



Fire Protection Training

Procedures Handbook 4300

FIRE PHYSICS & CHEMISTRY

TOPIC: BLEVE

TIME FRAME: 1 Hour

LEVEL OF INSTRUCTION:

BEHAVIORAL OBJECTIVE:

Condition: A written quiz

Behavior: The student will be able to describe what a BLEVE is, how it occurs and what control actions may be necessary

Standard: With a minimum of 70% accuracy

MATERIALS NEEDED:

- Flip charts
- Chalkboard
- Chalk
- Pens
- Appropriate visual aids
- Audio visual equipment

REFERENCES:

- BLEVE, John E. Bowen "American Fire Journal" 1980
- IFSTA, Hazardous Materials For First Responders, Chapter 1 and 5

PREPARATION:

The term BLEVE has become a standard part of firefighter jargon over the past twenty years. It is commonly thought to involve an explosion accompanied by a fireball. This mental image is a misconception. A BLEVE need not be accompanied by fire at all and in fact every time a kernel of popcorn pops in the microwave a small BLEVE has occurred.



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BLEVE

PRESENTATION

APPLICATION

I. BLEVE

A. An Acronym For:

B boiling

L liquid

E expanding

V vapor

E explosion

B. BLEVE Defined: A Major Container Failure in Two or More Pieces, At a Moment in Time When the Containers Liquid Is At a Temperature Well Above Its Boiling Point at Normal Atmospheric Pressure.

C. Conditions Required for a BLEVE

1. A liquid must be present

a. Vapors or gas alone can not BLEVE

b. Liquid need not be flammable

(1) Water can BLEVE but there will be no fire

2. The liquid must be in a tightly closed container

a. Any size from aerosol can to water heater to railroad car

What does BLEVE stand for?

What conditions must be fulfilled for a BLEVE potential to exist?



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PRESENTATION	APPLICATION
<ul style="list-style-type: none">b. Vented container can be subject to BLEVE if vent damaged or inadequate for pressure within container <p>3. The temperature of the confined liquid must be above its boiling point at atmospheric pressure</p> <ul style="list-style-type: none">a. The higher the pressure at the surface of the liquid, the higher the temperature required to produce boiling.b. When a container of liquid is tightly closed and then heated, the vapor pressure increases. The increased vapor pressure is accompanied by an elevated boiling point.c. A fire is the most common occurrence that will bring the temperature above the normal boiling point.d. Heat is not always essential. Some liquids have extremely low boiling points at atmospheric pressure. These liquids are already considerably above their boiling point, even at normal atmospheric pressure. <p>4. There must be structural failure of the container. Failure may be due to:</p> <ul style="list-style-type: none">a. Direct flame impingement<ul style="list-style-type: none">(1) Most common cause of failure(2) Container failure almost always occurs in the metal around the vapor space. Metal in contact with the liquid is quite difficult to heat to the danger point because liquids are usually excellent conductors and	<p>Information sheet #1</p>



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<p style="text-align: center;">absorbers of heat whereas vapors are not.</p> <ul style="list-style-type: none">b. Metal fatiguec. Inadequate or damage relief valved. Mechanical damage<ul style="list-style-type: none">(1) Collision(2) Corrosion <p>D. BLEVE Warning Signs</p> <ul style="list-style-type: none">1. Pinging sound from metal shell2. Discoloration of container (normally cherry red)3. Flaking of small metal pieces4. Bubble or bulge on container5. Steam from tank surface6. Shrill sound from pressure relief valve<ul style="list-style-type: none">a. Especially if increasing with passage of time7. Tear in tank surface <p>A. CONTROLLING A BLEVE</p> <p>E. Guidelines</p> <ul style="list-style-type: none">1. Isolate and deny entry for at least 3000 feet2. If a flammable liquid is within the container there is no method of preventing a fire upon container failure3. If personnel or property are not threatened a "no attack" posture is warranted	



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<ul style="list-style-type: none">4. If property only is at stake a very cautious approach should be taken5. If fire has impinged on the vapor space of the container for more than ten minutes, a "no attack" posture is warranted6. In the event an attack is necessary<ul style="list-style-type: none">a. Use unstaffed master streams<ul style="list-style-type: none">(1) Water application at point of flame impingement first (weakest area of container)(2) Over entire vapor space second priorityb. Minimum of 500 GPM at each point of flame contact<ul style="list-style-type: none">(1) Sufficient water for several hoursc. Remove firefighters as soon as possible after setting up unstaffed monitors.	



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SUMMARY:

Boiling Liquid Expanding Vapor Explosions are unpredictable and can be particularly devastating. They may occur with or without an ensuing fire depending upon whether flammable liquids are involved. In order to have a BLