measured flash point rather than an estimated value, because the mixture's flash point and boiling point can be readily tested and quantified. In advance of testing, the flash point for a mixture can be predicted using the method described in Hanley. The flammability rating is determined per Annex C.

A.4.3 The quantity and location of NFPA 704 placards are based on factors such as fire department response and access; fire department operations; location, configuration, size, and arrangement of storage areas; location, configuration, and construction of the buildings; and other factors. The authority having jurisdiction should be consulted regarding the placement of identification to assist in response to incidents at the location.

A.5.1.1 See Annex B for additional health hazard rating background information.

A.5.1.3 In general, the health hazard that results from a fire or other emergency condition is one of acute (single) short-term exposure to a concentration of a hazardous material. This exposure can vary from a few seconds to as long as 1 hour. The physical exertion demanded by fire fighting or other emergency activity can be expected to intensify the effects of any exposure. In addition, the hazard under ambient conditions will likely be exaggerated at elevated temperatures.

A.5.1.4 The oral route of exposure (i.e., ingestion) is highly unlikely under the conditions anticipated by this standard. In such cases, other routes of entry should be considered to be more appropriate in assessing the hazard. Similarly, inhalation of dusts and mists is unlikely under the conditions anticipated by this standard. In such cases, the health hazard ratings should also be based on data for the more likely routes of exposure.

A.5.1.5 Some materials have products of combustion or decomposition that present a significantly greater degree of hazard than the inherent physical and toxic properties of the original material. The degree of hazard is dependent on the conditions at the time of the incident. In limited cases, NFPA 49, *Hazardous Chemicals Data,* provides information on the hazardous products of combustion or decomposition. (Note: Although NFPA 49 has been officially withdrawn from the *National Fire Codes,* the information is still available in NFPA's *Fire Protection Guide to Hazardous Materials.*)

In general, the Technical Committee on Classification and Properties of Hazardous Chemical Data does not consider elevating ratings based on decomposition or combustion products except for unusual circumstances. An example where the health rating could conceivably be increased is vinylidene chloride. Vinylidene chloride can emit a significant amount of phosgene under fire conditions, and under certain storage and use conditions, the rating of 2 could be increased to 4 for health. Another example is polyvinyl chloride, which emits hydrogen chloride and possibly chlorine under fire conditions. The rating of 0 or 1 could be increased to 3 or 4 for health. Conditions play a large part in any rating, as noted in Section 4.2, and professional judgment should be exercised. Some materials have combustion or decomposition products that present a significantly greater degree of hazard than the inherent physical and toxic properties of the original material. The degree of hazard is dependent on the conditions at the time of the incident.

A.5.2 Certain materials upon release can cause frostbite. Frostbite, as a health hazard, should be related to the skin/eye component of the health hazard rating criteria.

A.6.1.2 The definitions for liquid classification are found in NFPA 30, *Flammable and Combustible Liquids Code.*

Solids should normally be rated as pellets unless the form and handling conditions of the solid require otherwise.

A.6.2 For water-miscible solutions and liquids that do not sustain combustion in accordance with the hazard rating 1 criteria, the individual performing the hazard evaluation should recognize that in large vapor spaces, evaporation of volatile components of the mixture can create a flammable mixture, which could increase the fire or explosion hazard. This could occur even though the bulk material meets the aforementioned criteria.

In the case of mixtures stored in non-inerted tanks where the vapor space can contain ignitible vapor, the flammability rating should be based exclusively on a closed cup flash point test. In some cases, even solutions containing less than 1 percent volatile flammable materials could produce ignitible atmospheres (Britton).

A.7.1.1 The violence of a reaction or decomposition can be increased by heat or pressure. The violence of a reaction or decomposition can also be increased by mixing with other materials to form fuel–oxidizer combinations or by contact with incompatible substances, sensitizing contaminants, or catalysts.

A.7.1.1.3 Refer to NFPA 432, *Code for the Storage of Organic Peroxide Formulations,* for more specific information regarding the classification of organic peroxides.

A.7.1.2 The hazards of inadvertent mixing can be addressed by a chemical compatibility chart. Information to develop such a chart can be found in NFPA 491, *Guide to Hazardous Chemical Reactions.* (Note: Although NFPA 491 has been officially withdrawn from the *National Fire Codes,* the information is still available in NFPA's *Fire Protection Guide to Hazardous Materials.*) Information can also be found in Bretherick.

A.8.1.1 Only 2 special hazard symbols (OX and W̶) are required by NFPA 704, and SA is an optional symbol inside the NFPA special hazards quadrant. Outside NFPA 704, limited, special situations might exist in which individual circumstances dictate use of a unique hazard symbol. Other user-defined symbols or markings must be placed outside the NFPA "diamond." Appropriate training and communication addressing these other markings are essential. Other special hazard symbols (beyond OX and W̶) should not be considered to be part of the NFPA 704 hazard rating system. In many cases, the hazards represented by these symbols are already considered in the health, flammability, or instability rating categories. For example, a polymerization hazard is covered by the numerical instability rating and does not require a separate symbol. Also, corrosive properties are considered in the health rating and, again, do not require a separate symbol. In addition, because these additional symbols are not defined by the standard, emergency responders might not recognize their significance.

A.8.2.1 Guidance on use of the W̶ symbol and other associated information are located in Annex F, Water Reactivity Identification Criteria.

A.8.2.2 For further information on oxidizers, including oxidizer classes, see NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers.*

The severity of the hazard posed by an oxidizer can be ranked according to the classification system presented in NFPA 430. This numerical class can be included in the special hazards quadrant of the NFPA 704 placard. For example, because ammonium permanganate is a Class 4 oxidizer (per NFPA 430), the special hazards quadrant would be marked OX 4 to better define the hazard.

The adding of the quantification of the oxidation helps to better define the hazard. For example, both manganese dioxide (NFPA 430, Class 1) and ammonium permanganate (NFPA 430, Class 4) would be listed under the current system as OX in the NFPA 704 system, with no information on the degree of hazard.

A.8.2.3 Both the W̶ and the OX are special hazards. However, the W̶ rating should be ranked as the primary special hazard by display of the W̶ symbol inside the special hazards quadrant, because it is deemed more important from a fire-fighting perspective. The Committee recognizes that water application is a common first approach to fire fighting. Responders need to be immediately alerted to the W̶ rating and should not apply water without understanding the consequences of that action. The OX is still important but is secondary and is displayed outside the quadrant, as shown in Figure 9.1(c).

A.8.2.4 See defined term *simple asphyxiant gas.* Gases that are simple asphyxiants can displace the amount of oxygen in the air necessary to support life. Because these gases are colorless and odorless and offer no warning properties, the SA symbol added to the NFPA 704 diamond will alert responders to the potential hazard.

Annex B Health Hazard Rating

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Development of Quantitative Guidelines for Health. In developing this edition of NFPA 704, the Technical Committee on Classification and Properties of Hazardous Chemical Data determined that the standard should provide quantitative guidelines for determining the numerical health hazard rating of a material *(see Table B.1).*

B.1.1 Inhalation Hazard Considerations Using DOT Criteria. In addition, the Committee agreed that a health hazard rating of 4 or 3 should be assigned to any material classified as a "Poison-Inhalation Hazard" by the U.S. Department of Transportation (DOT). The poison-inhalation hazard classification was adopted by DOT from the United Nations (UN) criteria detailed in the UN publication *Recommendations on the Transport of Dangerous Goods. (See also "Notice of Proposed Rulemaking," Federal Register, and "Notice of Final Rule," Federal Register.)*

Table B.1 Health Hazard Rating Chart

	Gas/Vapor					
Degree of Hazard	Inhalation LC_{50} (ppm-v)	Saturated Vapor Concentration (× LC_{50} in ppm-v)	Dust/Mist Inhalation LC_{50} (mg/L)	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Skin/Eye Contact
4	0 to 1,000	10 to >10	0.00 to 0.5	0.00 to 5	0 to 40	—
3	1,001 to 3,000	1 to <10	0.51 to 2	5.01 to 50	40.1 to 200	Corrosive, irreversible eye injury Corrosive if pH ≤2 or ≥11.5
2	3,001 to 5,000	0.2 to <1	2.01 to 10	50.1 to 500	201 to 1,000	Severe irritation, reversible injury Sensitizers Lacrimators Frostbite from compressed liquefied gases
1	5,001 to 10,000	0 to <0.2	10.1 to 200	501 to 2,000	1,001 to 2,000	Slight to moderate eye irritation Mild irritation is borderline 0/1
0	>10,000	0 to <0.2	>200	>2,000	>2,000	Essentially nonirritating

Notes:

(1) $\text{ppm} = \dfrac{\text{mg/m}^3 \times 24.45}{\text{molecular weight}}$

(2) Saturated vapor concentration (ppm) at 20°C @ standard atmospheric pressure:

$$\text{SVC} = \frac{\text{Vapor pressure (mmHg)} \times 106}{760}$$

(3) See Section B.3 for definitions of LC_{50} and LD_{50}.

B.1.2 Inhalation Hazard Considerations Using UN Criteria. The UN criteria for inhalation toxicity are based on the LC_{50} and saturated vapor concentration of the material.

B.1.3 Oral and Dermal Hazard Considerations Using UN Criteria. Furthermore, in addition to inhalation toxicity, the UN has established criteria for oral and dermal toxicity, as well as corrosivity. Based on those criteria, the UN assigns materials to categories called Packing Groups: Packing Group I materials represent a severe hazard in transport, Group II materials represent a serious hazard, and Group III materials represent a low hazard.

The Committee decided to adopt the UN criteria for toxicity and corrosivity, and to correlate Packing Groups I, II, and III with the health hazard ratings 4, 3, and 2, respectively.

B.1.4 Adoption of UN Criteria. Adoption of the UN system has several advantages.

B.1.4.1 First, it addresses hazards in transportation that are similar to the type of emergencies likely to be encountered by fire-fighting personnel and emergency responders. Most other hazard ranking systems have been developed for occupational exposures.

B.1.4.2 Second, the UN system is well established, and it is presumed that a large number of chemical manufacturers have already classified (or can easily classify) materials into the appropriate packing groups.

B.1.4.3 Finally, users of chemicals can assign a 4, 3, or 2 health hazard rating by establishing whether a chemical has been assigned to a UN packing group due to toxicity or to corrosivity.

B.1.5 Hazard Considerations Using HMIS Criteria. To establish 1 and 0 health hazard rankings, the Committee utilized criteria for the 1 and 0 ratings contained in the Hazardous Materials Identification System (HMIS) developed by the National Paint & Coatings Association (NPCA) (*see Hazardous Materials Identification System Revised, Implementation Manual*). Although the NPCA criteria were developed for occupational exposure, the 1 and 0 criteria are on the low end of the hazard spectrum and are fairly consistent with, and complementary to, the 4, 3, and 2 ratings based on the UN criteria. No UN criteria were established for eye irritation, and the Committee adopted NPCA 3, 2, 1, and 0 criteria as health hazard ratings for eye irritation.

B.2 Additional Revisions to Health Hazard Rating. The Committee made a number of revisions to the proposed hazard rating system to provide conformity with existing industrial practice and to recognize the limitations and availability of corrosivity and eye irritation in a single "skin/eye contact" category and to utilize descriptive terms for the health hazard ratings. Minor changes were made to the 2, 1, and 0 criteria for oral toxicity and to the 1 and 0 criteria for dermal toxicity. Specifically, the distinction between solids and liquids in the oral toxicity criteria was eliminated, and the cutoff between 1 and 0 rankings for oral and dermal toxicity was lowered from 5000 to 2000 mg/kg.

In summary, the 4, 3, and 2 health hazard rankings for oral, dermal, and inhalation toxicity are based primarily on UN criteria. The 1 and 0 health hazard rankings for oral, dermal, inhalation toxicity, and all the "skin/eye contact" rankings are based primarily on NPCA criteria.

B.3 UN Definitions. For the user's assistance in utilizing this standard, the following definitions are extracted from Section 6.5 of *Recommendations on the Transport of Dangerous Goods.* In the absence of data for the species defined as follows, the committee currently considers other mammalian species, including human data and professional judgment to assign health ratings. In addition, Table B.1 can be used for guidance.

B.3.1 LD_{50} for acute oral toxicity: That dose of the substance administered which is most likely to cause death within 14 days in one half of both male and female young adult albino rats. The number of animals tested shall be sufficient to give a statistically significant result and be in conformity with good pharmacological practice. The result is expressed in milligrams per kilogram of body weight.

B.3.2 LD_{50} for acute dermal toxicity: That dose of the substance which, administered by continuous contact for 24 hours with the bare skin of albino rabbits, is most likely to cause death within 14 days in one half of the animals tested. The number of animals tested shall be sufficient to give a statistically significant result and be in conformity with good pharmacological practice. The result is expressed in milligrams per kilogram of body weight.

B.3.3 LC_{50} for acute toxicity on inhalation: That concentration of vapor, mist or dust which, administered by continuous inhalation to both male and female young adult albino rats for one hour, is most likely to cause death within 14 days in one half of the animals tested. If the substance is administered to the animals as dust or mist, more than 90 percent of the particles available for inhalation in the test must have a diameter of 10 microns or less, provided that it is reasonably foreseeable that such concentrations could be encountered by man during transport. The result is expressed in milligrams per liter of air for dusts and mists or in milliliters per cubic meter of air (parts per million) for vapors.

B.4 The following information extracted from Section 6.4 of *Recommendations on the Transport of Dangerous Goods* also applies:

The criteria for inhalation toxicity of dusts and mists are based on LC_{50} data relating to 1 hour exposures and where such information is available it should be used. However, where only LC_{50} data relating to 4 hour exposures to dusts and mists are available, such figures can be multiplied by four and the product substituted in the above criteria, i.e., LC_{50} (4 hour) × 4 is considered equivalent of LC_{50} (1 hour).

The criteria for inhalation toxicity of vapors are based on LC_{50} data relating to 1 hour exposures, and where such information is available it should be used. However, where only LC_{50} data relating to 4 hour exposures to dusts and mists are available, such figures can be multiplied by two and the product substituted in the above criteria, i.e., LC_{50} (4 hour) × 2 is considered equivalent of LC_{50} (1 hour).

Annex C Flammability

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Development of Flammability Ratings. The selection of the flash point breaks for the assignment of ratings within the flammability category is based on the recommendations of the Technical Committee on Classification and Properties of Flammable Liquids of the NFPA Committee on Flammable Liquids. This Technical Committee initiated the study that led to the development of this standard. Close cooperation between the Technical Committee and the Committee on Fire Hazards of Materials has continued.

C.2 Significance of Flash Point. Flash point indicates several things:

(1) If the liquid has no flash point, it is not a flammable liquid.
(2) If the liquid has a flash point, it has to be considered flammable or combustible.
(3) The flash point is normally an indication of susceptibility to ignition.

The flash point test can give results that would indicate if a liquid is nonflammable or if it should be rated 1 or 2 as a mixture containing, for example, carbon tetrachloride. As a specific example, sufficient carbon tetrachloride can be added to gasoline so that the mixture has no flash point. However, on standing in an open container, the carbon tetrachloride evaporates more rapidly than the gasoline. Over a period of time, the residual liquid first shows a high flash point, then a progressively lower one until the flash point of the final 10 percent of the original sample approximates that of the heavier fractions of the gasoline. To evaluate the fire hazard of such liquid mixtures, fractional evaporation tests can be conducted at room temperature in open vessels. After evaporation of appropriate fractions, such as 10, 20, 40, 60, and 90 percent of the original sample, flash point tests can be conducted on the residue. The results of such tests indicate the grouping into which the liquid should be placed if the conditions of use are such to make it likely that appreciable evaporation will take place. For open system conditions, such as in open dip tanks, the open cup test method gives a more reliable indication of the flammability hazard.

C.3 Flash Point Test Methods. In the interest of reproducible results, the following procedures are recommended for determining flash point:

(1) The flash point of liquids having a viscosity less than 5.5 mm^2/s [5.5 centistokes (cSt)] at 40°C (104°F) or less than 9.5 mm^2/s (9.5 cSt) at 25°C (77°F) and a flash point below 93.4°C (200°F) can be determined in accordance with ASTM D 56, *Standard Method of Test for Flash Point by the Tag Closed Tester.* (In those countries that use the Abel or Abel-Pensky closed cup tests as an official standard, these tests will be equally acceptable to the Tag Closed Cup Method.)
(2) For liquids having flash points in the range of 0°C (32°F) to 110°C (230°F), the determination can be made in accordance with ASTM D 3278, *Flash Point of Liquids by Setaflash Closed Tester,* or ASTM D 3828, *Standard Test Method for Flash Point by Small Scale Closed Tester.*
(3) For viscous and solid chemicals, the determination can be made in accordance with Test Method E 502, *Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods.*

(4) The flash point of liquids having a viscosity of 5.5 mm²/s (5.5 cSt) or greater at 40°C (100°F) or 9.5 mm²/s (9.5 cSt) or greater at 25°C (77°F) can be determined in accordance with ASTM D 93, *Test Methods for Flash Point by the Pensky-Martens Closed Tester.*

Annex D Combustible Dusts

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 A combustible dust is considered to be a finely divided solid material that is 420 micrometers (μm) or smaller in diameter (material passing a U.S. No. 40 Standard sieve) that presents an explosion hazard when dispersed and ignited in air.

When a dust becomes suspended in air, there is a risk of a dust cloud ignition leading to a flash fire. The minimum explosible concentration (MEC) is the minimum concentration of combustible dust suspended in air, measured in mass per unit volume, that will support a deflagration as defined by the text procedure in ASTM E 1515, *Standard Test Method for Minimum Explosible Concentration of Combustible Dusts.* Evaluation of the hazard of a combustible dust should be determined by the means of actual test data. Each situation should be evaluated and applicable tests selected. The following list represents the factors that are sometimes used in determining the deflagration hazard of a dust:

(1) MEC
(2) Minimum ignition energy (MIE)
(3) Particle size distribution
(4) Moisture content as received and as tested
(5) Maximum explosion pressure at optimum concentration
(6) Maximum rate of pressure rise at optimum concentration
(7) K_{St} (normalized rate of pressure rise) as defined in ASTM E 1226, *Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*
(8) Layer ignition temperature
(9) Dust cloud ignition temperature
(10) Limiting oxidant concentration (LOC) to prevent ignition
(11) Electrical volume resistivity
(12) Charge relaxation time
(13) Chargeability

See NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*; NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*; and NFPA 68, *Guide for Venting of Deflagrations*, for additional information about combustible dusts and combustible dust explosions.

For purposes of better determining the flammability for a 2 or 3 rating, the most important aspects are particle size distribution, MIE, processing experience, housekeeping, and other related factors.

Annex E Instability, Thermal Hazard Evaluation Techniques

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

E.1 Intrinsic Thermal Stability. Thermal stability for hazard evaluation purposes can be done by a number of methods. Frequently used techniques include differential scanning calorimetry (DSC) and accelerating rate calorimetry (ARC). These tests should be performed in a manner meeting or exceeding the requirements outlined in ASTM E 537, *Standard Test Method for Assessing the Thermal Stability of Chemicals by Methods of Differential Thermal Analysis*, or ASTM E 1981, *Guide for Assessing the Thermal Stability of Materials by Methods of Accelerating Rate Calorimetry.*

Obtaining the instability rating through testing and Instantaneous Power Density (IPD) data is preferred. This method is discussed in Section E.2, and IPD takes precedence over other small-scale calorimetric methods. When data are unavailable to apply the IPD method, the following two alternatives are available: Data from DSC or ARC (or their equivalent) can be used to determine the adiabatic exotherm initiation temperature. This can be used to define ratings of 0, 1, or 2.

Materials that exhibit adiabatic exotherm initiation temperatures below 200°C should be rated at least 2; materials that polymerize vigorously with evolution of heat should also be rated at least 2.

Materials that exhibit adiabatic exotherm initiation temperatures between 200°C and 500°C should be rated 1; materials that might polymerize when heated should also be rated 1.

Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C should be rated zero.

Professional judgment should be applied to a chemical being rated using this method that might have an instability rating of 2 or greater.

Reactive materials are far more likely to suffer catalytic or surface effects in small test containers, hence biasing the adiabatic exotherm initiation temperature.

This judgment should include comparisons with the qualitative criteria described in Table 7.2, analogy with chemicals of similar chemical structure and historical incidents, plus data obtained using the following methods.

Information to assist this professional judgment includes, but is not limited to, data obtained via DSC or ARC. ASTM D 2879, *Standard Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope*, can be used as an indication of thermal stability when data meeting the requirements of ASTM E 537 are not available. Self-Accelerating Decomposition Temperature (SADT) test results can also be used. Alternatively, calculations based on the CHETAH program could be carried out.

It should be noted that tests performed in small-volume analytical apparatus are not predictive of the explosive behavior of large masses of material and therefore cannot distinguish instability ratings of 3 and 4.

Appropriate testing should be conducted for mixtures because the mixtures might react differently than indicated by the individual components.

E.2 Instantaneous Power Density. IPD is calculated as the product of the enthalpy of decomposition/reaction and the initial rate of reaction, determined at 250°C (482°F). This quantity represents the amount of heat energy per unit time per unit volume (watts per milliliter) that a material will initially give at 250°C (482°F). The values that make up the power density can be obtained from thermodynamic tables, calculations, and experimental measurements. The values are obtained from appropriate measurements using DSC *(see ASTM E 698, Standard Test Method for Arrhenius Kinetic Constants for Thermally Unstable Materials)*, or ARC *(see ASTM E 1981, Guide for Assessing the Thermal Stability of Materials by Methods of*

Accelerating Rate Calorimetry). In a typical calculation, the rates of reaction as a function of temperature are obtained and expressed in terms of an Arrhenius expression and an overall, initial-rate expression (Laidler). This rate expression represents the initial rate of decomposition where the decrease in concentration of the material as a result of the decomposition/reaction has not progressed to a significant (<5%) level. This allows the initial concentration of the material to be used in the simplified rate expression. *(See Table E.2.)*

Table E.2 Instability Rating as a Result of Thermal Instability

Instability Rating	Instantaneous Power Density at 250°C
4	1000 W/mL or greater
3	At or above 100 W/mL and below 1000 W/mL
2	At or above 10 W/mL and below 100 W/mL
1	At or above 0.01 W/mL and below 10 W/mL
0	Below 0.01 W/mL

To clarify the calculation of IPD, a sample calculation is provided.

DSC was carried out, and the following parameters were obtained for a material of interest:

Enthalpy of decomposition (ΔH): -80.5 cal/g
Arrhenius activation energy (E_a): 36.4 kcal/mol
Arrhenius pre-exponential (A_{PRE}): $1.60 \times 10^{15}\ s^{-1}$
Reaction order (n): 1
Initial concentration of material or density of pure material (conc.): 0.80 g/mL

The initial rate of decomposition of the material at 250°C (482°F) can be calculated using the following Arrhenius expression, where R is the universal gas constant whose value is taken as 1.987 cal/(mol°C):

$$\text{Rate} = \text{conc}^{\text{order}} \times A_{\text{PRE}} \times e^{-E_{a}/RT}$$

The units used are as follows:

$$\frac{g}{mL \times s} = \left(\frac{g}{mL}\right)^{\text{order}} \times \left(\frac{g}{mL \times s}\right)^{1-\text{order}} \times e^{-\frac{cal/mol}{cal/(mol \times K)^{K}}}$$

$$\text{Rate} = 0.80^{+1} \times 1.60 \times 10^{+15} \times e^{-\frac{36400}{1.987 \times (273+250)}}$$

$$\text{Rate} = 0.79 \frac{g}{mL \times s}$$

$$\text{Rate} = 0.80^{+1} \times 1.60 \times 10^{+15} \times e^{-\frac{36400}{1039}}$$

The power density is given as the product of this decomposition and the enthalpy of decomposition (the value of 4.184 W/cal/sec allows the use of units W/mL):

$$\text{IPD} = -\Delta H \times \text{Rate}$$

$$\text{Units: } \frac{W}{mL} = \frac{cal}{g} \times \frac{g}{mL \times s} \times 4.184 \frac{W}{cal/s}$$

$$\text{IPD} = -(80.5) \times 0.79 \times 4.184 \frac{W}{cal/s}$$

$$\text{IPD} = 63 \frac{cal}{s \times mL} \times 4.184 \frac{W}{cal/s}$$

$$\text{IPD} = 270 \frac{W}{mL}$$

The IPD is used as a positive value: the greater the power density, the greater the rate of energy release per volume. Therefore, the exothermic enthalpy of reaction, thermodynamically taken with a negative sign to show release of heat to the surroundings, is taken as a negative so as to rectify the sign of IPD.

This material, having an IPD of 270 W/mL, would be rated a 3 per Table E.2.

Annex F Water Reactivity Identification Criteria

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

F.1 General. It is again noted that with the assignment of water reactivity ratings, a considerable degree of judgment can be needed, as noted in Section 4.2, combined with the guidance in this annex.

F.2 Numerical ratings indicating degrees of water reactivity hazards are detailed in Table F.2. The number, alongside the water reactivity symbol (e.g., ~~W~~ 2), can be used when the information is available to provide information about the degree of water reactivity for emergency responders.

It should be emphasized that the water reactivity rating is not shown in the instability hazard space in the sign, which refers specifically to the intrinsic instability of the material.

Materials that have a rating of 0 or 1 for water reactivity should not be given the ~~W~~ symbol in the special hazards space on the placard.

The special hazard ~~W~~ rating of 3 is the highest rating for water reactivity; there is no special hazard rating of 4 for water reactivity. The purpose of water reactivity is to warn of cases where the use of water (in nonflooding quantities) during emergency response can increase the hazard or change the perceived hazard due to a chemical. Heat of mixing tests between a chemical and water can provide a measure of how vigorous the reaction with water will be in a fire-fighting scenario. The following two scenarios are to be considered: a material that rapidly releases heat on contact with water and a material that rapidly releases heat and gas on contact with water. These guidelines apply only to the first scenario, that is, a chemical that reacts exothermically to release heat on contact with water but does not produce gaseous or low boiling [<100°C (<212°F)] by-products, or azeotropes. The heat of mixing shall be determined using a Two Drop Mixing Calorimeter (Hofelich et al.) or equivalent technique using a 1:1 wt/wt ratio of chemical to water. Alternatively, the heat of mixing data can be found in handbooks or calculated.

Table F.2 Degrees of Water Reactivity Hazards

Degree of Hazard	Criteria
4	Not applicable
3 — Requires a ₩ to be displayed in the special hazards quadrant	Materials that react explosively with water without requiring heat or confinement (qualitative description most applicable when assigning water reactivity ratings to solids because the heat of mixing is determined by physical characteristics and the degree to which the material has dissolved) Materials whose heat of mixing is greater or equal to 600 cal/g
2 — Requires a ₩ to be displayed in the special hazards quadrant	Materials that react violently with water, including the ability to boil water, or that evolve flammable or toxic gas at a sufficient rate to create hazards under emergency response conditions (qualitative description most applicable when assigning water reactivity ratings to solids because the heat of mixing is determined by physical characteristics and the degree to which the material has dissolved) Materials whose heat of mixing is at or above 100 cal/g and less than 600 cal/g
1 — Does NOT require a ₩ to be displayed in the special hazards	Materials that react vigorously with water, but not violently (criterion most applicable when assigning water reactivity rating to solids because the heat of mixing is determined by physical characteristics and the degree to which the material has dissolved) Materials whose heat of mixing is at or above 30 cal/g and less than 100 cal/g Materials that react with water, producing either heat or gas leading to pressurization or toxic or flammable gas hazards.
0 — Does NOT require a ₩ to be displayed in the special hazards quadrant.	Nonreactive below 30 cal/g

F.3 Water Reactivity Hazard Degree 0. The chemical is essentially nonreactive with water, therefore the ₩ symbol is not used. Using the Two Drop Mixing Calorimeter (Hofelich et al.) or equivalent technique, the heat of reaction is less than 30 calories per gram of total mixture (cal/g), using a 1:1 wt/wt ratio of chemical to water. Gas is not generated, although the evaporation rate of a volatile liquid chemical can be increased during water application. The heat of reaction can also be capable of generating sufficient water vapor pressure to damage some closed containers. An example of a water reactivity rating of 0 is diethanolamine with a –6.5 cal/g Two Drop Mixing Calorimeter Test result, with no gas release.

F.4 Water Reactivity Hazard Degree 1. The heat of reaction is too small to preclude the use of water during emergency response. Because water is an acceptable agent for dilution of spills and for fire control, chemicals with this rating are not assigned the ₩ symbol. Using the Two Drop Mixing Calorimeter (Hofelich et al.) or equivalent technique, the heat of reaction is greater than or equal to 30 calories per gram of total mixture (cal/g) but less than 100 cal/g, using a 1:1 wt/wt ratio of chemical to water. The heat of reaction might be capable of causing the water to boil at atmospheric pressure.

A chemical that on the basis of heat of reaction results alone would normally be assigned a water reactivity rating of 0 should be increased to a water reactivity rating of 1 if any gas is generated via reaction with water, even if the heat of reaction is below 30 cal/g.

The following are examples of chemicals whose release of gas raise them from a water reactivity rating of 0 to a water reactivity rating of 1.

(1) *50 percent sodium hydroxide.* The exothermic heat of solution measured using the Two Drop Mixing Calorimeter is –35.3 cal/g with no gas release; therefore, a water reactivity rating of 1 is assigned. It should be noted that the heat of solution of a solid material such as sodium hydroxide is not constant but decreases as the solid goes into solution. The first water that is added to sodium hydroxide could in fact boil, even though the Two Drop Calorimeter indicates a heat release of much less than 100 cal/g. Where large quantities of such solids are wetted by small quantities of water, the instability hazard might be better represented by a water reactivity rating of ₩ 2.

(2) *Sodium hydrosulfite.* The exothermic reaction with water releases heat, which can lead to spontaneous combustion of a solid. The rating assigned to this chemical is a water reactivity rating of 1.

(3) *Acetic anhydride.* The exothermic 1:1 molar reaction with water produces 2 moles of acetic acid and no gas release. Because the reactants are not completely miscible at ambient temperature, the reaction tends to be slow unless a solubilizing agent is present. The water reactivity rating assigned to this chemical is 1.

F.5 Water Reactivity Hazard Degree 2. The reaction with water is rapid and should be used only where it can be applied in flooding quantities (which can be impractical for large piles of solids). Using the Two Drop Mixing Calorimeter test, the heat of reaction is greater than or equal to 100 cal/g but less than 600 cal/g using a 1:1 wt/wt ratio of chemical to water. The heat of reaction is likely to boil the water at 1:1 wt/wt ratios and can be sufficient both to boil the water and to vaporize the chemical. Other than carbon dioxide or steam (or other nonhazardous gases), if flammable or toxic gases are generated in hazardous quantities via reaction with water, the water reactivity rating of 1 determined on the basis of heat of reaction would be raised to a water reactivity rating of 2 (₩ 2). The following are examples of chemicals whose release of gas raise them from a water reactivity rating of 1 to a water reactivity rating of 2:

(1) *Calcium carbide.* Although the dry solid does not burn, a nonviolent but vigorous exothermic reaction with water produces calcium hydroxide plus flammable acetylene gas. Trapped pockets of acetylene in a pile of solid can ignite and explode.
(2) *Dichlorosilane.* In contact with water, exothermic hydrolysis is accompanied by evaporation of the volatile liquid phase. Toxic dichlorosilane plus hydrogen chloride gases are released and spontaneous ignition of the dichlorosilane can occur.
(3) *Thionyl chloride.* The heat release using the Two Drop Mixing Calorimeter test is −61.1 cal/g with release of gas.

F.6 Water Reactivity Hazard Degree 3. Using the Two Drop Mixing Calorimeter test, the heat of reaction is greater than or equal to 600 cal/g. This is often sufficient to cause ignition of flammable components.

The ~~W~~ 3 rating is not increased to a ~~W~~ 4 rating if gas is generated, because "explosive reaction" already implies gas generation. An example of a ~~W~~ 3 rating is triethyl aluminum. The heat release using the Two Drop Mixing Calorimeter test is −1008 cal/g with release of gas.

The Two Drop Mixing Calorimeter test data presented in this annex were published by Hofelich.

Annex G Informational References

G.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

G.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 30, *Flammable and Combustible Liquids Code*, 2003 edition.

NFPA 68, *Guide for Venting of Deflagrations*, 2002 edition.

NFPA 430, *Code for the Storage of Liquid and Solid Oxidizers*, 2004 edition.

NFPA 432, *Code for the Storage of Organic Peroxide Formulations*, 2002 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2006 edition.

NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*, 2007 edition.

Fire Protection Guide to Hazardous Materials, 13th edition, 2002.

G.1.2 Other Publications.

G.1.2.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D 56, *Standard Method of Test for Flash Point by the Tag Closed Tester*, 1993.

ASTM D 86, *Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure*, 2000.

ASTM D 93, *Test Methods for Flash Point by the Pensky-Martens Closed Tester*, 1994.

ASTM D 235, *Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)*, 1999.

ASTM D 2879, *Standard Test Method for Vapor Pressure–Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope*, 1997.

ASTM D 3278, *Flash Point of Liquids by Setaflash Closed Tester*, 1989.

ASTM D 3828, *Standard Test Method for Flash Point by Small Scale Closed Tester*, 1993.

ASTM D 6668, *Standard Test Method for the Discrimination Between Flammability Ratings of F = 0 and F = 1*, 2001.

ASTM E 537, *Standard Test Method for Assessing the Thermal Stability of Chemicals by Methods of Differential Thermal Analysis*, 1986.

ASTM E 698, *Standard Test Method for Arrhenius Kinetic Constants for Thermally Unstable Materials*, 1979.

ASTM E 1226, *Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*, 2005.

ASTM E 1515, *Standard Test Method for Minimum Explosive Concentration of Combustible Dusts*, 2000.

ASTM E 1981, *Guide for Assessing the Thermal Stability of Materials by Methods of Accelerating Rate Calorimetry*, 1998.

Test Method E 502, *Standard Test Method for Selection and Use of ASTM Standards for the Determination of Flash Point of Chemicals by Closed Cup Methods*, 1984.

G.1.2.2 UN Publications. United Nations, UN Plaza, New York, NY 10017.

Recommendations on the Transport of Dangerous Goods, 4th revised edition.

G.1.2.3 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Federal Register, "Notice of Final Rule," Vol. 50, p. 41092 et seq., October 8, 1985.

Federal Register, "Notice of Proposed Rulemaking," Vol. 50, p. 5270 et seq., February 7, 1985.

G.1.2.4 Other Publications.

Bretherick, L., *Handbook of Reactive Chemicals*, 6th edition, Boston: Butterworths, 1999.

Britton, L. G., "Survey of Fire Hazard Classification Systems for Liquids," *Process Safety Progress*, Vol. 18, No. 4, Winter, 1999.

Hanley, B., "A Model for the Calculation and the Verification of Closed Cup Flash Points for Multicomponent Mixtures," *Process Safety Progress*, Summer 1998, pp. 86–97.

Hofelich, T. C., "A Quantitative Approach to Determination of NFPA Reactivity Hazard Rating Parameters," *Process Safety Progress*, Vol. 16, No. 3, p. 121, 1997.

Hofelich, T. C., D. J. Frurip, and J. B. Powers, "The Determination of Compatibility via Thermal Analysis and Mathematical Modeling," *Process Safety Progress*, Vol. 13, No 4. pp. 227–233, 1994.

Laidler, K. L., *Chemical Kinetics*, Chapter 3, New York: McGraw-Hill, 1965.

National Paint & Coatings Association, *Hazardous Materials Identification System Revised, Implementation Manual*, 1981.

Stull, D. R., "Fundamentals of Fire and Explosion," AIChE Monograph Series, No. 10, Vol. 73, 1977.

G.2 Informational References. (Reserved)

G.3 References for Extracts in Informational Sections. (Reserved)

Index

Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion*" are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
- Standards Council decides, based on all evidence, whether or not to issue Document or to take other action, including hearing any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M	*Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
U	*User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
I/M	*Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
L	*Labor:* A labor representative or employee concerned with safety in the workplace.
R/T	*Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
E	*Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.
I	*Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.
C	*Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.
SE	*Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES;

1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
4. Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

NFPA Document Proposal Form

NOTE: All Proposals must be received by 5:00 pm EST/EDST on the published Proposal Closing Date.

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555.

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2/24/2009

DETAILED PROCEDURES

Source : ASU Environmental Health and Safety Office
URL : http://www.astate.edu/a/ehs/environmental-compliance/detailed-procedures.dot
Date : October 14th, 2014

DETAILED PROCEDURES

ASBESTOS

The purposes of the Asbestos Abatement Program are:

- To protect public health & the environment
- To administer the program in compliance with the Asbestos School Hazard Abatement Reauthorization Act (ASHARA [MAP]), 40 CFR Part 763
- To establish standards for demolitions, renovations, and disposal of friable asbestos containing materials in order to reduce visible emission of asbestos-containing materials as provided by the National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR, Part 61
- To establish standards for response actions provided by the Asbestos Model Accreditation Plan, 40 CFR, Part 763. Subpart E, ASHARA.

External Resources

- *ADEQ Arkansas Asbestos Program (http://www.adeq.state.ar.us/air/asbestos/asbestos.htm)*
- *Chrysotile Institute (http://www.chrysotile.com*

BIO-SPILL KIT INSTRUCTIONS

Always use appropriate personal protective equipment when using this kit. This kit is for small manageable laboratory Spills. Refer to MSDS (included with kit) for spill agents.

Universal Biosafety Instructions

Assume all blood and body fluid spills are contaminated and potentially hazardous to your health.

This kit contains protective clothing necessary for use when providing care to patients with infectious diseases, performing laboratory tests, handling specimens and/or cleaning up spills potentially infectious agents. A disposal bag with the "Biohazard" symbol is also provided for use when clothing becomes contaminated. All items in the kit must be discarded after use.

General Precautions from OSHA Publication Number 3127,1992

- Wear appropriate protective body coverings (such as gowns, shoe covers, gloves, masks and appropriate eye protection) when occupational exposure to a potentially infectious material is anticipated.
- Take extreme caution to avoid accidental wounds from sharp instruments contaminated with potential infectious materials. Place used sharp instruments in a liquid-proof, puncture-resistant container.
- Always use mechanical means such as tongs, forceps or a brush and a dust pan to pick u contaminated broken glassware; never pick up with hands even if gloves are worn.
- Wear gloves when handling blood specimens, blood-soiled items, body fluids, excretions and secretion as well as surfaces, materials and objects exposed to them. Replace gloves if torn, puncture contaminated or their ability to function as a barrier is compromised.
- Wear appropriate eye protection when splashes, sprays, spatters or droplets of blood or other potential infectious materials pose a hazard to the eyes.
- Wash hands after removing gown and gloves and before leaving the rooms of infected patients. Hands should also be washed thoroughly and immediately if they become contaminated with potential infectious materials. Use an antiseptic hand cleanser or towelette when soap and water are not immediately available. Wash hands with soap and water as soon as feasible.
- Promptly clean up spills of blood and other potentially infectious materials. The type and characteristic of the appropriate cleaning solution will depend upon the task and degree of exposure anticipated.
- Clean and decontaminate all equipment and work surfaces that have been contaminated with blood other potentially infectious materials.
- Place articles soiled with blood and/or body fluids in the provided disposal bag.
- An accident or spill that results in an exposure should be immediately reported to a supervisor.

WARNING: All items contained in this kit are for one-time use only. Once used, they should be placed in the disposal bag provided and disposed of properly. These items should not be worn outside the contaminated area.

DISPOSAL: All contaminated clothing, materials and gloves should be disposed of properly. Materials that are saturated or contaminated with infectious materials are governed by local, state and federal laws. The compliance with such regulations is responsibility of the buyer. If you have any questions, call the Safety Tech Line at 1-

800-356-2501. Our safety professionals are on hand from 6 a.m. to 9 p.m. CT, Monday-Friday to answer your call.

CAUTION: Spills of Infectious Agents Should Be Cleaned up by trained professionals only.

BLOODBORNE PATHOGENS

Who does this apply to?

This standard applies in cases where employees are exposed to blood and body fluids as a course of their normal employment.

Who is at risk for exposure?

- Custodial Staff
- Nursing & Health Professionals
- Athletic Trainers
- Health Physical Education Center Employees
- University Police Officers
- First Responders
- Environmental Health Employees
- Occupational Safety Employees

What are blood borne pathogens?

Bloodborne Pathogens are microorganisms that are carried in blood and body fluids and cause diseases, such as Hepatitis and the HIV virus.

How can I be exposed?

Occupational Exposure means the anticipated skin, eye, or mucous membrane contact with blood or other body fluids while an employee is performing his or her job. Examples: Blood Products, Semen, Vaginal Secretions, Fluid in the uterus of a pregnant woman, Fluid around the heart, Fluid surrounding the brain, Other body fluids with visible blood.

Routes of Exposure

Exposure Incident refers to an incident where an employee comes into contact with a person's blood or other bodily fluids. Contact in this sense means that the employee was exposed to blood or body fluids in his/her: eyes, nose, or mouth.

Other Routes of Exposure

Other ways an employee could be exposed include things such as: Needle sticks, Human Bites, Cuts, and Abrasions.

How do I protect myself?

Universal Precautions means that you treat everyone's blood and body fluids as infectious. Since you cannot look at a person and tell whether or not they are infected, you assume that the person's blood/body fluids is infected and protect yourself accordingly. Remember, it only takes just one exposure to become infected. THINK BEFORE YOU ACT.

- USE PERSONAL PROTECTIVE EQUIPMENT: Gloves, Goggles, Masks, Aprons
- USE ENGINEERING CONTROLS: Sharps Containers, Blood Spill Kits
- USE WORK PRACTICE CONTROLS: Wash Hands, Use Biohazard bags to identify infectious waste, Do Not eat, drink, or apply cosmetics in areas where there is a risk of exposure

Symptoms of Exposure

Hepatitis B

Symptoms of Hepatitis B include: Fatigue, Nausea, Loss of Appetite, Stomach Pain, Jaundice, Darkened Urine

HIV

Symptoms of HIV include: Weakness, Fever, Sore Throat, Nausea, Headaches, Diarrhea

What if I'm exposed?

Contact your supervisor and Environmental Health & Safety (2862) immediately. Initial treatment within the first 24 hours is crucial.

For more information about bloodborne pathogens or to receive training about blood borne pathogens, call EH&S (2862). For more information about AIDS, see the official AIDS website: (http://aids.gov/hiv-aids-basics/)

LEAD BASED PAINT

This program is to ensure compliance with Arkansas Regulation 25 - Arkansas Lead-Based Paint Hazard (Arkansas Department of Environmental Quality).

Arkansas State University has a certified Lead Inspector and a certified Lead Risk Inspector.

The EH&C department will assess lead-based paint concerns in all properties owned by the University that fall into the criteria for assessment. Risk assessment will be performed in housing units as needed.

STATE ENVIRONMENTAL PERMITTING

Arkansas State University has an Air Permit from the Arkansas Department of Environmental Quality for the pathological incinerator located on the ASU Farm. This incinerator is for the destruction of biological waste from teaching and research laboratories.

The incinerator also is used to destroy sensitive documents. More information about secure document disposal can be found with other waste disposal.

The University must operate the incinerator under the parameters of the Air Permit.

STORM WATER POLLUTION PREVENTION

Remember: All parking lots drain to storm drains! Cigarette butts and trash end up in Arkansas streams and rivers!

Document Downloads

Storm Water Management Plan:
http://www.astate.edu/dotAsset/7c5f754d-edcc-49e1-ae18-f230bc291dc7.pdf

External Resources

EPA Stormwater Program:
http://water.epa.gov/polwaste/npdes/stormwater/index.cfm

WASTE DISPOSAL

Biological (Medical) Waste Disposal

The Environmental Health & Safety Department arranges for the disposal of all biological (medical) waste at ASU.

Students utilizing residence facilities may receive a bio-waste container for disposal of bio-hazard sharps. The containers are located at the RA Desks in the residence facilities. Contact the RA Desk, Residence Life or EH&S for more information.

For more information about biological (medical) waste disposal and bloodborne pathogens, or to schedule a pick-up, call EH&S (2862).

Pathological Waste Program

Arkansas State University has a Pathological Waste Incinerator. This incinerator is to properly dispose of pathological waste from Biological laboratories. The pathological incinerator is permitted through the Arkansas Department of Pollution Control and Ecology.

Secure Documents

Those documents that contain secure information such as identification or financial information may be incinerated in the pathological incinerator. EH&S will make every effort to pick up and destroy your secure documents. EH&S has limited storage so please contact EH&S (2862) with 10 boxes or less at a time.

Access the waste disposal/pick up request form:
http://www.astate.edu/a/ehs/environmental-compliance/waste-disposal-request.dot

(see example in the next two pages).

WASTE DISPOSAL REQUEST

CHEMICAL WASTE DISPOSAL REQUEST FORM

This interactive form may be used to submit a request for a chemical waste pick-up. When you have completed entering your waste information, click on "submit pick-up request." Your request will be processed promptly and pick-up of your chemical waste should occur within 5 days. If there are any questions regarding your submittal, a EH&S Waste Management staff person will contact you.

(*) denotes required information.

FOPL Account Number: ☐

Researcher's First Name: ☐

Researcher's Last Name: ☐

Department: ☐

* Email Address: ☐

Contact Name: ☐

Telephone: ☐

Location of Waste:

Building: ☐

Room Number: ☐

Area: ☐

I certify that the waste is described, sealed, and labeled.

Name: ☐

Date: ☐

Proper Chemical Name: ☐

INSTRUCTIONS

A. Label the Waste:

Attach the "Hazardous Waste" label to each container. Be sure to fill out the label completely.

B. Complete the following list:

1. For unknowns: In the "Proper Chemical Name" column, list the waste as "Unknown A," "Unknown B," etc. Mark the "Hazardous Waste" label "Unknown A, B," etc.

2. For contaminated dry waste: Describe the waste in the "Proper Chemical Name" column. Indicate the total weight of the waste in the "Amount Wt./Vol." column
3. For mixtures: Write "Mixture" as the "Proper Chemical Name." List each chemical on a separate line on the "Hazardous Waste" label, and indicate the percent content by volume.
4. For pure chemicals: Write the full chemical name in the "Proper Chemical Name" column. Do not abbreviate, draw structures or give brand names.
5. In the "Physical State" column, choose either "solids", "liquids", or "gas".
6. In the "Amount" column, state the amount in either pounds or gallons
7. Copy the item number from this list onto the "Hazardous Waste" label.

C. For pick-up:

When you are finished entering your waste information below. Click on "Submit Pick-up Request" to send your request to the EH&S Hazardous Waste Management staff.

Waste Information (do not use abbreviations, formulas, or brand names)

Physical State: ○ Solid ○ Liquid ○ Gas

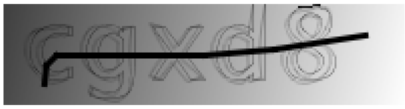
Number of Containers: ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7

Amount:

Weight/Vol. ○ Pounds ○ Gallons

Chemicals in Mixture:

If you have any questions or comments regarding your chemical waste, please state them in the space below:



*Validate Image:

Submit

LASER SAFETY

Source : ASU Environmental Health and Safety Office
URL : http://www.astate.edu/a/ehs/environmental-compliance/
Date : October 14th, 2014

ENVIRONMENTAL COMPLIANCE

Environmental Health & Safety establishes and maintains governing principles to ensure laboratory and environmental compliance.

Our duties include laboratory safety audits, maintenance and operation of environmental permits, and the disposal of hazardous and regulated materials.

LASER SAFETY

ANSI standards require all employees who work with or are potentially exposed to Class 3B or Class 4 laser radiation to have a through understanding of the hazards of lasers of those Classes. Arkansas State University has chosen The Laser Institute of America Laser Safety in Educational Institutions Training - Online to fulfill the training requirements. The cost of the training is $99 and must be paid when taking the course.

Laser Safety in Educational Institutes Training-Online
(http://www.lia.org/store/course/EDUONLINE)

Contact Starr Fenner, Laser Safety Officer for more information or call 972-2862.

ASU official information on Laser Safety is available through the following document:

ARKANSAS STATE UNIVERSITY
GOVERNING PRINCIPLES AND PROCEDURES FOR LASER SAFETY

Number : S-007
Responsible Official : Provost
Version : 01
Adopted : August 26th, 2009
Date of Preparation : June 5th, 2009
Number of Pages : 16

http://www.astate.edu/a/ehs/environmental-compliance/files/LaserSafetyManual082609S-007Final.pdf

ARKANSAS STATE UNIVERSITY
GOVERNING PRINCIPLES AND PROCEDURES FOR LASER SAFETY

Number: S-007 **Responsible Official: Provost**
Version: 01 **Adopted: 8/26/2009**

1.0 INTRODUCTION

Arkansas State University (ASU) is committed to the safety and well-being of its employees, students, and affiliated workers and to complying with all national standards in the use of lasers in its research and educational programs.

2.0 PURPOSE

The purpose of this manual is to ensure the safe use of lasers at ASU by identifying hazards, providing medical surveillance, and providing laser safety training for individuals using lasers.

3.0 DEFINITIONS

ANSI. American National Standards Institute

Class 1 Laser. Low-power lasers and laser systems that cannot emit laser radiation levels greater than the Maximum Permissible Exposure (MPE). Class 1 lasers and laser systems are incapable of causing eye damage.

Class 2 Lasers. Visible, low power lasers or laser systems that are incapable of causing eye damage unless they are viewed directly for an extended period (greater than 1000 seconds).

Class 3 Lasers. Medium-power lasers and laser systems capable of causing eye damage with short duration (<0.25 s) exposures to the direct or specularly reflected beam. Includes Class 3a and 3b lasers.

Class 3a Lasers. Lasers or laser systems that normally would not be hazardous if viewed for only momentary periods with the unaided eye. They may present a hazard if viewed using collecting optics.

Class 3b Lasers. Laser or laser systems that can be hazardous if viewed directly. This includes intrabeam viewing or specular reflections.

Class 4 Lasers. High powered lasers and laser systems capable of causing severe eye damage with short-duration (<0.25 s) exposures to the direct, specularly reflected, or diffusely reflected beam. Class 4 lasers and laser systems are also capable of causing severe skin damage and igniting flammable and combustible materials.

Laser Safety Officer (LSO). The individual with responsibility for ensuring laser safety on the ASU campus. S/he is a member of the Radiation Safety Committee.

Laser System Groupings. Lasers and laser systems are grouped according to their capacity to cause injury, and specific controls are then described for each group.[1] Information on the label must include class, the maximum output power, the pulsed duration (if pulsed), and the laser medium or emitted wavelengths.

Maximum Permissible Exposure (MPE). The level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin. The criteria for MPE for the eye and skin are detailed in Section 8 of ANSI Z136.1-1993.

MSDS. Material Safety Data Sheet – available on the Environmental Health and Safety (EH&S) homepage.

Radiation Safety Committee (RSC). The RSC has responsibility for monitoring laser use on the ASU-Jonesboro campus.

Standard Operating Procedures. Established procedure to be followed in use of lasers in each of the given categories.

4.0 APPLICABILITY

The requirements and recommended details of this policy are applicable to all lasers used by ASU employees, students, and unaffiliated workers in research and instructional laboratories

5.0 REGULATIONS

ASU has adopted the American National Standard for the Safe Use of Lasers:ANSIZ136.1-1993. ANSI Z136.1-1993 is recognized as a minimum standard for laser safety. A copy of the ASU Laser Safety Manual must be available in each department using Class 3b or Class 4 lasers. A copy of ANSI 2136.1-1993 or later applicable edition is available in the Radiation Safety Office and in the Office of Environmental Health and Safety.

Radiation Safety Governing Principles and Procedures

5.0 GOVERNING PRINCIPLES

5.1 Radiation Safety Committee

The Radiation Safety Committee (RSC) has responsibility for overseeing laser safety at ASU. Please refer to the Radiation Safety Governing Principles for information concerning the RSC.

5.2 Compliance Standards

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[1] Lasers manufactured after August 1, 1976, are classified and labeled by the manufacturer.

Before using lasers on the ASU-Jonesboro campus, investigators are required to provide the RSC with Standard Operating Procedures for Class 3b and Class 4 lasers, as well as a plan to control other hazards (Appendix A).

5.3 Training

Only qualified and authorized personnel are permitted to operate lasers. All employees, students, and/or unaffiliated workers who are required to operate lasers must read the Laser Safety Governing Principles and Procedures and receive initial and annual laser safety training. The Principal Investigator determines the employee’s operational qualification from departmental or technical training or other acceptable learning experience.

Before operating a Class 3 or Class 4 laser, or a Class 1 laser system that encloses a Class 3 or Class 4 laser, a person must review the Laser Safety Governing Principles and Procedures. The Principal Investigator or Lab Supervisor must provide a thorough review of the laser equipment to be used and the standard operating procedures for the specific equipment to be used. S/he, moreover, must ensure that a new user reads the operating and safety instructions furnished by the manufacturer before operating the equipment.

4.2 Medical Surveillance

Most lasers are capable of causing eye injury to anyone who looks directly into the beam or specular reflections. In addition, diffuse reflection of a high-power laser beams can burn exposed skin, ignite flammable materials, and activate toxic chemicals that release hazardous fumes, gases, debris, and radiation. The equipment and optical apparatus required to produce the lasing action and control and direct the laser beam also introduce additional hazards associated with water, high voltage, high pressure, cryogenics, noise, radiation, and toxic gases. Consequently, medical surveillance is required as follows:

- Individuals operating Class 1, 2, and 3a lasers are exempt from eye exams as are laser users who terminate their work in the laser laboratory unless an employee has had a known laser injury to the eye.
- Laser operators or individuals who will work in areas where there may be exposure to laser radiation from a Class 3b or Class 4 laser are required to have had a baseline eye examination prior to using the laser.
- An eye exam is required in the event of exposure or suspected exposure incident.

4.3 Exposure Incidents

If an exposure incident occurs, the Laser Safety Officer (LSO) must be notified by the Principal Investigator or by the person operating the laser. If the incident causes an injury or could potentially have caused an injury, the person or persons who have received an exposure should inform their supervisors and request an eye examination. The LSO will conduct an investigation, and an incident report will be written.

4.4 Laser Hazards

Before appropriate controls can be selected and implemented, laser radiation hazards must be identified and evaluated. It is the responsibility of the Principal Investigator who operates or supervises the operation of the laser to correctly identify the class of the laser and apply the concomitant controls. Refer to either ANSI Z136.1- 1993 or contact the LSO for additional information.

Types of laser-related hazards include:

- **Eye**: Acute exposure of the eye to lasers of certain wavelengths and power can cause corneal or retinal burns (or both). Chronic exposure to excessive levels may cause corneal or lenticular opacities (cataracts) or retinal injury.
- **Skin**: Acute exposure to high levels of optical radiation may cause skin burns, while carcinogenesis may occur for ultraviolet and near ultraviolet wavelengths.
- **Chemical**: Some lasers require hazardous or toxic substances to operate (i.e., chemical dye, Excimer lasers).
- **Electric shock**: Most lasers require high voltages that can be lethal.
- **Fire hazards**: The solvents used in dye lasers are flammable. High voltage pulse or flash lamps may cause ignition. Flammable materials may be ignited by direct beams or specular reflections from high power continuous wave (CW) infrared lasers.
- **Water Hazards**: In general, lasers are water-cooled, so flooding is a possibility. Hose connections should be checked regularly.

7.0 ROLES AND RESPONSIBILITIES

Responsibility for the administration of the safety standards contained herein rests with the Chancellor of the University or his/her designee and is directly overseen by the Associate Vice Chancellor for Research. The RSC is responsible for the implementation of the appropriate safety standards by: 1) reviewing and approving investigator use of lasers, 2) maintaining records of laser acquisition and registration, 3) operating a comprehensive laser safety program, and 4) make policy recommendations to the University administration. The LSO, as the RSC's representative, shall have the authority and responsibility to monitor and enforce the control of laser hazards.

Principal Investigators are responsible for:

- The immediate supervision of lasers in the laboratory.
- Providing, implementing, and enforcing the safety recommendations and requirements prescribed in this program.
- Classifying and labeling all of their lasers.
- Completing a Laser Registration Form and sending it to the Laser Safety Officer.
- Training and documenting all employees who work with and around Class 2a, 2, 3a, 3b, and 4 lasers in the safe use of lasers.
- Registering for the Medical Surveillance program for users of Class 3b and Class 4 lasers.
- Notifying the LSO immediately in the event of an exposure to a Class 3b or Class 4 laser.

Laser Operators are responsible for:

- Following laboratory alignment, operational, safety, and maintenance Standard Operating Procedures.
- Reading additional safety instructions in laser equipment operators' manuals.
- Keeping the Principal Investigator fully informed of any departure from established safety procedures. This includes notification of an exposure incident.
- Reading the University's Laser Safety Manual, and becoming familiar with its contents.
- Registering for the Medical Surveillance program for users of Class 3b and Class 4 lasers.

The Laser Safety Officer or his/her representative will:

- Maintain an inventory of all Class 3b and Class 4 lasers. Classify or verify classification if necessary.
- Be responsible for hazard evaluation of laser work areas, including the establishment of Nominal Hazard Zones.
- Approve Standard Operating Procedures, alignment procedures and other control measures.
- Provide consultative services on evaluation and control of laser hazards and worker training programs.
- Inspect all Class 3b and Class 4 lasers for compliance at least annually with ASU Laser Safety Program. Ensure any required corrective action is taken.
- Suspend, restrict or terminate the operation of a laser or laser system without adequate hazard controls, and advise Radiation Safety Committee of such action.
- Approve wording on area signs and equipment labels.
- Maintain records required by various regulatory bodies. Ensure records are maintained of medical examinations and training has been provided.
- Investigate incidents involving potentially harmful laser exposures.

The Radiation Safety Committee will:

- Develop and promulgate Governing Principles and procedures regarding laser safety within the university;
- Review and grant permission for, or disapprove, the use of laser equipment of Class 3 or
- higher for experimental, routine, or non-routine uses within the university from the
- standpoint of health and safety of experimenters, students, and staff, and the general public;
- Recommend candidates to the Associate Vice Chancellor for Research for the position of University Laser Safety Officer;
- Outline the duties of the Laser Safety Officer;
- Insure compliance with laser safety standards, including federal and state regulations, and
- non-regulatory standards as outlined in the American National Standards Institute (ANSI) Z136 series of laser safety standards;
- Review annual reports from the LSO regarding personnel training records, laser hazard control measures, laser safety inspections, and other matters concerning use and operational hazards of lasers;
- Investigate alleged infractions of safety rules or improper use of laser equipment brought to their attention by the radiation safety officer or other responsible personnel; and

- recommend remedial action to correct such infractions.

:

8.0 PROCEDURES

8.1 Eye Protection

Principal Investigators and/or staff who operate or supervise the operation of a laser are responsible for determining the need for laser eye protection for a particular laser. If required, eye protection will be provided by the supervisor for staff and visitors to the area. The booklet "Guide for Selection of Laser Eye Protection" produced by the Laser Institute of America may provide assistance in eyewear selection. Check with the Principal Investigator or the LSO for a copy.

8.2 Power Levels

The minimum laser radiant energy or laser power level required for the application should always be used.

8.3 Beam Control

To minimize direct eye exposure, observe these precautions:

- Do not intentionally look directly into the laser beam or at a specular reflection, regardless of its power.
- Terminate the beam path at the end of its useful path.
- Locate the beam path at a point other than eye level when standing or when sitting at a desk.
- Orient the laser so that the beam is not directed toward entry doors or aisles.
- Minimize specular reflections.
- Securely mount the laser system on a stable platform to maintain the beam in a fixed position during operation and limit beam traverse during adjustments.
- Confine primary beams and dangerous reflections to the optical table.
- Clearly identify beam paths and ensure that they do not cross populated areas or traffic paths.
- When the beam path is not totally enclosed, locate the laser system so that the beam will be outside the normal eye-level range, which is between 1.2 to 2 meters from the floor. A beam path that exits from a controlled area must be enclosed where the beam irradiance exceeds the MPE.

8.4 Warning Signs for Low-Power Lasers

Post "CAUTION-LOW POWER LASER" signs at each entrance to the operating area. If the laser has not been labeled by the manufacturer, attach a label to the laser with its classification and relevant warning information. (*Refer to the ANSI Z136.1-1993 for further guidance on control measures for various classifications of lasers.)*

8.5 Standard Operating Procedures for Class 3b and 4 Lasers

- All Principal Investigators are required to write Standard Operating Procedures (SOP) for all laser operations involving Class 3b and Class 4 lasers. The SOP must detail alignment, operation, safety, and maintenance procedures and should be posted or attached to the inside surface of the lab door. Other unusual operating circumstances may require additional procedures. Contact the Laser Safety Officer for assistance.
- A log must be maintained showing **periods of use, service, maintenance, incidents, and** monthly interlock checks. (See Appendix A.)
- A laser classification label must be conspicuously affixed to the laser housing.
- Each entrance must be posted with a danger sign in accordance with ANSI Z136.1-1993.
- Entrances to laboratories with Class 3b or 4 lasers shall have a lighted warning sign that is fail-safe interlocked with the laser, to activate when the laser is energized. The sign must be tested monthly. **A written record must be kept of each test.**
- All protective enclosures that surround laser devices and high-voltage electrical sources must be equipped with interlocks to prevent operation of the equipment when enclosures are not in place. Interlocks must be tested monthly to ensure that they are operational. Interlocks must be designed so that after they are actuated, the capacitor banks, shutters, or power supplies cannot be re-energized except by manually resetting the system.
- The responsible individual in a laser area controlled by a warning light is permitted to momentarily override (bypass) interlocks to allow access of authorized persons if all of the following conditions are met:
    - There is no laser radiation hazard at the point of entry.
    - The necessary protective devices are worn by the personnel entering the area.
    - An interlock bypass circuit is designed into the interlock control system.
    - This bypass circuit must only be operated from inside the interlocked area. It must delay no more than 15 seconds before shutting down the system.
- If interlocks are not feasible, the Principal Investigator may consider the use of alarms, voice warnings, danger lights, door locks, key cards, or extensive security. The Laser Safety Officer and the Radiation Safety Committee must be consulted in choosing alternatives to interlocks.
- Laser laboratories and controlled areas must be designed so that personnel can enter and leave under emergency conditions.
- Lasers must have a master switch with a key or coded access that prevents use once the key has been removed or a code has been entered. The key must not be left in the control panel when he laser is not in use.
- An alarm, a warning light, or a verbal "countdown" command must be used during activation and start up.
- Lasers must have a permanently attached beam stop or attenuator and emission delays.
- Laser-controlled areas shall be established which have limited access and shielding sufficient to contain or direct scattered radiation. Access to the area during laser operation requires the permission of the responsible operator.
- Class 3b and 4 infrared laser beams with a wavelength greater than or equal to 710 nm must be terminated with fire resistant material.
- Securely fasten all mirrors, prisms, beam stops, etc. in the beam path. Ensure that the laser is also securely fastened.

- Circuit breakers must be identified for each laser.
- The entire beam path of Class 3 and Class 4 lasers, including the target area, should be surrounded by an enclosure equipped with interlocks that prevent operation of the laser system unless the enclosure is properly secured. When total enclosure of the laser beam path is not practical, both the non-enclosed laser beam and any strong reflections must be terminated at the end of their useful paths using such devices as backstops, shields or beam traps.
- Materials that diffusely reflect laser radiation must be used in place of specularly reflective surfaces wherever possible.
- To minimize personnel exposure, specularly reflecting surfaces that are needed for beampath control should be enclosed or shielded.
- Ultraviolet (UV) and infrared (IR) lasers that emit invisible beams require additional
- Controls including the following:
    - Visual or audible beam-warning devices must be installed in areas where personnel may be exposed to radiation in excess of the MPE. These warning devices must be clearly identified and visible from all areas of potential exposure.
    - Shielding must be installed that will attenuate UV radiation to levels below the MPE for the wavelength being used.
    - Hazardous concentrations of by-products formed by the reaction of intense UV radiation with materials in the area must be controlled.
    - IR beam enclosures and backstops must be fabricated of IR-absorbent material and must also be fire-resistant.
- Controlled laser areas must be surveyed by the user both initially and when beam path changes are made to locate and identify direct and reflected beams that exceed the MPE. Shielding may be required to limit unwanted radiation.
- Personnel must never look directly into any laser beam.
- High powered laser optical **systems must never be aligned by direct beam viewing** if the radiant exposure or irradiance exceeds the MPE.
- Use low-power lasers, diffuse reflectors, image-retaining screens, exposed Polaroid film, and other devices that will minimize eye exposure.
- Using optical systems such as cameras, telescopes, microscopes, etc., to view laser beams may increase the eye hazard. Therefore, all collecting optics must incorporate suitable means (such as interlocks, filters, or attenuators) to prevent eye exposures above the MPE.
- Laser protective eye wear shall be worn whenever MPE levels may be exceeded. However, **it is good practice to always wear eye protection when lasers are in use**. In general, eye wear provides protection over a narrow range of the laser spectrum. Eye wear designed for protection at one wavelength may afford little or no protection at another wavelength. Consult eye wear manufacturers and the LSO for proper selection of protective eye wear.
- Laser protective eye wear must be approved by the American National Standards Institute (ANSI) and clearly labeled with optical densities and wavelengths for which protection is afforded. Eye wear must be inspected periodically by the user for pitting and cracking of the attenuating material, and for mechanical integrity and light leaks in the frame.
- Protection for the skin may be afforded through the use of clothing to cover normally exposed skin areas.

- Protective equipment is no substitute for common sense and the use of good safety practices.
- When lasers are to be left unattended, de-energize the power supplies or capacitor banks and remove the keys from power switches or master interlocks to prevent unauthorized activation of the equipment.
- The operation of unattended lasers is only allowed when a specific SOP has been written and approved by the Principal Investigator and the Radiation Safety Committee.
- Occasionally, it may be necessary to remove protective enclosures or override equipment interlocks or other safety devices for service adjustments, maintenance, special training exercises, etc. In these instances, a temporary controlled laser area must be set up. Specific methods for handling situations of this type must be described in the SOP.
- Because the area will not have all the standard safety features, the SOP must describe provisions for protecting personnel who could potentially be exposed.
- When the entire beam path is not fully enclosed, restrict access into the area to persons wearing proper protective equipment. Make sure that all optical paths from the restricted access area are adequately covered to prevent escape of laser radiation greater than the MPE for the eye. Refer to the ANSI Z136.1-1993 and Table 10 of this manual for further guidance on control measures for various classifications of lasers.

8.6 Converting to a Class 1 Enclosed Laser

Any laser or laser system can be converted to a Class 1 enclosed laser by including all of the following controls in the laser system design. These controls will effectively enclose the laser, thus preventing personal contact with emitted radiation while permitting unrestricted access into the area.

Approval must be obtained from the Radiation Safety Committee in order to convert a Class 3b or Class 4 laser to a Class 1 enclosed laser. **Users of these converted Class 1 lasers must still attend Laser safety training.**

- House the laser system within a protective enclosure to prevent escape of laser radiation above the MPE.
- The protective housing must prevent personnel access to the laser system during normal operations.
- Personnel entering the enclosure to perform maintenance or adjustment tasks must be made aware of the higher risk laser class.
- Install safety interlocks wherever the protective enclosure can be opened, removed or displaced. When activated, these interlocks must prevent a beam with a radiant energy above the MPE from leaving the laser or laser system. Service adjustments or maintenance work performed on the laser system must not render the interlocks inoperable or cause exposure levels outside the enclosure to exceed the MPE, unless work is performed in a laser area with limited access and appropriate safeguards, supervision, and control.
- The protective enclosure and the laser system must be designed and fabricated so that if a failure occurs, the system will continue to meet the requirements for an enclosed laser operation.

- Modifications to commercial laser systems must be evaluated. Contact the LSO for an evaluation. If the modifications decrease the safety controls, an SOP will be required.
- Attenuated Viewing Windows: Use viewing windows containing a suitable filter material that will attenuate the transmitted laser radiation to levels below the MPE under all conditions of operation.
- Label the enclosure with **"CAUTION-ENCLOSED LASER"** signs and attach a label directly to the laser which gives the laser classification in the absence of the enclosure. Make sure that the label can be seen immediately when the enclosure is opened.

8.7 Controlling Associated Hazards

The Radiation Safety Committee is responsible for oversight of other hazards associated with laser use and requires that laboratories that house Class 3b or Class 4 lasers provide Standard Operating Procedures (Appendix A) to control hazards as follows:

- **Electrical Equipment and Systems.** Always be aware of the high risk of injury and fire in laser operations because of the presence of electrical power sources. The installation, operation, and maintenance of electrical equipment and systems must conform to existing standards. Contact Environmental Health and Safety (EH&S) for assistance.
- **Lighting.** Adequate lighting is necessary in controlled areas. If lights are extinguished during laser operation, provide control switches in convenient locations or install a radio-controlled switch. Luminescent strips should be used to identify table and equipment corners, switch locations, aisles, etc. When ambient light is not sufficient for safe egress from a laser area during an electrical power failure, install emergency lighting.
- **Ionizing and Non-ionizing Radiation.** Laser operations may involve ionizing radiation that originates from the presence of radioactive materials or the use of electrical power in excess of 15kV. If radioactive material is present in the laser system, "CAUTION-RADIOACTIVE MATERIAL" sign must be prominently displayed. If X-rays are generated a CAUTION-X-RAYS" sign must be prominently displayed. Microwave and radio frequency (RF) fields may be generated by laser systems or support equipment. Contact the Radiation Safety Office at 753-1093 to obtain an evaluation of these hazards before starting an operation.
- **Hazardous Materials**. Bring only those hazardous materials into the laser area that are needed for the operation. Do not allow laser beams and strong reflections to affect combustible materials, explosives, highly flammable liquids or gases or substances that decompose into highly toxic products under elevated temperatures. Conduct or sponsor tests that establish the effects of beam interactions with hazardous materials. Test results can be used to determine safe parameters for laser operation. All hazardous materials must be properly used, stored and controlled. **Consult Material Safety Data Sheets, and EH&S for additional information.**
- **Dyes and Solutions.** Dye lasers normally use a lasing medium composed of a complex fluorescent organic dye dissolved in an organic solvent. These dyes vary greatly in toxicity, mutagenicity, and potential carcinogenicity. Most solvents suitable for dye solutions are flammable and toxic by inhalation and/or skin absorption. Prepare and handle dye-solutions inside a chemical fume hood. Wear a lab coat, eye protection and gloves. Pressure-test all dye laser components before using dye solutions. Pay particular attention to tubing connections. Install spill pans under pumps and reservoirs. Be alert to

contaminated parts. Keep dye-mixing areas clean. Obtain Material Safety Data Sheets from EH&S for all dyes and solvents. And use in accordance with those instructions.

- **Water.** In general, lasers are water-cooled, so flooding is a possibility. Check hose connections regularly.

APPENDIX A
ARKANSAS STATE UNIVERSITY
STANDARD OPERATING PROCEDURE FOR LASER SAFETY

This procedure shall be developed by the Principal Investigator and approved by the RSC before laser use commences and shall be approved by the RSC every two years thereafter, unless the procedures undergo substantive change. In the latter case, the Principal Investigator is required to submit the revised SOP to the RSC for its review and approval prior to the onset of any work conducted under the new procedures. Operators must read and sign the most recent SOP annually.

1. GENERAL INFORMATION

Department/Laboratory:

Date:

Principal Investigator:

Phone number:

2. LASER DESCRIPTION

Attach latest Laser Inventory (available from Laser Safety Supervisor). Update as required.

3. LASER SAFETY PROGRAM

See the ASU Laser Safety Governing Policies and Procedures for:

- Responsibilities of the laser operator/user and the Principal Investigator:
- Laser Permit Requirements
- Training Requirements
- Eyewear Requirements, including annual eyewear inspections
- Sign and Labeling Requirements
- Non-radiation Hazards

4. HAZARDS & CONTROLS

Check if applicable:

☐ High Voltage

☐ Entryway (door)

☐ Interlocks or Controls

☐ Laser Enclosure

☐ Interlocks

☐ Laser Housing

☐ Interlocks

☐ Panic Button

☐ Emergency Stop

☐ Beam Stops

☐ Infrared Laser terminates in fire-resistant material and the absorber must be inspected at least quarterly

☐ Master Switch (operated by key or computer code)

☐ Laser Secured to Base

5. PERSONAL PROTECTIVE EQUIPMENT

Eyewear:

Acquisition date:

Type Wavelength (nm):

Wavelength:

Attenuated (nm):

Optical Density (OD):

Example:

Aug 08

CO2 10,600 10,600 At least 3.5 Glendalewhite frames

Identify each set of laser protective eyewear with a unique designation (name or number).

What (item): And is available from (where) which must be worn (when):

6. OPERATING PROCEDURES

A. Initial preparation of lab environment for normal operation (key position, warning light on, interlock activated, identification of personnel, other);

B. Target area preparation:

C. Operational procedures are as follows:

D. Shutdown procedures are as follows:

E. Special procedures (alignment, safety tests, interlock bypass, emergency, etc.):

7. Non-Radiation Hazards Survey

Please circle correct response.

1. Electrical

Are there any exposed wiring terminals or connections?	Yes/No/NA
Is a positive on/off switch available and connected?	Yes/No/NA
Are all connections permanent (Screwed or clamped)?	Yes/No/NA
Are personnel trained in CPR?	Yes/No/NA
Is access to the power supply controlled	Yes/No/NA

2. Chemical

Is personal protective equipment available	Yes/No/NA
Are Material Safety Data Sheets available?	Yes/No/NA
Is absorbent or diluent available?	Yes/No/NA
Are personnel trained in the hazards of the chemical?	Yes/No/NA

3. Cutting Edge

Is the cutting edge identified prominently?	Yes/No/NA
Are personnel trained in safety for this hazard?	Yes/No/NA

4. Compressed Gases

Is the gas cylinder properly secured and connected?	Yes/No/NA

Is an MSDS available for the gas (If required)?	Yes/No/NA
Are personnel trained in safety for this hazard?	Yes/No/NA

5. Ventilation

Is proper ventilation present for the laser space?	Yes/No/NA

6. Noise

Are noise levels excessive?	Yes/No/NA
Is hearing protection available?	Yes/No/NA
Are personnel trained in safety for this hazard?	Yes/No/NA

7. Confining Space, Explosion, Physical Safety

Is the hazard identified?	Yes/No/NA
Is training provided in safety for this hazard?	Yes/No/NA
Is protective equipment available?	Yes/No/NA

8. PRINCIPAL INVESTIGATOR ACKNOWLEDGEMENT OF COMPLIANCE

This SOP is accurate to the best of my knowledge.

Name (Print):

Signature:

Signature Date:

7. OPERATOR REVIEW

I have read this procedure, been trained by the Principal Investigator, and understand its contents.

Name (Print):

Signature:

Signature Date:

FIRST AID

Source : ASU Environmental Health and Safety Office
URL : http://www.astate.edu/a/ehs/emergency-services/first-aid/
Date : October 14th, 2014

FIRST AID PROCEDURES

Listed below are basic first aid procedures for classrooms and laboratories.

BURNS

Minor (small scalds, burns from hot objects)

- Flush the burned area with cool water from a tap or use cool wet compresses applied to the skin.
- Cleanse the burned area. Apply burn cream from the first aid kit.
- If blistering occurs – recommend that student seek treatment at Wilson Student Health Center (WSHC) or with personal physician.

Chemical Burn

- Start treatment immediately by placing the burned area under cool running water and continue flushing for at least 15 minutes.
- If the chemical has splashed into the eye, irrigate the injured eye with cool water. Make sure the eye is open and the head is positioned so the water will not run into the other eye. Irrigate for at least 15 minutes, and then cover the eye with a sterile compress. Recommend the individual seek emergency medical treatment. UPD will transport student to medical treatment facility.

Staff should pull Safety Data Sheet and send with student to medical treatment facility.

CUTS, SCRAPES, AND BRUISES

- Clean area with a Betadine wipe, which can be found in the first aid kit. Cover with a light protective adhesive bandage.
- Treat bruises that involve bleeding into the tissue beneath the outer layer of skin with cold packs to reduce swelling.
- For deeper cuts that go through the skin, control bleeding with direct pressure and elevation. If bleeding persists or recurs, recommend the student seek medical treatment at the Wilson Student Health Center or with personal physician.

FAINTING

- Check to make sure the individual is breathing.
- Lay the person on his/her back; raise the legs higher than the head to promote the flow of blood to the heart and brain.
- When person revives, color returns to the face, suggest lying or sitting for a few minutes before attempting to stand.
- Recommend the student seek medical treatment at the Wilson Student Health Center or with personal physician.

NOSEBLEADS

- Have the person sit down with head angled slightly forward so the blood doesn’t run back into the throat.
- If the blood comes from only one nostril, press the fleshy part of the nostril firmly toward the midline; if from both, pinch the nostrils together. Maintain pressure for 5 to 10 minutes.
- If the bleeding is profuse or cannot be controlled within 30 minutes, or if nosebleeds occur frequently, advise the student they should seek medical treatment at Wilson Student Health Center or with personal physician.

SPRAINS

- Start with RICE – Rest, Ice, Compressions and Elevation. Do not let the individual use the injured body part.
- Apply an ice pack and mild compression with an elastic bandage to the injured body part for several hours to keep swelling down.
- Keep the sprain elevated, using pillows.
- If there is discoloration or deformity, advise the student they may wish to seek medical treatment from Wilson Student Health Center or with personal physician.

EYE INJURIES

Minor

- DO NOT rub or apply pressure or ice to the injured eye.
- Cover eye with patch and recommend student seek medical treatment from Wilson Student Health Center or with personal physician.
- If the injury is a black eye, you may apply ice to cheek and area around eye, but not directly on the eyeball itself.

Severe

- If an object is impaled in the eye, CALL 9-911, DO NOT remove the object.
- Cover both eyes with sterile dressings to immobilize have student transported to medical treatment facility of their choice.
- DO NOT rub or apply pressure or ice to the injured eye.

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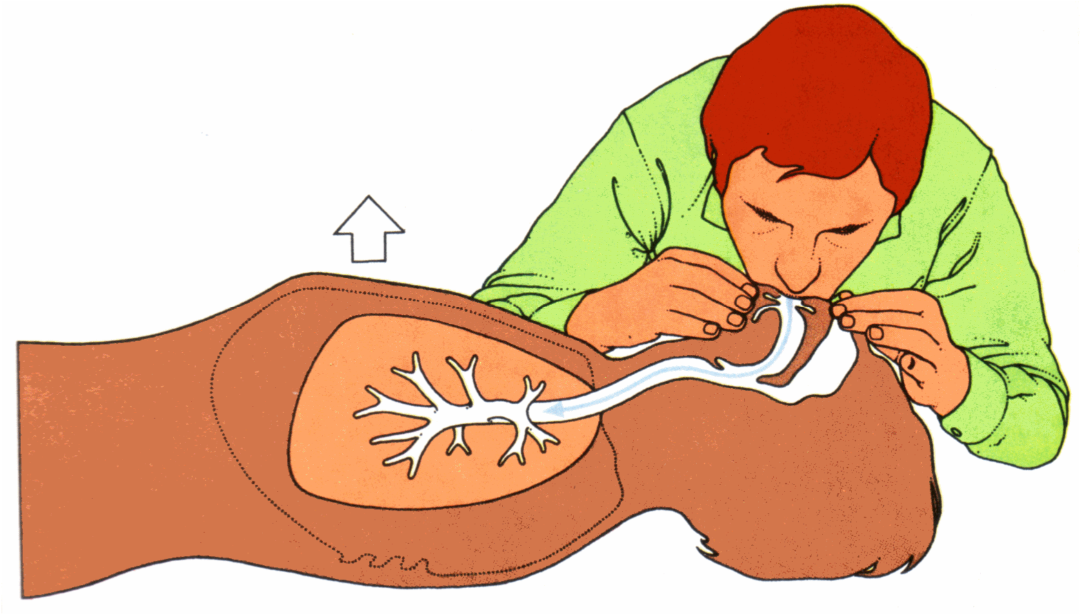
FIRST AID

CPR: Cardiopulmonary Resuscitation
AED: Automated External Defibrillator

Source : ASU Environmental Health and Safety Office
URL : http://www.astate.edu/a/ehs/training/index.dot
Date : October 14th, 2014

CPR/AED AND FIRST AID



FURTHER AMERICAN RED CROSS COURSES ARE OFFERED UPON REQUEST

First Aid, Adult CPR/AED & First Aid, Pediatric CPR/AED, Pediatric CPR/AED & First Aid, Adult/Pediatric CPR/AED & First Aid.

If you need one of these trainings contact EH&S (870) 972-2862 to have one of these courses added.

THIS TRAINING IS PROVIDED TO Arkansas State University Faculty, Students and Staff ONLY

Blended learning includes an online component which must be completed prior to the classroom session. You pay $19.00 to the American Red Cross for the certificate after you receive the link to the online session.

Skill evaluation is located in Environmental Research Safety & Training Building Room 116 from two to five p.m., dates are listed on the scheduler.

Class size is limited to 10 per session, so please register as soon as possible. If you cannot make it to your scheduled session, let EH&S know. Bring the receipt from the Cashiers' Window and your certificate of completion from the American Red Cross. Please show up on time.

Register for CPR Training now >>

https://ittc-web.astate.edu/hrscheduler/#!classList

PLEASE BRING THE FOLLOWING INFORMATION TO THE CASHIER'S WINDOW:

Fees: **Students and family** pay **$5.00** for materials to account: **110000-312041-711703-1720.**

American
Red Cross

Adult First Aid/CPR/AED

READY REFERENCE

CHECKING AN INJURED OR ILL ADULT

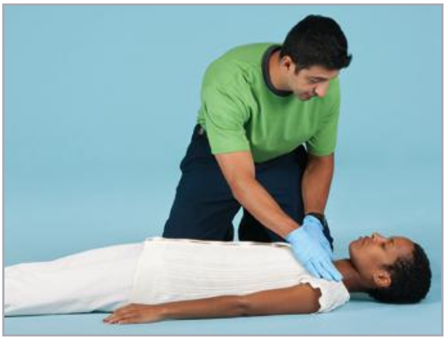
APPEARS TO BE UNCONSCIOUS

TIP: *Use disposable gloves and other personal protective equipment and obtain consent whenever giving care.*

AFTER CHECKING THE SCENE FOR SAFETY, CHECK THE PERSON:

1 CHECK FOR RESPONSIVENESS

Tap the shoulder and shout, "Are you OK?"



2 CALL 9-1-1

If **no** response, **CALL** 9-1-1 or the local emergency number.

- If an unconscious person is face-down, roll face-up, supporting the head, neck and back in a straight line.

If the person responds, obtain consent and **CALL** 9-1-1 or the local emergency number for any life-threatening conditions.

CHECK the person from head to toe and ask questions to find out what happened.

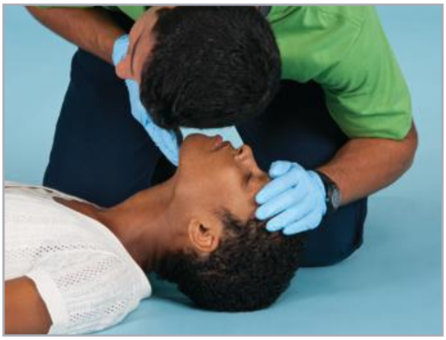
3 OPEN THE AIRWAY

Tilt head, lift chin.

4 CHECK FOR BREATHING

CHECK quickly for breathing for no more than **10** seconds.

- Occasional gasps are not breathing.



5 QUICKLY SCAN FOR SEVERE BLEEDING

WHAT TO DO NEXT

- Give **CARE** based on conditions found.
- IF NO BREATHING—Go to PANEL 6 or PANEL 7 (if an AED is immediately available).
- IF BREATHING—Maintain an open airway and monitor for any changes in condition.

CONSCIOUS CHOKING

CANNOT COUGH, SPEAK OR BREATHE

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON, HAVE SOMEONE CALL 9-1-1 AND GET CONSENT.

1 GIVE 5 BACK BLOWS

Give **5** back blows.

- Bend the person forward at the waist and give **5** back blows between the shoulder blades with the heel of one hand.

2 GIVE 5 ABDOMINAL THRUSTS

- Place a fist with the thumb side against the middle of the person's abdomen, just above the navel.
- Cover your fist with your other hand.
- Give **5** quick, upward abdominal thrusts.

3 CONTINUE CARE

Continue sets of **5** back blows and **5** abdominal thrusts until the:

- Object is forced out.
- Person can cough forcefully or breathe.
- Person becomes unconscious.

WHAT TO DO NEXT

- IF THE PERSON BECOMES UNCONSCIOUS—**CALL** 9-1-1, if not already done, and give care for an unconscious choking adult, beginning with looking for an object (PANEL 5, Step 3).

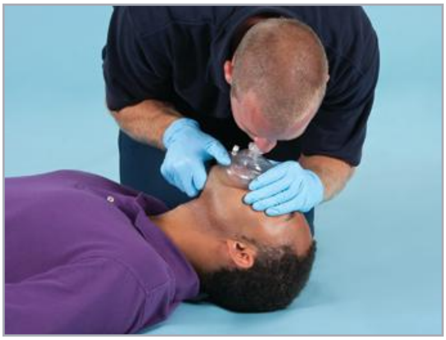
UNCONSCIOUS CHOKING

CHEST DOES NOT RISE WITH RESCUE BREATHS

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 GIVE RESCUE BREATHS

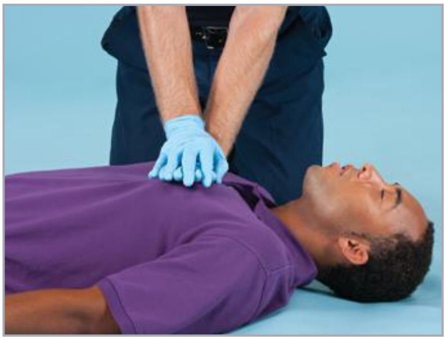
Retilt the head and give another rescue breath.



2 GIVE 30 CHEST COMPRESSIONS

If the chest still does not rise, give **30** chest compressions.

> **TIP:** *Person must be on firm, flat surface. Remove CPR breathing barrier when giving chest compressions.*



3 LOOK FOR AND REMOVE OBJECT IF SEEN

4 GIVE 2 RESCUE BREATHS

WHAT TO DO NEXT

- IF BREATHS DO NOT MAKE THE CHEST RISE—Repeat steps 2 through 4.
- IF THE CHEST CLEARLY RISES—**CHECK** for breathing. Give **CARE** based on conditions found.

CPR

NO BREATHING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 GIVE 30 CHEST COMPRESSIONS

Push hard, push fast in the middle of the chest at least **2** inches deep and at least **100** compressions per minute

TIP: *Person must be on firm, flat surface.*

2 GIVE 2 RESCUE BREATHS

- Tilt the head back and lift the chin up.
- Pinch the nose shut then make a complete seal over the person's mouth.
- Blow in for about **1** second to make the chest clearly rise.
- Give rescue breaths, one after the other.

Note: *If chest does not rise with rescue breaths, retilt the head and give another rescue breath.*

3 DO NOT STOP

Continue cycles of CPR. Do not stop CPR except in one of these situations:

- You find an obvious sign of life, such as breathing.
- An AED is ready to use.
- Another trained responder or EMS personnel take over.
- You are too exhausted to continue.
- The scene becomes unsafe.

WHAT TO DO NEXT

- IF AN AED BECOMES AVAILABLE—Go to AED, PANEL 7.
- IF BREATHS DO NOT MAKE THE CHEST RISE— AFTER RETILTING HEAD—Go to Unconscious choking, PANEL 5.

TIP: *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*

AED—ADULT OR CHILD OLDER THAN 8 YEARS OR WEIGHING MORE THAN 55 POUNDS

NO BREATHING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

TIP: *Do not use pediatric AED pads or equipment on an adult or child older than 8 years or weighing more than 55 pounds.*

1 TURN ON AED

Follow the voice and/or visual prompts.

2 WIPE BARE CHEST DRY

TIP: *Remove any medication patches with a gloved hand.*

3 ATTACH PADS

4 PLUG IN CONNECTOR, IF NECESSARY

5 STAND CLEAR

Make sure no one, including you, is touching the person.

- Say, "EVERYONE, STAND CLEAR."

6 ANALYZE HEART RHYTHM

Push the "analyze" button, if necessary. Let AED analyze the heart rhythm.

7 DELIVER SHOCK

If SHOCK IS ADVISED:

- Make sure no one, including you, is touching the person.
- Say, "EVERYONE, STAND CLEAR."
- Push the "shock" button, if necessary.

8 PERFORM CPR

After delivering the shock, or if no shock is advised:

- Perform about **2** minutes (or **5** cycles) of CPR.
- Continue to follow the prompts of the AED.

TIPS:

- *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*
- *If two trained responders are present, one should perform CPR while the second responder operates the AED.*

CONTROLLING EXTERNAL BLEEDING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 COVER THE WOUND

Cover the wound with a sterile dressing.

2 APPLY DIRECT PRESSURE UNTIL BLEEDING STOPS

3 COVER THE DRESSING WITH BANDAGE

Check for circulation beyond the injury (check for feeling, warmth and color).

4 APPLY MORE PRESSURE AND CALL 9-1-1

If the bleeding does not stop:

- Apply more dressings and bandages.
- Continue to apply additional pressure.
- Take steps to minimize shock.
- **CALL** 9-1-1 or the local emergency number if not already done.

TIP: *Wash hands with soap and water after giving care.*

BURNS

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 REMOVE FROM SOURCE OF BURN

2 COOL THE BURN

Cool the burn with cold running water at least until pain is relieved.

3 COVER LOOSELY WITH STERILE DRESSING

4 CALL 9-1-1

CALL 9-1-1 or the local emergency number if the burn is severe or other life-threatening conditions are found.

5 CARE FOR SHOCK

POISONING

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 CALL 9-1-1 OR POISON CONTROL HOTLINE

For life-threatening conditions (such as if the person is unconscious or is not breathing, or if a change in the level of consciousness occurs), **CALL** 9-1-1 or the local emergency number.

OR

If the person is conscious and alert, **CALL** the National Poison Control Center (PCC) hotline at **1-800-222-1222** and follow the advice given.

2 PROVIDE CARE

Give **CARE** based on the conditions found.

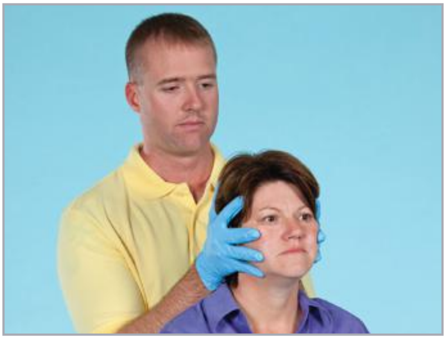
HEAD, NECK OR SPINAL INJURIES

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 CALL 9-1-1 OR THE LOCAL EMERGENCY NUMBER

2 MINIMIZE MOVEMENT

Minimize movement of the head, neck and spine.



3 STABILIZE HEAD

Manually stabilize the head in the position in which it was found.

- Provide support by placing your hands on both sides of the person's head.
- If head is sharply turned to one side, **DO NOT** move it.

STROKE

FOR A STROKE, THINK F.A.S.T.

AFTER CHECKING THE SCENE AND THE INJURED OR ILL PERSON:

1 THINK F.A.S.T.

Face— Ask the person to smile. Does one side of face droop?

Arm— Ask the person to raise both arms. Does one arm drift downward?

Speech— Ask the person to repeat a simple sentence (such as, “The sky is blue.”). Is the speech slurred? Can the person repeat the sentence correctly?

Time— **CALL 9-1-1** immediately if you see any signals of a stroke. Try to determine the time when signals first appeared. Note the time of onset of signals and report it to the call taker or EMS personnel when they arrive.

2 PROVIDE CARE

Give **CARE** based on the conditions found.

Stock No. 656732

American Red Cross

Pediatric First Aid/CPR/AED

READY REFERENCE

CHECKING AN INJURED OR ILL CHILD OR INFANT

APPEARS TO BE UNCONSCIOUS

TIPS:

- *Use disposable gloves and other personal protective equipment whenever giving care.*
- *Obtain consent from parent or guardian, if present.*

AFTER CHECKING THE SCENE FOR SAFETY, CHECK THE CHILD OR INFANT:

1 CHECK FOR RESPONSIVENESS

Tap the shoulder and shout, "Are you OK?"

- For an infant, you may flick the bottom of the foot.

2 CALL 9-1-1

If **no** response, **CALL** 9-1-1 or the local emergency number.

- If an unconscious child or infant is face-down, roll face-up, supporting the head, neck and back in a straight line.

If **ALONE**—Give about **2** minutes of **CARE**, then **CALL** 9-1-1.

If the child or infant responds, **CALL** 9-1-1 or the local emergency number for any life-threatening conditions and obtain consent to give **CARE**. **CHECK** the child from head to toe and ask questions to find out what happened.

3 OPEN THE AIRWAY

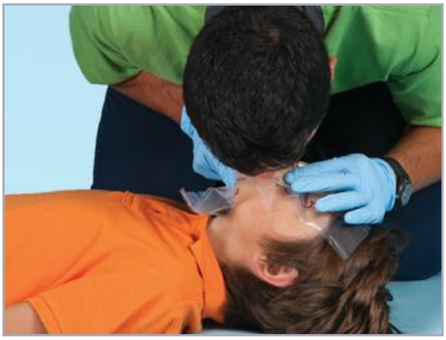
Tilt head back slightly, lift chin.

4 CHECK FOR BREATHING

CHECK quickly for no more than **10** seconds.

- Occasional gasps are not breathing.
- Infants have periodic breathing, so changes in breathing pattern are normal for infants.

5 GIVE 2 RESCUE BREATHS



If no breathing, give **2** rescue breaths.

- Tilt the head back and lift the chin up.
- Child: Pinch the nose shut, then make a complete seal over child's mouth.
- Infant: Make complete seal over infant's mouth and nose.
- Blow in for about **1** second to make the chest clearly rise.
- Give rescue breaths, one after the other.

TIPS:

- *If you witnessed the child or infant suddenly collapse, skip rescue breaths and start CPR (PANEL 7).*
- *If the chest does not rise with rescue breaths, retilt the head and give another rescue breath.*

6 QUICKLY SCAN FOR SEVERE BLEEDING

WHAT TO DO NEXT

- IF THE CHEST STILL DOES NOT CLEARLY RISE AFTER RETILITING HEAD—Go to Unconscious Choking, PANEL 6.
- IF **NO** BREATHING—Go to CPR, PANEL 7 or AED, PANEL 8 (if AED is immediately available).
- IF BREATHING—Monitor breathing and for any changes in condition.

CONSCIOUS CHOKING—CHILD

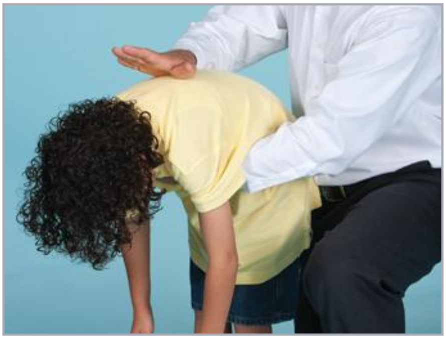
CANNOT COUGH, SPEAK OR BREATHE

TIP: *Stand or kneel behind the child, depending on his or her size.*

AFTER CHECKING THE SCENE AND THE INJURED OR ILL CHILD, HAVE SOMEONE CALL 9-1-1 AND GET CONSENT FROM THE PARENT OR GUARDIAN, IF PRESENT.

1 GIVE 5 BACK BLOWS

Bend the child forward at the waist and give **5** back blows between the shoulder blades with the heel of one hand.



2 GIVE 5 ABDOMINAL THRUSTS

- Place a fist with the thumb side against the middle of the child's abdomen, just above the navel.
- Cover your fist with your other hand.
- Give **5** quick, upward abdominal thrusts.

3 CONTINUE CARE

Continue sets of **5** back blows and **5** abdominal thrusts until the:

- Object is forced out.
- Child can cough forcefully or breathe.
- Child becomes unconscious.

WHAT TO DO NEXT

- IF CHILD BECOMES UNCONSCIOUS—**CALL** 9-1-1, if not already done. Carefully lower the child to the ground and give **CARE** for an unconscious choking child, beginning with looking for an object (PANEL 6, Step 3).

CONSCIOUS CHOKING—INFANT

CANNOT COUGH, CRY OR BREATHE

AFTER CHECKING THE SCENE AND THE INJURED OR ILL INFANT, HAVE SOMEONE CALL 9-1-1 AND GET CONSENT FROM THE PARENT OR GUARDIAN, IF PRESENT.

1 GIVE 5 BACK BLOWS

Give firm back blows with the heel of one hand between the infant's shoulder blades.

2 GIVE 5 CHEST THRUSTS

Place two or three fingers in the center of the infant's chest just below the nipple line and compress the breastbone about **1½** inches.

TIP: *Support the head and neck securely when giving back blows and chest thrusts. Keep the head lower than the chest.*

3 CONTINUE CARE

Continue sets of **5** back blows and **5** chest thrusts until the:

- Object is forced out.
- Infant can cough forcefully, cry or breathe.
- Infant becomes unconscious.

WHAT TO DO NEXT

- IF INFANT BECOMES UNCONSCIOUS—**CALL** 9-1-1, if not already done. Carefully lower the infant onto a firm, flat surface and give **CARE** for an unconscious choking infant, beginning with looking for an object (PANEL 6, Step 3).

UNCONSCIOUS CHOKING—CHILD AND INFANT

CHEST DOES NOT RISE WITH RESCUE BREATHS

AFTER CHECKING THE SCENE AND THE INJURED OR ILL CHILD OR INFANT:

1 GIVE RESCUE BREATHS

Retilt the head and give another rescue breath.

2 GIVE CHEST COMPRESSIONS

If the chest still does not rise, give **30** chest compressions.

TIP: *Child or infant must be on firm, flat surface. Remove CPR breathing barrier when giving chest compressions.*

3 LOOK FOR AND REMOVE OBJECT IF SEEN

4 GIVE 2 RESCUE BREATHS

WHAT TO DO NEXT

- IF BREATHS DO NOT MAKE THE CHEST RISE—Repeat steps 2 through 4.
- IF THE CHEST CLEARLY RISES—**CHECK** for breathing. Give **CARE** based on conditions found.

CPR—CHILD AND INFANT

NO BREATHING

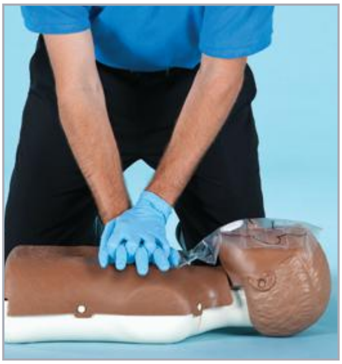
AFTER CHECKING THE SCENE AND THE INJURED OR ILL CHILD OR INFANT:

1 GIVE 30 CHEST COMPRESSIONS

Push hard, push fast in the middle of the chest.

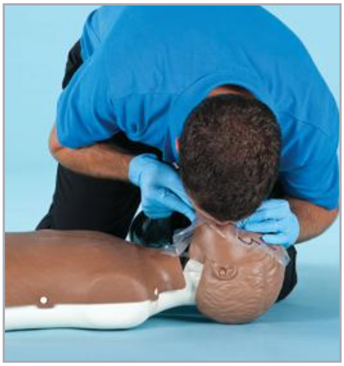
- Child: Push about **2** inches deep.
- Infant: Push about **1½** inches deep.
- Push fast, at least **100** compressions per minute.

TIP: *Child or infant must be on firm, flat surface.*



2 GIVE 2 RESCUE BREATHS

- Tilt the head back and lift the chin up.
- Child: Pinch the nose shut, then make a complete seal over child's mouth.
- Infant: Make complete seal over infant's mouth and nose.
- Blow in for about **1** second to make the chest clearly rise.
- Give rescue breaths, one after the other.



3 DO NOT STOP

Continue cycles of CPR. Do not stop CPR except in one of these situations:

- You find an obvious sign of life, such as breathing.
- An AED is ready to use.
- Another trained responder or EMS personnel take over.
- You are too exhausted to continue.
- The scene becomes unsafe.

TIP: *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*

WHAT TO DO NEXT FOR CHILD AND INFANT

- IF AN AED BECOMES AVAILABLE—Go to AED, PANEL 8.
- IF BREATHS DO NOT MAKE CHEST RISE—Give **CARE** for unconscious choking (PANEL 6).

AED—CHILD AND INFANT YOUNGER THAN AGE 8 OR WEIGHING LESS THAN 55 POUNDS

NO BREATHING

TIP: *When available, use pediatric settings or pads when caring for children and infants. If pediatric equipment is not available, rescuers may use AEDs configured for adults.*

AFTER CHECKING THE SCENE AND THE INJURED OR ILL CHILD OR INFANT:

1 TURN ON AED

Follow the voice and/or visual prompts.

2 WIPE BARE CHEST DRY

3 ATTACH PADS

If pads risk touching each other,
use front-to-back pad placement.

4 PLUG IN CONNECTOR, IF NECESSARY

5 STAND CLEAR

Make sure no one, including you, is touching the child or infant.

- Say, "EVERYONE, STAND CLEAR."

6 ANALYZE HEART RHYTHM

Push the "analyze" button, if necessary. Let AED analyze the heart rhythm.

7 DELIVER SHOCK

IF A SHOCK IS ADVISED:

- Make sure no one, including you, is touching the child or infant.
- Say, "EVERYONE, STAND CLEAR."
- Push the "shock" button, if necessary.

8 PERFORM CPR

After delivering the shock, or if no shock is advised:

- Perform about **2** minutes (or **5** cycles) of CPR.
- Continue to follow the prompts of the AED.

TIPS:

- *If two trained responders are present, one should perform CPR while the second responder operates the AED.*
- *If at any time you notice an obvious sign of life, stop CPR and monitor breathing and for any changes in condition.*

CONTROLLING EXTERNAL BLEEDING

AFTER CHECKING THE SCENE AND THE INJURED CHILD OR INFANT:

1 COVER THE WOUND

Cover the wound with a sterile dressing.

2 APPLY DIRECT PRESSURE UNTIL BLEEDING STOPS

3 COVER THE DRESSING WITH BANDAGE

Check for circulation beyond the injury (check for feeling, warmth and color).

4 APPLY MORE PRESSURE AND CALL 9-1-1

If the bleeding does not stop:

- Apply more dressings and bandages.
- Continue to apply additional pressure.
- Take steps to minimize shock.
- **CALL** 9-1-1 if not already done.

TIP: *Wash hands with soap and water after giving care.*

BURNS

AFTER CHECKING THE SCENE AND THE INJURED CHILD OR INFANT:

1 REMOVE FROM SOURCE OF BURN

2 COOL THE BURN

Cool the burn with cold running water at least until pain is relieved.

3 COVER LOOSELY WITH STERILE DRESSING

4 CALL 9-1-1

CALL 9-1-1 or the local emergency number if the burn is severe or other life-threatening conditions are found.

5 CARE FOR SHOCK

POISONING

AFTER CHECKING THE SCENE AND THE INJURED CHILD OR INFANT:

1 CALL 9-1-1 OR POISON CONTROL HOTLINE

For life-threatening conditions (such as if the child or infant is unconscious or is not breathing or if a change in the level of consciousness occurs), **CALL** 9-1-1 or the local emergency number.

OR

If conscious and alert, **CALL** the National Poison Control Center (PCC) hotline at 1-800-222-1222 and follow the advice given.

2 PROVIDE CARE

Give **CARE** based on the conditions found.

SEIZURE

AFTER CHECKING THE SCENE AND THE INJURED CHILD OR INFANT:

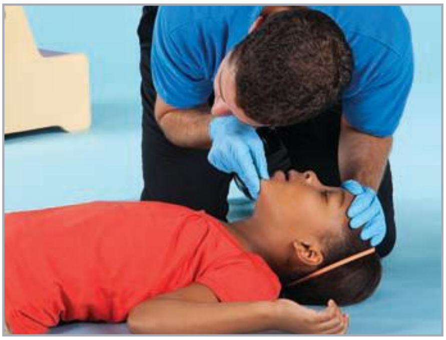
1 CALL OR HAVE SOMEONE CALL 9-1-1

2 REMOVE NEARBY OBJECTS

- DO NOT hold or restrain the child or infant.
- DO NOT place anything between the teeth or in the mouth.

3 AFTER SEIZURE PASSES

Monitor breathing and for changes in condition.



WHAT TO DO NEXT

- Comfort and reassure the child or infant. If fluids or vomit are present, roll the child or infant to one side to keep the airway clear.
- Provide **CARE** based on conditions found.

Stock No. 656733

HANDS-ONLY CPR

FOR WITNESSED SUDDEN COLLAPSE

American Red Cross

1. CHECK and CALL

1. **CHECK** the scene, then **CHECK** the person.
2. Tap on the shoulder and shout, “Are you okay?” and quickly look for breathing.
3. CALL 9-1-1 if no response.
4. If unresponsive and not breathing, BEGIN CHEST COMPRESSIONS.

TIPS:
- Whenever possible use disposable gloves when giving care.
- Occasional gasps are not breathing.

2. GIVE CHEST COMPRESSIONS

1. Place the heel of one hand on the center of the chest.
2. Place the heel of the other hand on top of the first hand, lacing your fingers together.
3. Keep your arms straight, position your shoulders directly over your hands.
4. Push hard, push fast.
   - Compress the chest at least 2 inches.
   - Compress at least 100 times per minute.
   - Let the chest rise completely before pushing down again.
5. Continue chest compressions.

3. DO NOT STOP

Except in one of these situations:

- You see an obvious sign of life (breathing).
- Another trained responder arrives and takes over.
- EMS personnel arrive and take over.
- You are too exhausted to continue.
- An AED is ready to use.
- The scene becomes unsafe.

AED AUTOMATED EXTERNAL DEFIBRILLATOR

If an AED is available:

1. Turn on AED.
2. Wipe chest dry.
3. Attach the pads.
4. Plug in connector, if necessary.
5. Make sure no one is touching the individual.
6. Push the “Analyze” button, if necessary.
7. If a shock is advised, push the “Shock” button.
8. Perform compressions and follow AED prompts.

Go to redcross.org or call your chapter to sign up for training in full CPR, First Aid, Babysitter’s Training, Pet First Aid and much more.

Developed with the support of the American Red Cross Badger Chapter.

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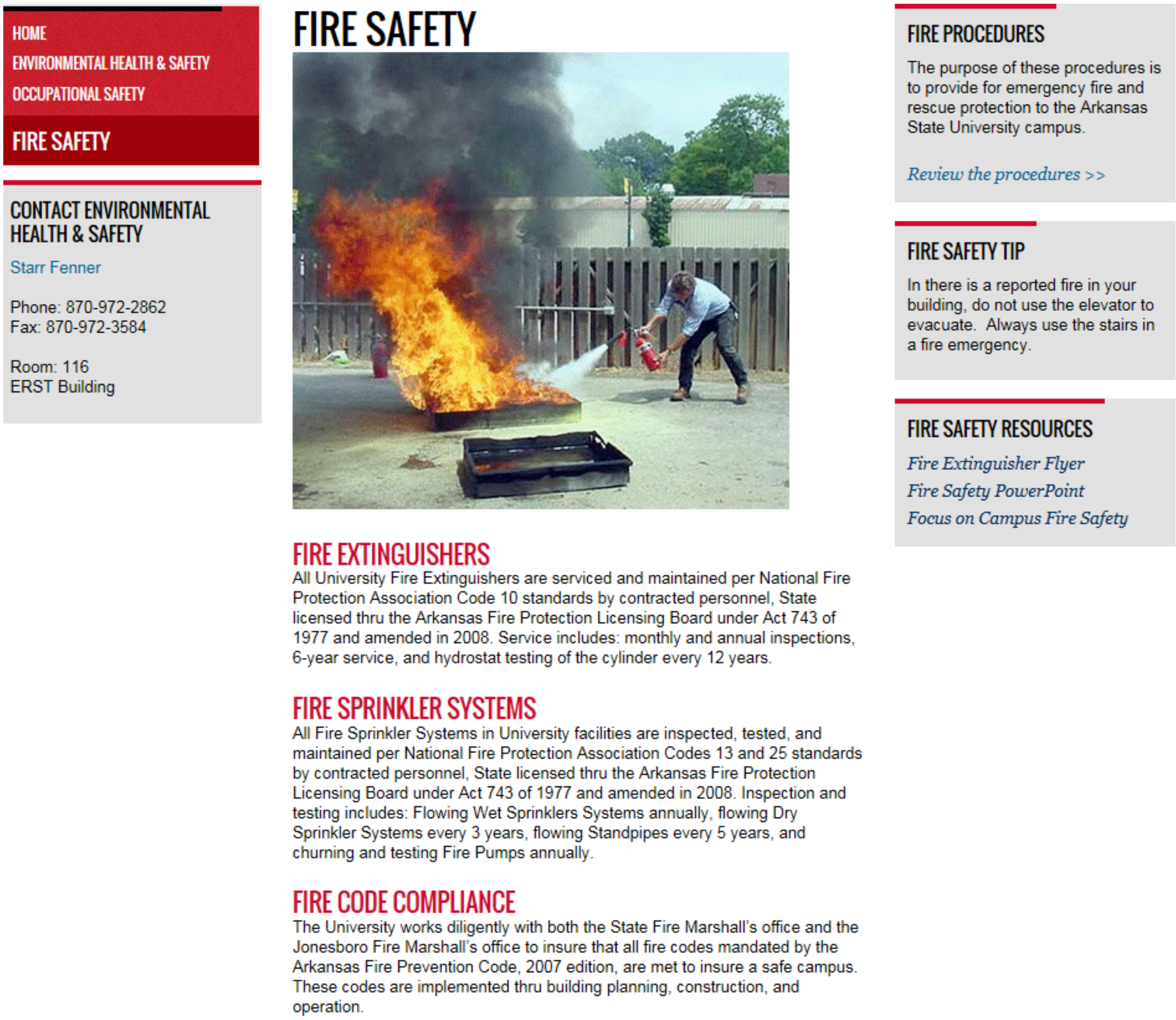
FIRE SAFETY

Source : ASU Environmental Health and Safety Office
URL : http://www.astate.edu/a/ehs/occupational-safety/fire-safety/
Date : October 14th, 2014



HOME
ENVIRONMENTAL HEALTH & SAFETY
OCCUPATIONAL SAFETY
FIRE SAFETY

CONTACT ENVIRONMENTAL HEALTH & SAFETY

Starr Fenner

Phone: 870-972-2862
Fax: 870-972-3584

Room: 116
ERST Building

FIRE SAFETY

FIRE EXTINGUISHERS

All University Fire Extinguishers are serviced and maintained per National Fire Protection Association Code 10 standards by contracted personnel, State licensed thru the Arkansas Fire Protection Licensing Board under Act 743 of 1977 and amended in 2008. Service includes: monthly and annual inspections, 6-year service, and hydrostat testing of the cylinder every 12 years.

FIRE SPRINKLER SYSTEMS

All Fire Sprinkler Systems in University facilities are inspected, tested, and maintained per National Fire Protection Association Codes 13 and 25 standards by contracted personnel, State licensed thru the Arkansas Fire Protection Licensing Board under Act 743 of 1977 and amended in 2008. Inspection and testing includes: Flowing Wet Sprinklers Systems annually, flowing Dry Sprinkler Systems every 3 years, flowing Standpipes every 5 years, and churning and testing Fire Pumps annually.

FIRE CODE COMPLIANCE

The University works diligently with both the State Fire Marshall's office and the Jonesboro Fire Marshall's office to insure that all fire codes mandated by the Arkansas Fire Prevention Code, 2007 edition, are met to insure a safe campus. These codes are implemented thru building planning, construction, and operation.

FIRE PROCEDURES

The purpose of these procedures is to provide for emergency fire and rescue protection to the Arkansas State University campus.

Review the procedures >>

FIRE SAFETY TIP

In there is a reported fire in your building, do not use the elevator to evacuate. Always use the stairs in a fire emergency.

FIRE SAFETY RESOURCES

Fire Extinguisher Flyer
Fire Safety PowerPoint
Focus on Campus Fire Safety

Fire extinguishers contain different substances; the nature of these makes them appropriate to a particular class of fire. **At ABI, we have TWO kinds of fire extinguishers:**

1. **Dry Chemical Powder**. This is a mixture containing basically sodium bicarbonate, potassium bicarbonate (corrosive), potassium chloride, and mono-ammonium phosphate. This mix has effect on fire classes A, B, and C. Activation of the fire extinguisher releases the powder mixture on the fire, creating a layer that isolates oxygen from the atmosphere. These extinguishers contain 10 pounds of powder and cylinders are painted on red; they are in special cabinets in ABI <u>offices and halls</u>.

2. **Halotron® I**. This is a mixture of 2,2-dichloro-1,1,1-trifluoroethane plus a proprietary mixture of two gases. It is effective also on fire classes A, B, and C. These extinguishers are also red colored, contain 11 pounds of gases, and are inside special cabinets in the <u>laboratories</u>. Halotron® I is different to the Dry Chemical Powder type in being a gas, and does not leave residues after application; therefore no collateral damage occurs on instruments or other assets in the area where it is employed.

To operate a fire extinguisher, first twist the metal pin to break the plastic seal. **P**ull the pin, **A**im at the base of the fire, **S**queeze the handle to release the extinguishing agent, and **S**weep from side to side (mnemonic: **PASS**). Keep in mind that fire extinguishers of the size we have at ABI (10-11 pounds) are effective at maximum distances of 10 feet, and will last only 50-60 seconds.

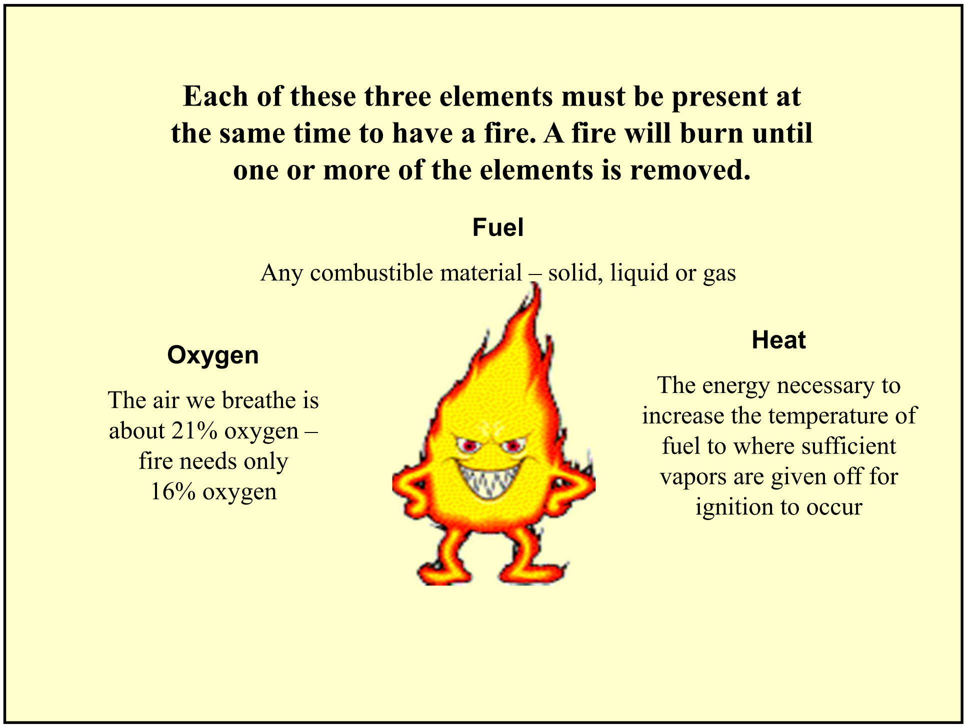
If you are trapped by fire and smoke, crawling while escaping will allow you to breathe the oxygen present in lower areas; smoke will concentrate in upper areas, increasing the risk of suffocation/choking hazard.

October 14th, 2014

LABORATORIES

OFFICES AND HALLWAYS

Fire Safety



Each of these three elements must be present at the same time to have a fire. A fire will burn until one or more of the elements is removed.

Fuel

Any combustible material – solid, liquid or gas

Oxygen

The air we breathe is about 21% oxygen – fire needs only 16% oxygen

Heat

The energy necessary to increase the temperature of fuel to where sufficient vapors are given off for ignition to occur

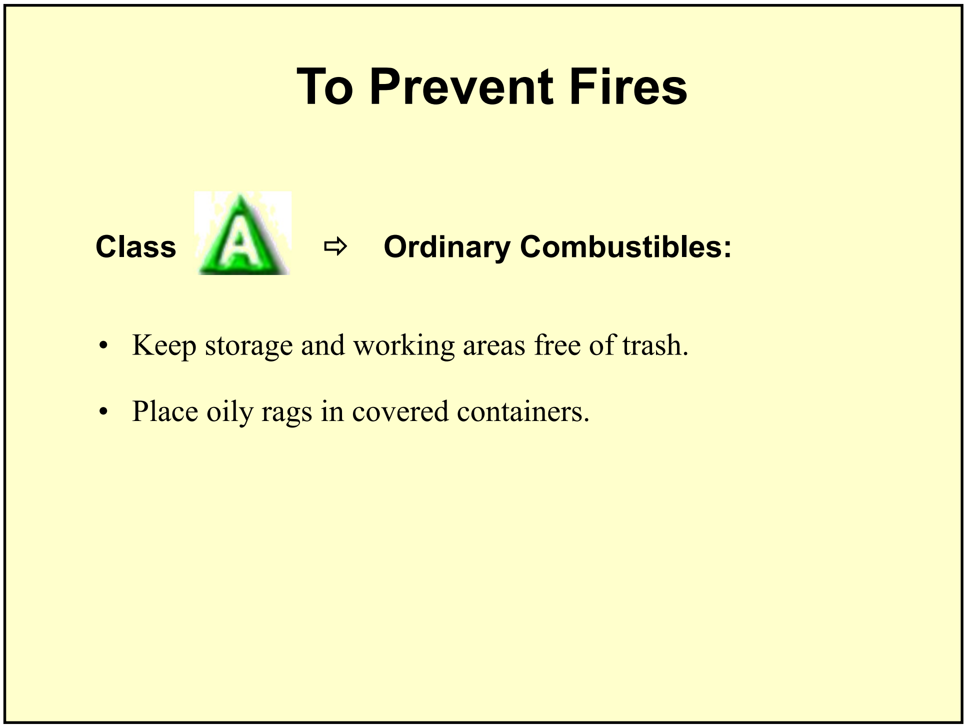
There are 4 classes of fire:

Class A
Ordinary combustibles or fibrous material, such as wood, paper, cloth, rubber, and some plastics.

Class B
Flammable or combustible liquids such as gasoline, kerosene, paint, paint thinners and propane.

Class C
Energized electrical equipment, such as appliances, switches, panel boxes and power tools.

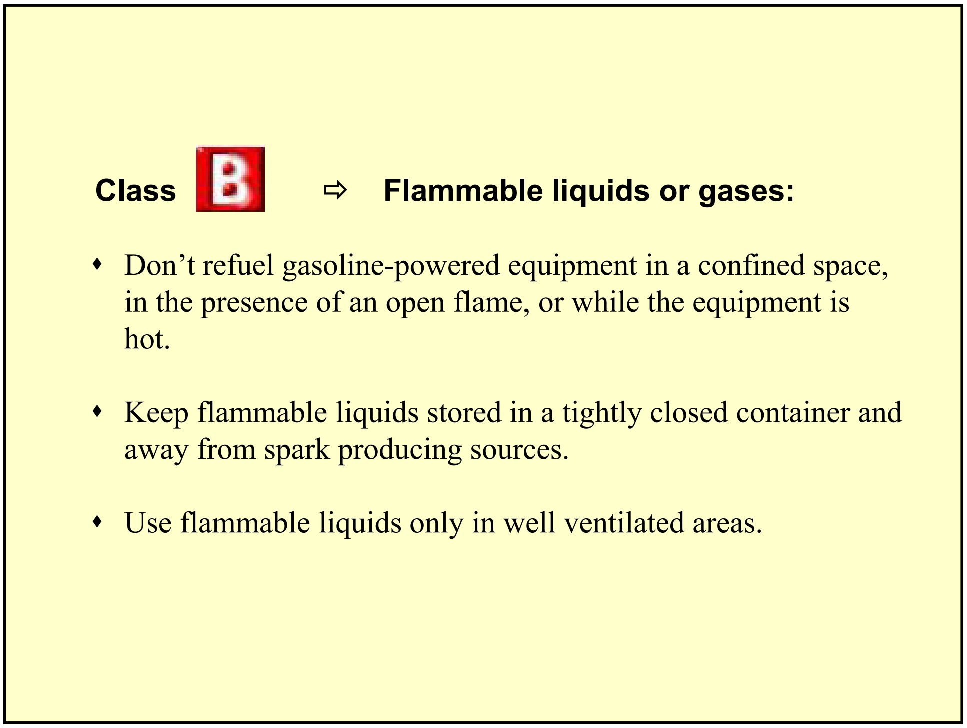
Class D
Certain combustible metals, such as magnesium, titanium, potassium, and sodium.



To Prevent Fires

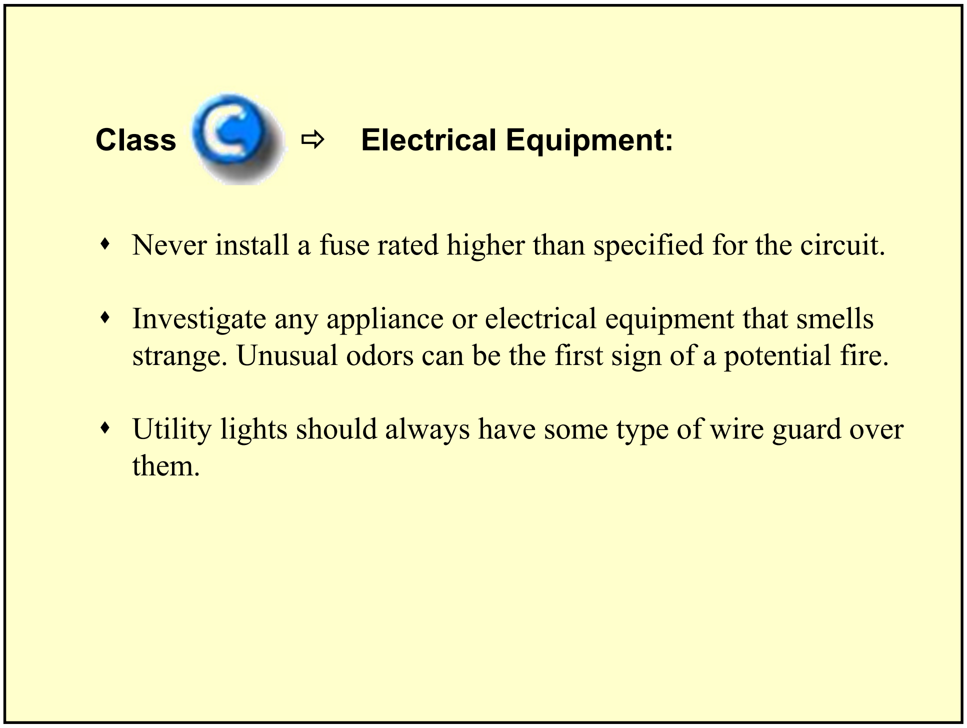
Class A ⇨ **Ordinary Combustibles:**

- Keep storage and working areas free of trash.
- Place oily rags in covered containers.



Class B ⇨ Flammable liquids or gases:

- Don’t refuel gasoline-powered equipment in a confined space, in the presence of an open flame, or while the equipment is hot.
- Keep flammable liquids stored in a tightly closed container and away from spark producing sources.
- Use flammable liquids only in well ventilated areas.



Class C ⇨ Electrical Equipment:

- Never install a fuse rated higher than specified for the circuit.
- Investigate any appliance or electrical equipment that smells strange. Unusual odors can be the first sign of a potential fire.
- Utility lights should always have some type of wire guard over them.

Class D ⇨ Flammable metals:

- Knowledge of the properties of the metals and using good judgment and common sense will assist you in controlling or avoiding potential fires/reactions.

Be prepared for a fire emergency

- Check the location of fire alarms and know how they work.
- Learn your building evacuation plan.
- Know where your two nearest exits are located. Learn how doors swing and where stairs lead.
- Make sure nothing blocks fire pulls, extinguishers and emergency exits.
- Learn the sound of your building fire alarm.
- Post emergency numbers (including security and first aid) near your telephone.
- Make sure you know what to do if the fire alarm sounds. Plan your escape.

When you notice a fire:

- Pull the nearest fire alarm “pull station” while exiting the floor.
- If there is no pull station:

Dial 911
Emergency Number

OR Alternate
Emergency Number

- Do not assume that anyone else has already called the fire department.
- Stay calm and be prepared to answer the operator’s questions regarding the emergency.
- EVACUATE !

When you hear the fire alarm:

- Leave at once, taking direction from the emergency warden.
- Do not delay yourself by gathering personal items. Your safety always comes first.
- Before you open any door, feel the door with the back of your hand. If the door is cold, slowly open it a crack.
- If there is no smoke in hallways or stairwells, follow your building’s evacuation plan. Get out quickly using designated fire exits.

When you hear the fire alarm (continued):

- Close doors behind you, however do NOT lock the door. Locking the door hinders the fire department’s search and rescue efforts.
- The stairway will be your primary escape route. **Never, never use elevators under any circumstances**.
- Once in the stairway, proceed down to the first floor and out of the building. Never go up.

If you are trapped in smoke or heat:

- Before you open any door, feel the door with the back of your hand. If the door is warm to the touch, DO NOT attempt to open the door.
- Stuff the cracks around doors with towels, rags, clothing or tape, and cover vents to keep out smoke.
- Stay low to the floor, and if possible, cover your mouth and nose with a damp cloth or dust mask to help you breathe.
- If there is a phone in the room where you are trapped, call the fire department to tell them exactly where you are located. Do this even if you see fire apparatus on the street below.

If you are trapped (continued):

- Wait at a window and signal for help. Do not panic or jump!! WAIT!
- If possible, open the window at the top or bottom, but do not break it, you may need to close the window if smoke rushes in.
- Be patient. Rescuing all the occupants of a building can take several hours.

After a fire emergency:

- Once you are out of the building, STAY OUT! Do not go back inside for any reason.
- Report to your warden for roll call at your designated assembly point.
- Tell the fire department via your warden if you know of anyone trapped inside the building.
- Only re-enter if and when the fire department tells you it is safe to do so.

In the event of a fire,
your personal safety is your
most important concern.

Remember – you are
not required to fight a fire.

BEFORE you consider fighting a fire . . .

- Call the fire department.
- Confirm that the fire is small and is not spreading.
- Confirm you have a safe path to an exit not threatened by the fire.
- You know what kind of extinguisher is required and the correct extinguisher is immediately at hand.

NEVER fight a fire if . . .

- The fire is spreading beyond the immediate area in which it started, or if it is already a large fire.
- The fire could block your escape route.
- You are unsure of the proper operation of the extinguisher.
- You doubt that the extinguisher you are holding is designed for the type of fire at hand or is large enough to fight the fire.

Multi-Class Ratings

Many extinguishers available today can be used on different types of fires and will be labeled with more than one designator, e.g. A-B, B-C, or A-B-C.

This label shows that this extinguisher can be used on ordinary combustibles (A) or flammable liquids (B). The red slash through the last symbol tells you that the extinguisher cannot be used on electrical fires (C).

Be advised that most fire extinguishers will function for less than 40 seconds.

New Style of Labeling

Old Style of Labeling

10 Tips on How and When to Use a Fire Extinguisher

1

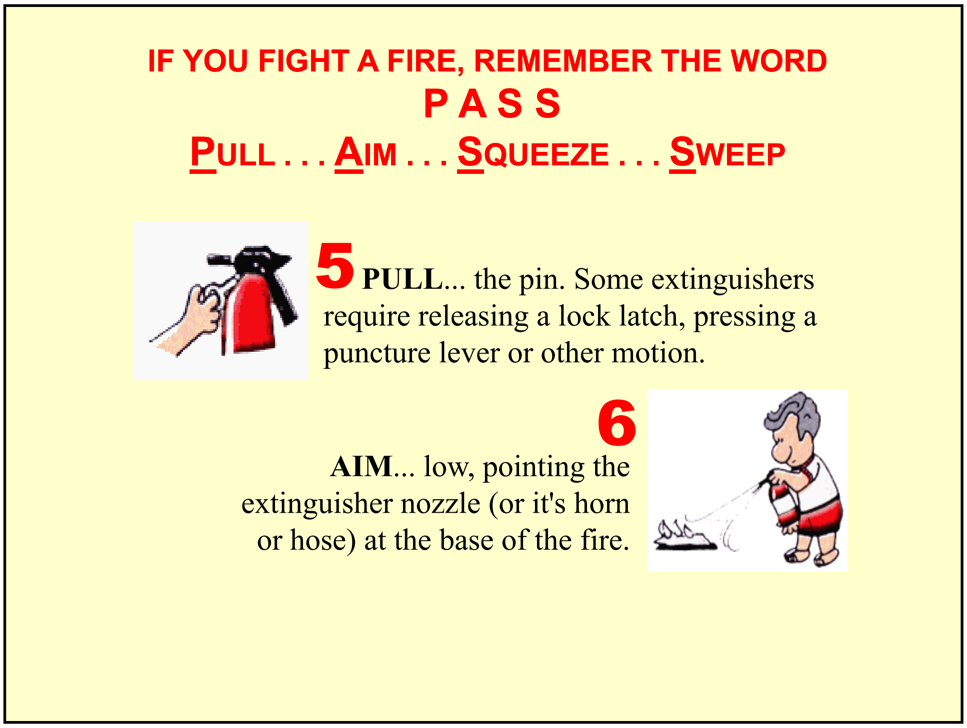
Most fires start small. Except for explosions, fires can usually be brought under control if they are attacked correctly with the right type and size of extinguisher within the first 2 minutes!

2 A fire extinguisher should be "listed and labeled" by an independent testing laboratory. The higher the rating number on an A or B extinguisher, the more fire it can put out. Be careful, high-rated units are often heavier models. Make sure you can hold and operate the model you are using.

3 Before attempting to fight a small fire, be sure everyone is out of the area. Ensure someone has called the fire department.
If the fire starts to spread or threatens your escape path, get out immediately!

4

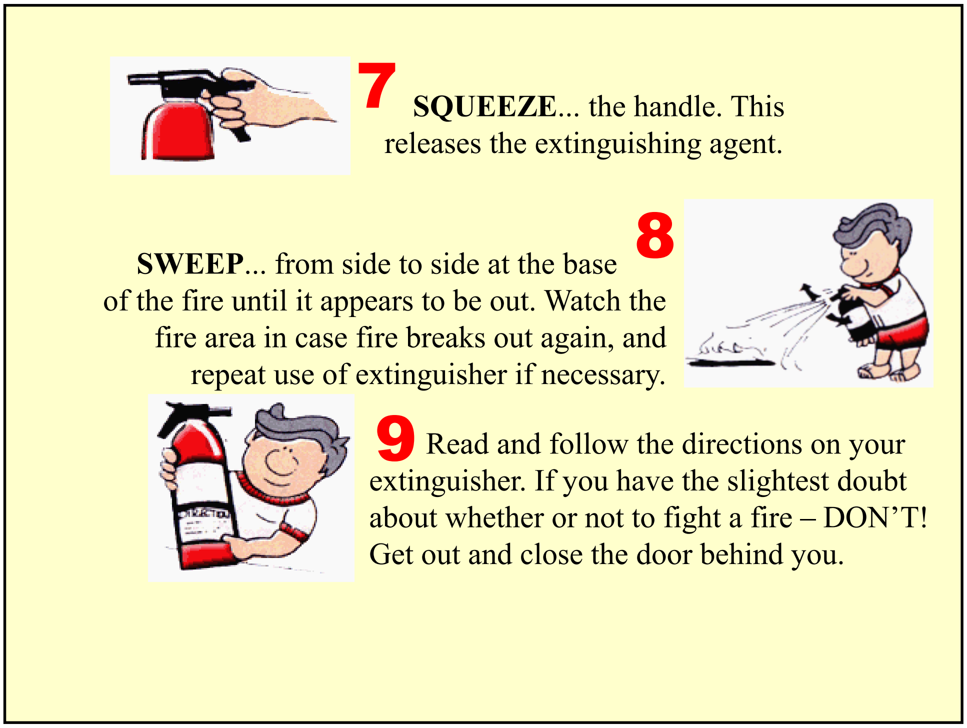
The operator must know how to use the extinguisher quickly without taking time to read directions during an emergency. Remember that the extinguishers need care and must be recharged after every use.



IF YOU FIGHT A FIRE, REMEMBER THE WORD
P A S S
PULL . . . AIM . . . SQUEEZE . . . SWEEP

5 **PULL**... the pin. Some extinguishers require releasing a lock latch, pressing a puncture lever or other motion.

6 **AIM**... low, pointing the extinguisher nozzle (or it's horn or hose) at the base of the fire.



7 **SQUEEZE**... the handle. This releases the extinguishing agent.

8 **SWEEP**... from side to side at the base of the fire until it appears to be out. Watch the fire area in case fire breaks out again, and repeat use of extinguisher if necessary.

9 Read and follow the directions on your extinguisher. If you have the slightest doubt about whether or not to fight a fire – DON'T! Get out and close the door behind you.

Remember!

Your Safety Comes First

**When in doubt,
leave the fire
fighting to the
professionals**

PORTABLE FIRE EXTINGUISHERS

Arkansas Workers' Compensation Commission/Health and Safety Division
1-800-622-4472

GOALS

This handout is designed to provide an overview of portable fire extinguishers that are used in most industries.

INTRODUCTION

The Occupational Safety and Health Administration's (OSHA's) 29 CFR 1910.157, Portable Fire Extinguishers Standard, is the regulation that requires employers to train their employees in the use of portable fire extinguishers to extinguish small, i.e. incipient stage, fires in the workplace. The National Fire Protection Association (NFPA) 10, Standard For Portable Fire Extinguishers, provides additional information regarding hazard classification, placement of fire extinguishers, and extinguisher capacity.

DEFINITIONS

Class A fire - a fire involving **ordinary combustible materials such as paper, wood, cloth**, and some rubber and plastic materials.

Class B fire - a fire involving **flammable or combustible liquids, flammable gases, greases** and similar materials, and some rubber and plastic materials.

Class C fire - a fire involving **energized electrical equipment** where safety to the employee requires the use of electrically nonconductive extinguishing media. **Never use water to extinguish an electrical fire!**

Class D fire - a fire involving comb**ustible metals such as magnesium, titanium, zirconium, sodium, lithium and potassium**.

Dry chemical - an extinguishing agent composed of very small particles of chemicals such as, but not limited to, sodium bicarbonate, potassium bicarbonate, urea-based potassium bicarbonate, potassium chloride, or monoammonium phosphate supplemented by special treatment to provide resistance to packing and moisture absorption (caking) as well as to provide proper flow capabilities. Dry chemical does not include dry powders.

Dry Powder - a compound used to extinguish or control Class D fires.

Extinguisher classification - means the letter classification given an extinguisher to designate the class or classes of fire on which an extinguisher will be effective.

Extinguisher rating - means the numerical rating given to an extinguisher which indicates the extinguishing potential of the unit based on standardized tests developed by Underwriters' Laboratories, Inc.

Flame resistance - the property of materials, or combinations of component materials, to retard ignition and restrict the spread of flame.

Halotron 1 - a rapidly evaporating liquid (hydrochlorofluorocarbon) that removes heat from the combustion zone by displacing the oxygen. Electronically non-conductive units that will not cause thermal or static shock to sensitive electrical equipment. Recommended for use in computer rooms, data storage areas and laboratories.

Incipient stage fire - a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus.

Inspection - a visual check of fire protection systems and equipment to ensure that they are in place, charged, and ready for use in the event of a fire.

Maintenance - the performance of services on fire protection equipment and systems to assure that they will perform as expected in the event of a fire. Maintenance differs from inspection in that maintenance requires the checking of internal fittings, devices and agent supplies.

Multipurpose dry chemical - a dry chemical which is approved for use on Class A, Class B and Class C fires.

GENERAL REQUIREMENTS

Potable fire extinguishers must be provided. Mounted, located an identified so that they are readily accessible to employees without subjecting employees to possible injury. **Fire extinguishers should not be located behind doors, boxes, in closets, nor should they be used as coat or hat racks**.

Only approved portable fire extinguishers must be used.

Portable fire extinguishers using carbon tetrachloride or chlorobromomethane are not allowed to be used.

Portable fire extinguishers must be maintained in a fully charged and operable condition and kept in their designated places at all times except during use.

If an employee observes that-a portable fire extinguisher is not in its designated place and/or its gauge indicates that it is discharged, the employee should report this information to their supervisor immediately so that the extinguisher can be replaced to its designated place and/or recharged.

SELECTION

The portable fire extinguishers that are selected to be used at your facility must be appropriate for the environment in which they will be used. For most facilities, the multipurpose type fire extinguishers that are approved for extinguishing Class A, Class B and Class C incipient stage fires are appropriate. Since the multipurpose fire extinguishers leave a residue that can harm sensitive equipment, carbon dioxide or halotron 1 extinguishers would be preferred in areas where there are computers or other sensitive electronic equipment.

INSPECTION

Portable fire extinguishers must be visually inspected monthly and subjected to an annual maintenance check. The date of the annual maintenance must be recorded and retained for at least one year after *the* last entry or the life of the shell, whichever is less.

Alternate equivalent protection must be provided whenever portable fire extinguishers are removed from service for maintenance and recharging.

HYDROSTATIC TESTING

Portable fire extinguishers must be hydrostatically tested every 5 or 12 years (dependent upon the type of extinguisher), except under the following conditions:

1. When the unit has been repaired by soldering, welding, brazing, or use of patching compounds;
2. When the cylinder or shell threads are damaged;
3. When there is corrosion that has caused pitting, including corrosion under removable name plate assemblies;
4. When the extinguisher has been burned in a fire; or
5. When a calcium chloride extinguishing agent has been used in a stainless steel shell.

TRAINING

Employers should familiarize and train their employees in the use of portable fire extinguishers to extinguish small, incipient stage fires in the workplace. It must be emphasized that employees must not use the portable fire extinguishers to fight large fires. If the fire is too large to be extinguished by using a portable fire extinguisher, employees should pull the "Fire Alarm" and **LEAVE THE BUILDING!**

There are four basic steps to operating a portable fire extinguisher. An easy way to remember the procedure is to think of the word **"PASS"**.

- **P - Pull** the pin: This means pulling out the pin located below the trigger.

- **A - Aim** low: Stand about 6 - 8 feet away from the fire and point the extinguisher nozzle at the base of the fire. Always hold the extinguisher vertically. Never cradle it horizontally or at an angle in your arms.

- **S - Squeeze** the trigger: Squeeze the trigger slowly and evenly. This will release the extinguishing agent and expel it through the nozzle.

- **S - Sweep** side to side: Sweep the nozzle from side to side as the extinguishing agent is expelled -"driving the fire back". As the fire closest to you goes out, you may move closer to the fire and continue the sweeping motion until the fire is extinguished. **If the fire does not go out immediately, get out of the building**!

REFERENCES

Videos that are pertinent to this subject may be obtained, at no cost, from the Arkansas Department of Labor/ Arkansas Workers' Compensation Commission's Health and Safety Division Resource Center at (501)-682-9090.

Revised 5/00

http://amerex-fire.com/products/hand-portables/abc-multi-purpose-stored-pressure-dry-chemical-extinguishers/

https://fireextinguisherdepot.com/amerex-b417t-abc-fire-extinguisher-2-5-lb-rechargeable-ul-rating-1a-10b-c.html

AMEREX

Quality is Behind the Diamond.

ABC Multi-Purpose Stored Pressure Dry Chemical Extinguishers

Specifications

ABC or Multi-Purpose extinguishers utilize a specially fluidized and siliconized mono ammonium phosphate **dry chemical** in the form of a fine pale yellow powder. It chemically insulates Class A fires by melting at approximately 350°F and coats surface to which it is applied. It smothers and breaks the chain reaction of Class B fires and will not conduct electricity back to the operator.

ABC or Multi-Purpose Fire Extinguishers can be used on Class A, B, or C fires.

- **Class A:** Wood, Paper, cloth, trash, plastics (solids that are not metals).
- **Class B:** Flammable Liquids-Gasoline, oil, grease, acetone (includes flammable gases).
- **Class C:** Electrical: Energized electrical equipment (anything that is plugged in).

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AMPAC™ HALOTRON

HOME < PRODUCTS < HALOTRON I

Halotron I is a proven clean fire extinguishing agent designed for streaming applications in portable and handheld fire extinguishers. It is the world's most widely distributed halocarbon-based clean fire extinguishing agent for such applications. Halotron I has shown, by way of repeated successful extinguishment of real-world fires, that it can quickly and effectively protect valuable assets without generating an undesirable solid residue during the fire-extinguishment process.

It is common for users of fire extinguishers to have limited experience in their operation, and an independent study showed that Halotron I is easier to use for such relatively inexperienced users than other halocarbon clean agents. Halotron I is a safe, effective, environmentally acceptable chemical blend based on the raw material HCFC-123. It was originally introduced in 1992 to replace severe ozone depleting halon 1211, or bromochlorodifluoromethane (BCF).

Halotron I is discharged as a rapidly evaporating liquid, with a throw length of 6 to 45 feet (1.8 to 13.7 meters). Its relatively high boiling point of 80.6°F (27°C) gives it an advantage over other clean extinguishing agents, which tend to have lower boiling points and therefore evaporate sooner, limiting their throw length and overall effectiveness to the non-expert firefighter.

Also, unlike traditional dry chemical agents such as monoammonium phosphate (ABC Dry Chemical) or potassium bicarbonate (Purple K), which can be corrosive, Halotron I is a clean agent that leaves no residue after application, and consequently inflicts little to no collateral damage on equipment in the vicinity of the fire.

Halotron I is approved as environmentally acceptable under the U.S. EPA's SNAP program and has undergone the most extensive testing of any halogenated clean agent for portable fire extinguishers since 1992. There are more than 30 separate UL listings for Halotron I portable extinguishers, which is more than twice the number available with any other halocarbon-based clean agent.

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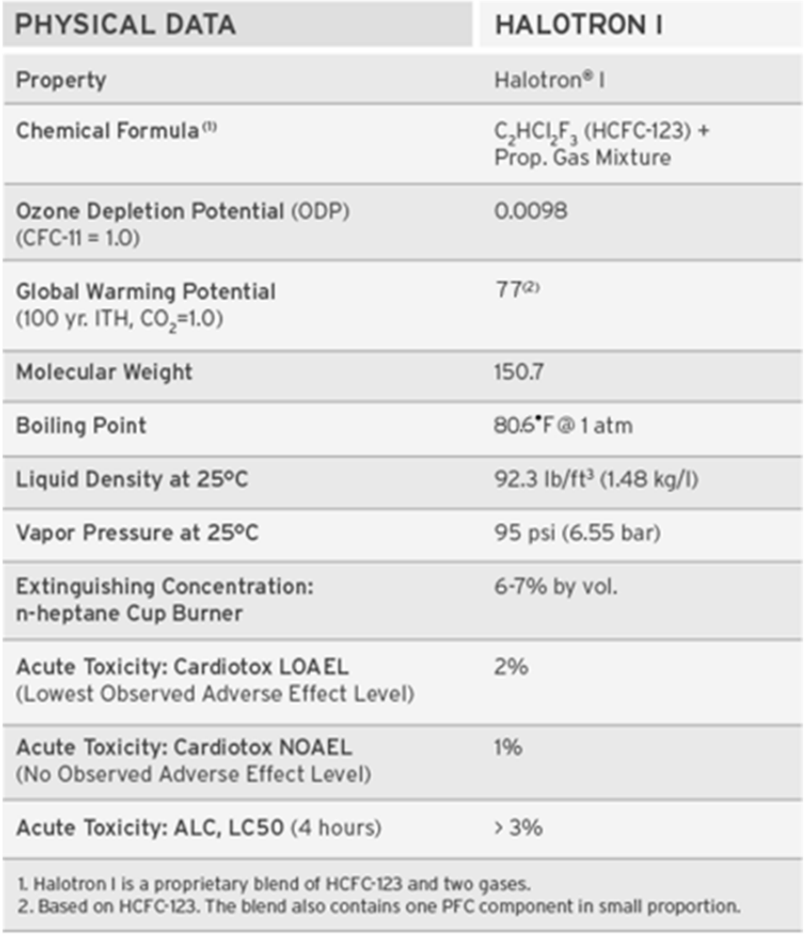
Low ODP and Low GWP

Halotron® I has very low ozone depletion potential (ODP) of 0.0098, as well as a low global warming potential (GWP) of 77 (based on HCFC-123). It has a relatively high boiling point of 80.6°F (27°C).

Overall, when combined with its efficiency, Halotron I has the most well balanced environmental profile of any clean fire extinguishing agent.



PHYSICAL DATA	HALOTRON I
Property	Halotron® I
Chemical Formula ⁽¹⁾	$C_2HCl_2F_3$ (HCFC-123) + Prop. Gas Mixture
Ozone Depletion Potential (ODP) (CFC-11 = 1.0)	0.0098
Global Warming Potential (100 yr. ITH, CO_2=1.0)	77⁽²⁾
Molecular Weight	150.7
Boiling Point	80.6°F @ 1 atm
Liquid Density at 25°C	92.3 lb/ft³ (1.48 kg/l)
Vapor Pressure at 25°C	95 psi (6.55 bar)
Extinguishing Concentration: n-heptane Cup Burner	6-7% by vol.
Acute Toxicity: Cardiotox LOAEL (Lowest Observed Adverse Effect Level)	2%
Acute Toxicity: Cardiotox NOAEL (No Observed Adverse Effect Level)	1%
Acute Toxicity: ALC, LC50 (4 hours)	> 3%

1. Halotron I is a proprietary blend of HCFC-123 and two gases.
2. Based on HCFC-123. The blend also contains one PFC component in small proportion.

◄01 | 02

Additional Technical Information

There are also numerous additional technical documents about Halotron I available upon request:

Halotron I Health and Toxicity Bulletin
Halotron I Material Compatibility Charts
Halotron I Filling Procedure Manual for 300-500 lb (136-227 kg) Type Fire-extinguishing Systems
Halotron I Total Flooding Quantity Chart (English & SI Units)
Halotron I Portable Extinguisher Filling/Agent Recovery Manual
Halotron I Product Specification
Product Video (May 2003)
Wheeled Unit Test Video (October 2003)
Product Brochures
Publication Reprints
U.S. FAA CertAlert 95-03
ISO 9001 Certificate (issued by TUV Rhineland of North America)

To obtain these documents,
or if you have any questions:

PLEASE CONTACT HALOTRON ➔

American Pacific Corporation
HALOTRON DIVISION
3883 Howard Hughes Parkway #700
Las Vegas, Nevada USA 89169

Tel +1 702 735 2200
Fax +1 702 735 4876
Email halotron@apfc.com

HCFC Phase-Out Issue

Halotron I is based on HCFC-123, which has a low ozone depletion potential of 0.0098 (CFC-11 = 1.0). It is currently regulated as a Class II substance in the U.S. under the Montreal Protocol and the Clean Air Act Amendments (CAA) of 1990. It is therefore subject to certain consumption limits that regulate the use of the primary raw material for Halotron I, HCFC-123, in the period beyond 2015. Total "consumption" of Class II substances is capped with reductions that began in 2004. Although HCFC-123 is a Class II substance, it has an extraordinarily low ODP, much lower than other Class II substances, such as HCFC-22. Recycled HCFC-123 material is expected to be available to service existing and produce new fire extinguishers beyond 2015.

For more information, please contact us for the "Just the Facts" bulletin.

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MATERIAL SAFETY DATA SHEET

Section 1. Chemical product and company identification

Product Name:	ABC Dry Chemical Fire Extinguishant
Synonym:	Multi-purpose Dry Chemical (CH550, F15, F18)
Manufacturer:	AMEREX CORPORATION
Internet Address:	www.amerex-fire.com
Address:	7595 Gadsden Highway P.O. Box 81 Trussville, AL 35173-0081
Telephone:	(205) 655-3271
Emergency Contacts:	Chemtrec 1(800) 424-9300 or (703) 527–3887
Revised:	February, 2012

Section 2. Hazard identification and emergency overview

Emergency overview: Light yellow, fine solid powder, odorless.

Adverse health effects and symptoms: Irritating to the respiratory system, eyes and skin. Symptoms may include coughing, shortness of breath, and irritation of the lungs, eyes, and skin. Ingestion, although unlikely, may cause cramps, nausea and diarrhea.

Exposure guidelines:

Ingredients	OSHA PEL****	ACGIH TLV	DFG MAK *
Mono-ammonium phosphate	PNOC** Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3
Ammonium sulphate	PNOC Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3
Mica	6 mg/m^3	3 mg/m3	NR
Fullers Earth	PNOC Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	PNOC Total dust, 4 mg/m^3 Respirable fraction, 1.5 mg/m^3

Silicone oil	NR***	NR	NR
Calcium carbonate	PNOC Total dust, 15 mg/m^3 Respirable fraction, 5 mg/m^3	PNOC Total dust, 10 mg/m^3 Respirable fraction, 3 mg/m^3	-------
Amorphous silica	143 mg/m^3 or $\frac{80 \text{ mg/m}^3}{\% \text{ SiO}_2}$	10 mg/m^3	4 mg/m^3
Yellow 14 pigment	NR	NR	NR

*German regulatory limits **PNOC = Particulates not otherwise classified (ACGIH) also known as Particulates not otherwise regulated (OSHA) *** NR = Not Regulated. All values are 8 hour time weighted average concentrations.
**** Total dust PEL for Washington state= 10mg/ m^3 for PNOC

Hazard symbols: WHMIS (Canadian workplace hazardous materials identification system

D2B Product may irritate eyes, skin, or mucous membranes

Section 3. Composition/information on ingredients

Name/Compound	Weight %	CAS #
Mono-ammonium phosphate and Ammonium sulphate	>94	7722-76-1 7783-20-2
Fullers Earth magnesium aluminum silicate-	<3	8031-18-3
Mica potassium aluminum silicate	1-2	12001-26-2
Silicone oil methyl hydrogen polysiloxane	<1	63148-57-2
Calcium carbonate	<1	1317-65-3
Amorphous silica precipitated synthetic zeolite	<1	112926-00-8
Yellow 14 pigment – di-azo dye	<1	5468-75-7

Section 4. First Aid Measures

Eye Exposure: Irrigate eyes with water and repeat until pain free. Seek medical attention if irritation develops or if vision changes occur.

Skin Exposure: In case of contact, wash with plenty of soap and water. Seek medical attention if irritation develops.

Inhalation: If respiratory irritation or distress occurs remove victim to fresh air. Seek medical attention if irritation persists.

Ingestion: If victim is conscious and alert, give 2-3 glasses of water to drink and do not induce vomiting. Seek immediate medical attention. Do not leave victim unattended. To prevent aspiration of swallowed product, lay victim on side with head lower than waist. If vomiting occurs and the victim is conscious, give water to further dilute the chemical.

Medical conditions possibly aggravated by exposure: Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema, or bronchitis. Skin contact may aggravate existing skin disease. Chronic overexposure may cause pneumoconiosis (“dusty lung” disease).

Section 5. Fire fighting measures

Extinguishing media: non combustible and non flammable – product is an extinguishing agent.

Unusual fire/explosion hazards: in a fire this material may decompose, releasing oxides of sulfur and carbon (see Section 10).

Insensitive to mechanical impact or static discharge.

HMIS Hazard Ranking:
health = 1, flammability = 0, reactivity = 0, personal protective equipment: ½ mask APR w/HEPA cartridges (see Section 8).

Section 6. Accidental release measures

Clean up released material using vacuum or wet sweep and shovel to minimize generation of dust. Wear appropriate respiratory protection. Bag and drum for disposal. If product is used and/or contaminated, use PPE and containment appropriate to the nature of the mixture. Prevent material from entering waterways.

Section 7. Handling and storage

Avoid skin, eye, or respiratory exposure. Use appropriate PPE when handling or maintaining equipment, and wash thoroughly after handling (see Section 8). Keep product in original container or extinguisher. Contents may be under pressure – inspect for extinguisher rust periodically to insure container integrity. Do not mix with other extinguishing agents.

Section 8. Exposure controls/ personal protection

During the application of this product against fires, exhaust gases and the products of incomplete combustion (PICs) are the principal respiratory hazards. In the manufacture of extinguishers, automated systems and point source ventilation controls sufficiently minimize respiratory exposure. Employers and employees must use their collective judgment in determining occupational settings where the use of a dust mask or air purifying respirator is prudent. The need for respiratory protection is not likely for short-term use in well ventilated areas.

Respiratory protection: use N95 dust mask or air-purifying respirator (APR) with high efficiency particulate air (HEPA) filters.

Eye protection: wear chemical goggles.

Skin protection: use nitrile, latex, or similar gloves and coveralls. Good personal hygiene practices essential, such as avoiding food, tobacco products, or other hand-to-mouth contact when handling. Wash thoroughly after handling.

Section 9. Physical and chemical properties

Appearance: yellow powder, finely divided odorless solid.
Specific gravity: ~ .88 in aerated condition
Solubility: product is coated-not immediately soluble in water
Non –flammable
Flash point: none
Vapor pressure: < 1 mm Hg
pH: approximately 4-5
Boiling point: not applicable
No explosive or oxidizing properties

Section 10. Stability and reactivity

Stability: stable

Incompatibles: strong alkalis (bases), magnesium, strong oxidizers such as calcium hypochlorite (pool chlorine) and isocyanuric acids.

Decomposition products: heat of fire may release carbon monoxide, carbon dioxide, and sulfur dioxide. Oxides of phosphorous and ammonia reported.

Possibility of hazardous reactions: Slight. See incompatibilities above.

Section 11. Toxicological information

Acute toxicity:	Mono ammonium phosphate LD_{50} (rat): > 1000mg/kg body weight Ammonium sulfate LD_{50} (rat): 2840 mg/kg body weight Target organs in man: respiratory system, eyes, skin. This product is an irritant to epithelial tissue, and may aggravate dermatitis. No information was found indicating the product causes sensitization.
Chronic toxicity:	Pneumoconiosis, or “dusty lung” disease, may result from chronic exposure to any dust.
Reproductive toxicity:	This product’s ingredients are not known to have reproductive or teratogenic effects.

Section 12. Ecological information

Ecotoxicity:	negative effects unknown. Provides nutrient nitrogen and phosphorus to plant life.
Persistence/ Degradability:	degrades rapidly in humid/wet environment.

Bioaccummulation: extent unknown.

Mobility in soil: slow evaporation rate; water soluble, may leach to groundwater.

Section 13. Disposal considerations

This product is not a RCRA characteristically hazardous or listed hazardous waste. Dispose of according to state or local laws, which may be more restrictive than federal laws or regulations. Used product may be altered or contaminated, creating different disposal considerations.

Section 14. Transportation information

This product is not a hazardous material under U.S. Department of Transportation (DOT) 49 CFR 172, and is not regulated by the DOT or Transport Canada "Transportation of Dangerous Goods" regulations.

When shipped in a stored pressure type fire extinguisher, and pressurized with a non-flammable, non-toxic inert expellant gas, the fire extinguisher is considered a hazardous material by the US Department of Transportation and Transport Canada. The proper shipping name shall be FIRE EXTINGUISHER and the UN designation is UN 1044. The DOT hazard class/ division is 2.2. Non-Flammable Gas. Packing Group –N/A.

Section 15. Regulatory information

International Inventory Status:

All ingredients are on the following inventories

Country(ies)	Agency	Status
United States of America	TSCA	Yes
Canada	DSL	Yes
Europe	EINECS/ELINCS	Yes
Australia	AICS	Yes
Japan	MITI	Yes
South Korea	KECL	Yes

European Risk and Safety phrases:

EU Classification:	Harmful.	
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Components:

Mono ammonium phosphate:

EU Classification:	Harmful.	
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Ammonium sulfate:

EU Classification:	Irritant	
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

U.S. federal regulatory information:

None of the chemicals in this product are under SARA reporting requirements or have SARA threshold planning quantities (TPQs) or CERCLA reportable quantities (RQs), or are regulated under TSCA 8(d).

State regulatory information:

Chemicals in this product are covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: None
California – Permissible Exposure Limits for Chemical Contaminants: None
Florida – Substance List: Mica Dust, Ammonium Sulfate
Illinois – Toxic Substance List: None
Kansas – Section 302/303 List: None

Massachusetts – Substance List: Mica Dust, Ammonium Sulfate
Minnesota – List of Hazardous Substances: None
Missouri – Employer Information/Toxic Substance List: None
New Jersey – Right to Know Hazardous Substance List: None
North Dakota – List of Hazardous Chemicals, Reportable Quantities: None
Pennsylvania – Hazardous Substance List: None
Rhode Island – Hazardous Substance List: Mica Dust, Ammonium Sulfate
Texas – Hazardous Substance List: No
West Virginia – Hazardous Substance List: None
Wisconsin – Toxic and Hazardous Substances: None

California Proposition 65: No component is listed on the California Proposition 65 list.

Section 16

When shipped in a stored pressure type fire extinguisher, and pressurized with a non-flammable, non-toxic inert expellant gas, the fire extinguisher is considered a hazardous material by the US Department of Transportation and Transport Canada. The proper shipping name shall be FIRE EXTINGUISHER and the UN designation is UN 1044. The DOT hazard class/ division is 2.2 Non-Flammable Gas. Packing Group—N/A

Section 17. Other information

This MSDS conforms to requirements under U.S., U.K., Canadian, Australian, and EU regulations or standards, and conforms to the proposed 2003 ANSI Z400.1 format.

The information herein is given in good faith but no warranty, expressed or implied, is made. Updated by Lindsay R. Hill, CIH.

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: HALOTRON® I

OTHER/GENERIC NAMES: HCFC Blend B, Halotron® I Pre-Sat Base

PRODUCT USE: Halotron® I is a clean fire-extinguishing agent for streaming and local applications. NFPA 2001, *"Standard on Clean Agent Fire Extinguishing Systems"* defines a "Clean Agent" to be "electrically non-conducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation." Halotron® I is a safe, effective, environmentally acceptable clean agent. It is discharged as a liquid, which rapidly evaporates (i.e. it is volatile). It is a proprietary three component chemical blend based on HCFC-123 that is approved by the U.S. EPA under its Significant New Alternatives Policy (SNAP) program (referred to as "HCFC Blend B") for commercial/industrial, military, and maritime use in streaming applications as a substitute for halon 1211 (bromochlorodifluoromethane or "BCF").

MANUFACTURER: American Pacific Corporation, Halotron Division. 10622 West 6400 North, Cedar City, UT 84721

FOR MORE INFORMATION CALL: (435) 865-5000

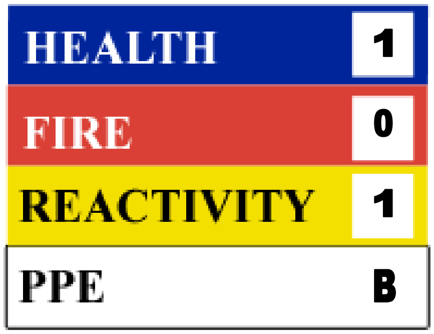
IN CASE OF EMERGENCY CALL: (435) 865-5044

2. COMPOSITION/INFORMATION ON INGREDIENTS

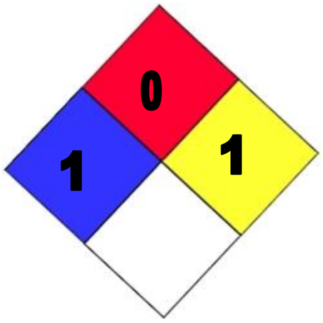
INGREDIENT NAME	CAS NUMBER	WEIGHT %
2,2-dichloro-1,1,1-trifluoroethane (HCFC-123)	306-83-2 (EC Number 206-190-3)	Greater than 93%
Proprietary Gas Mixture	Multiple, proprietary	Less than 7%

OSHA Hazard Communication Standard: This product is considered hazardous under the OSHA Hazard Communication Standard.

3. HAZARDS IDENTIFICATION



HMIS



NFPA

HMIS PERSONAL PROTECTIVE EQUIPMENT (PPE) DESIGNATIONS:

A:	SAFETY GLASSES
B:	SAFETY GLASSES, GLOVES
C:	SAFETY GLASSES, GLOVES, SYNTHETIC APRON
D:	FACE SHIELD, GLOVES, SYNTHETIC APRON
E:	SAFETY GLASSES, GLOVES, DUST RESPIRATOR
F:	SAFETY GLASSES, GLOVES, SYNTHETIC APRON, DUST RESPIRATOR
G:	SAFETY GLASSES, GLOVES, VAPOR RESPIRATOR
H:	SPLASH GOGGLES, GLOVES, SYNTHETIC APRON, VAPOR RESPIRATOR
I:	SAFETY GLASSES, GLOVES, COMBINATION DUST AND VAPOR RESPIRATOR
J:	SPLASH GOGGLES, GLOVES, SYNTHETIC APRON COMBINATION, DUST AND VAPOR RESPIRATOR
K:	AIRLINE HOOD OR MASK, GLOVES, FULL PROTECTIVE SUIT, BOOTS
X:	SITUATIONS REQUIRING SPECIALIZED HANDLING

EMERGENCY OVERVIEW:

Halotron I is a colorless volatile, pressurized liquid with a slight ether-like odor. As with any chemical, dose and exposure are critically important variables to understand any potential treatment. Short-term exposure to high concentrations may result in central nervous system and cardiac effects. Long-term exposure to concentrations above those time weighted averages recommended herein may result in liver effects.

HEALTH HAZARDS:

Inhalation: Inhalation of high concentrations of vapor may cause central nervous system effects such as dizziness, drowsiness, anesthesia, or unconsciousness. Anesthetic effects may occur at concentrations of 5000 ppm v/v or above. At concentrations of 20,000 ppm or higher, HCFC-123 may causes increased sensitivity of the heart to adrenaline which might cause irregular heart beats and possible ventricular fibrillation or death. Long-term exposure to concentrations above those time weighted averages recommended may cause liver damage with altered enzyme levels and central nervous system depression. When used on a fire, hazardous decomposition products are formed, but typically are within safe emergency exposure limits.

Eye contact: May cause irritation, tearing, or blurring of vision, which result in part due to the cooling effect of HCFC-123 evaporation.

Skin contact: Evaporative cooling can result in chilling sensations or frostbite effects. Repeated exposure to the skin can result in dermatitis. Prolonged skin contact should be avoided, but short-term contact is not considered hazardous.

Ingestion: Not likely to occur in industrial use. HCFC-123 is a highly volatile liquid.

This material is NOT LISTED by OSHA, NTP, or IARC as a CARCINOGEN.

Additional region specific information

European Union:

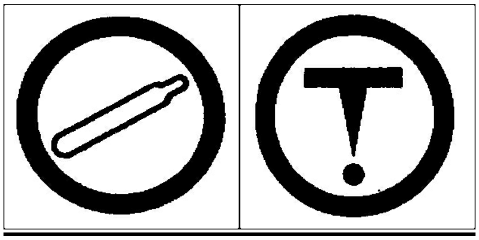
This chemical substance is not classified in the Annex I of Directive 67/548/EEC.

It is listed as a LPV

Canada:

Components are listed on the DSL

WHMIS Hazard Symbols



Halotron® I Fire Extinguishing Agent:

Caution: Contains a compressed gas. High concentrations may cause cardiac arrhythmia and central nervous system depression, and possibly asphyxiation. May produce irritating vapors during use. Use of this material in confined spaces when personnel are present is acceptable only if the volume of the space is sufficiently large, as specified on UL listed fire extinguishers containing this product and guidance contained herein.

First Aid: See other section of this MSDS. Toxicity information is located in other sections of this MSDS.

4. FIRST AID MEASURES

Routes of exposure	**Signs and symptoms of exposure:**	**Emergency and first aid procedures:**
SKIN:	Evaporative cooling can result in chilling sensations or frostbite effects. Short exposures, such as when filling equipment or in other situations, should not have a lasting effect. Repeated exposure to the skin, however, can result in dermatitis.	If significant exposure occurs, wash exposed area immediately with large amounts of water. Remove contaminated clothing and footwear. Contact a physician if irritation occurs.
INHALATION:	Significant exposure may cause central nervous system effects such as dizziness, drowsiness, anesthesia, or unconsciousness. Anesthetic effects may occur at concentrations of 5000 ppm (v/v) or above. At concentrations of 20,000 ppm (v/v) or higher, HCFC-123 may cause increased sensitivity of the heart to adrenaline which might cause irregular heartbeats and possibly ventricular fibrillation or death.	If experiencing breathing difficulties, move to fresh air. Apply artificial respiration if necessary. Never give anything by mouth to an unconscious person. Contact a physician if breathing difficulties occur. Note to physician: This material may make the heart more susceptible to arrhythmias. Catecholamines such as adrenaline, and other compounds having similar effects, should be reserved for emergencies and then used only with special caution.
INGESTION:	Not likely to occur in industrial use. Highly volatile liquid.	Do not induce vomiting; Give two glasses of water if ingestion occurs. Contact a physician
EYES:	Irritation and tearing may result from the cooling effect of HCFC-123 evaporation. Mild to moderate reversible eye damage, including irritation and corneal opacity has been seen in testing of undiluted HCFC-123.	Flush eyes with fresh water and move exposed person to a non-contaminated area. Contact a physician for cases where irritation or effects occur

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: None.
FLASH POINT METHOD: Not applicable.
AUTOIGNITION TEMPERATURE: Not determined.

UPPER FLAMMABILITY LIMIT (volume % in air): Not applicable.
LOWER FLAMMABILITY LIMIT (volume % in air): Not applicable.

EXTINGUISHING MEDIA: The properties of this chemical make it an ideal extinguishing media its self.

SPECIAL FIRE FIGHTING PROCEDURES: Ensure that the area where the fire occurred is well ventilated before re-entering. Wear protective clothing. Use water spray or fog to cool storage containers to help prevent an uncontrolled pressure release.

UNUSUAL FIRE AND EXPLOSION HAZARDS: The concentrated agent when applied to fire can produce toxic by-products specifically hydrogen halides, which can cause damage. Avoid inhalation of these materials by evacuating and ventilating the area.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE:

- **In the event of a large spill, allow for adequate ventilation, and do not re-enter an area without an SCBA until adequate ventilation is accomplished.**
- **For spills that might result in overexposure, evacuate the area and use protective gear and SCBA's.**
- **Avoid leakage into waterways because HCFC-123 is damaging to vegetation.**
- **Do not expose storage containers to fire, as uncontrolled pressure releases may result.**
- **The HCFC-123 vapors are heavier than air; therefore use caution when large volume releases occur in low-lying areas where concentrated vapors may accumulate.**
- **Recommended 1 Hr. Emergency Exposure Limit: 1000 ppm (v/v) on the same basis as above.**
- **Recommended 1 Min. Emergency Exposure Limit: 2500 ppm (v/v) on the same basis as above.**
- **Any food items that were directly sprayed by the liquid should be thrown away, and all surfaces that are used for food service should be washed (as normal) before re-use.**
- **WASTE DISPOSAL: Observe all federal, state, and local regulations for products of this type when accomplishing disposal.**
- **SECTION 313 SUPPLIER NOTIFICATION: This product contains more than 93% by weight 2,2-dichloro-1,1,1-trifluoroethane (CAS #306-83-2) which is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40CFR372).**

7. HANDLING AND STORAGE

NORMAL HANDLING: (See section 8 for recommended personal protective equipment.) Avoid prolonged contact with the skin and eyes. Avoid inhaling material and ensure that good ventilation is present when handling. Wash after handling and follow good personal hygiene and good housekeeping practices. Keep containers closed and transfer material using closed systems. Handle in a manner to minimize spills.

Additional Note: Approved DOT shipping containers are a normal safe method of storage. Containers should be maintained in good condition. Do not allow material to remain in deteriorating containers. Because this product can volatilize, special care should be taken for over pressurization hazards if the containers are overheated or near a radiant heat source. Protective shoes, such as steel toed shoes, should be worn in addition to the other specified personal protective equipment (PPE) when handling bulk containers. Eye protection with splash protective side shields should be used when any possibility of splash or spray exists

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Ventilate as necessary to minimize exposure levels. Inspect and clean ventilation systems regularly. Prolonged use should occur only in areas with adequate ventilation. Keep storage containers tightly closed. Vapors are heavier than air posing a potential hazard if large volumes are trapped in enclosed or low places.

PERSONAL PROTECTIVE EQUIPMENT:

- Wear protective clothing when handling a leak in a storage container (does not apply to fire protection equipment servicing, other than safety goggles and gloves if large volumes can be exposed to skin).
- Neoprene, PVC or PVA gloves should be worn when handling material for prolonged periods. Short exposures to skin are not likely to pose a hazard.•
  Respiratory protection is not normally needed, however, if handled in enclosed spaces where applicable exposure limits might be exceeded, a Self Contained Breathing Apparatus (SCBA) should be used.
- When performing filling or servicing operations, PERFORM THESE ACTIVITIES IN A WELL-VENTILATED AREA.
  If handling materials outside a closed, sealed system such that the possibility of splashing exists, wear safety glasses with side shields. This statement is not intended to apply to use of a fire extinguisher where the nozzle arrangement is intended to direct the discharge away from the user of the extinguisher.

TIME WEIGHTED EXPOSURE LIMITS: (For persons regularly exposed to material)

- Workplace Environmental Exposure Level, WEEL (AIHA) (8 hrs.): 50 ppm (v/v), based on the primary component (HCFC-123). See section 11 for more information.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless	**PHYSICAL STATE:** Pressurized liquid	**VAPOR PRESSURE OF LIQUID ALONE:** (68°F, 20°C): approx. 11.2 psig (77 kPa)	**RELATIVE DENSITY (AIR=1):** 5.14	**ODOR:** Slight ether-like odor
OCTANOL/WATER PARTITION COEFFICIENT (Log P_{ow}): 2.0-2.8	**MOLECULAR WEIGHT:** Approx. 150.7	**PRESSURE OF MIXTURE IN CONTAINER:** **(**70°F, 20°C): 95 psig (655 kPa)	**BOILING POINT AT 1 ATM.:** 27^{o}C (80.6^{o}F)	**GAS DENSITY:** Approx. 6.17 kg/m^3 (0.385 lb./ft^3) **LIQUID DENSITY:** (77°F, 25°C): 92.3 lb./ft^3 (1.48 kg/l)
EVAPORATION RATE: Faster than water, slower than ether		**FLASH POINT:** Not flammable		

10. STABILITY AND REACTIVITY

STABILITY: Normally stable (will decompose if exposed to a high radiant heat source, such as fire). The material is intended for use as a fire extinguishant.

INCOMPATIBILITIES: Incompatible with alkali or alkaline earth metals, and powdered metals Al, Zn, Be, etc.

HAZARDOUS DECOMPOSITION PRODUCTS: Decomposition products are hazardous. This material can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids, and possibly carbonyl halide.
.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

TOXIC PROPERTIES OF COMPONENTS: Acute toxicity is low.

- **For 2,2-dichloro-1,1,1-trifluoroethane (CAS # 306-83-2):**
  LC50 (4 hr.): 3.2% (32,000 ppm), (Inhalation)
  Oral Approximate Lethal Dose (ALD): 9 g/kg (body weight)
  Cardiotoxic LOAEL (Lowest Observed Adverse Effect Level): 2%vol.
  Cardiotoxic NOAEL (No Observed Adverse Effect Level): 1%vol.
  Toxicological testing was performed on HCFC-123 by the Program for Alternative Fluorocarbon Testing (PAFT). Data from acute toxicity studies in this program demonstrated that HCFC-123 has very low toxicity by skin application or inhalation.

- **For the proprietary gas mixture:**
  The toxic effects of the proprietary gas mixture in the absence of extreme temperature are primarily its ability to function as a simple asphyxiant (i.e. displace oxygen).

OTHER TOXICITY INFORMATION:

- **Animal Studies: For 2,2-dichloro-1,1,1-trifluoroethane (CAS #306-83-2):**
  Long-term exposure in a two year study (6 hours/day, 5 days/week) at concentrations of 300, 1000 and 5000 ppm decreased body weight, serum cholesterol, triglycerides and glucose, and increased urinary fluoride concentrations in rats. However, survival was significantly improved in all exposed groups compared to control animals. Inhalation of 300, 1000 and 5000 ppm caused an increase in benign tumors of the liver, pancreas, and testis. Tumors occurred late in life and none were assessed to be life threatening. Tumor formation is thought to occur through non-genotoxic mechanisms associated with a peroxisome proliferating potential or with hormonal disturbances in older rats.

  Exposure to dogs, guinea pigs or monkeys at 1000 ppm or greater for 6 hrs. /day, 7 days per week, for a total of 3 weeks, induced slight or mild liver damage with altered enzyme levels.

  Rodent studies indicate HCFC-123 is easily absorbed via inhalation. It distributes in all organs, more so in the liver. About 90% of inhaled HCFC-123 is eliminated via the lungs unchanged. The remaining amount is metabolized to trifluoroacetic acid and excreted in the urine. Small amounts of trifluoroacetylated proteins were detected in rats in laboratory studies.

  HCFC-123 did not affect reproductive performance in rats or harm the unborn animals in rats or rabbits at 5000 and 10,000 ppm.

  HCFC-123 was inactive in several test-tube genetic damage studies except the human lymphocyte chromosome aberration assay. HCFC-123 is also inactive in live animal genetic damage studies. Therefore, it is not considered genotoxic.

  Carcinogen: IARC: NO NTP: NO OSHA: NO

12. ECOLOGICAL INFORMATION

Aquatic toxicity:

Slightly toxic, 96 hour LC_{50} –Fathead minnow’s > 77mg/l

13. DISPOSAL CONSIDERATIONS

Observe all federal, state, and local regulations for products of this type when accomplishing disposal.

The manufacturer assumes no liability for the use of this product in a manner that causes environmental or other harm.

14. TRANSPORT INFORMATION

DOT SHIPPING NAME: UN1956, Compressed Gases, N.O.S., 2.2 (contains tetrafluoromethane, Argon),

DOT SHIPPING LABEL: Nonflammable Gas
IMCO CLASS: 2.2

It is recommended that DOT approved transport containers and carriers be used for shipment of this product.

NOTE: The transportation information above covers the Halotron I fire extinguishing agent as shipped in bulk containers, and not when contained in fire extinguishers or fire extinguishing systems. When shipped in a stored-pressure type fire extinguisher, and pressurized with argon gas, the fire extinguisher is considered a hazardous material by the US Department of Transportation and Transport Canada. The proper shipping name shall be FIRE EXTINGUISHER and the UN designation is UN 1044. The DOT hazard class/division is 2.2 Non-Flammable Gas. Packing Group – N/A.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)
TSCA INVENTORY STATUS: All components Listed on the TSCA Inventory.
OTHER TSCA ISSUES: None

SARA TITLE III/CERCLA "Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients. Listed only for Section 313 notification		
INGREDIENT NAME	SARA/CERCLA RQ (lb)	SARA EHS TPQ (lb)
SECTION 313 SUPPLIER NOTIFICATION: This product contains more than 93% by weight 2,2-dichloro-1,1,1-trifluoroethane (CAS #306-83-2) which is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40CFR372).		
Spills or releases resulting in the loss of any ingredient at or above its RQ (For those compounds where an RQ exists) require immediate notification to the National Response Center [(800) 424-8802], to the state where you are located, and to your Local Emergency Planning Committee or Fire Department.		
SARA 313 TOXIC CHEMICALS: The following ingredients are SARA 313 "Toxic Chemicals" and may be subject to annual reporting requirements. CAS numbers and weight percents are found in Section 2		
INGREDIENT NAME 2,2-dichloro-1,1,1-trifluoroethane (HCFC-123)	SARA/CERCLA RQ (lb) Not listed, Section 313 only	SARA EHS TPQ (lb) Section 313
No ingredients listed in this section.		
STATE RIGHT-TO-KNOW In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes. None of the components are listed under California Proposition 65. Tetrafluoromethane is listed under some US state's right to know act or lists		
INGREDIENT NAME Halotron I Pre-Sat Base	SARA/CERCLA RQ (lb) Examine local regulations to determine	SARA EHS TPQ (lb)Examine local regulations to determine

ADDITIONAL REGULATORY INFORMATION:

Regulations

Listed in the Toxic Substances Control Act (TSCA) Inventory.: Yes , all components are on the TSCA Inventory
Listed on EPA SARA (313) Hazard Class, **Subject to reporting requirements of EPCRA Section 313**
All components listed in Canadian DSL.
HCFC 123 is listed under EINECS EC Number 206-190-3 as a low production volume chemical. All components of the proprietary gas mixture are listed in Einecs based on ESIS lookup.

Information about limitation of use: This blend is intended solely for use as a fire extinguishing agent and should not be used for other purposes without contact and technical discussion with the manufacturer.

16. OTHER INFORMATION

CURRENT ISSUE DATE: 02 January 2013

PREVIOUS ISSUE DATE: 23 April 2010

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING: In section 14 Changed sequence order (UN Number First)
Change H1 MSDS From: Compressed Gases, N.O.S., 2.2, UN1956 (contains Tetrafluoromethane, Argon)
Change H1 MSDS to read: UN1956, Compressed Gas, N.O.S., 2.2 (contains Tetrafluoromethane, Argon)

OTHER INFORMATION: The user is responsible to evaluate the safety and environmental consequences of any intended uses. The manufacturer assumes no liability for any usages that result in adverse consequences.

IMPORTANT: The information presented herein, while not guaranteed, was prepared by competent technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling and storage. Other factors may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as a recommendation to infringe any existing patents or violate any Federal, Other National Governmental Entity, State, Provincial, or local laws.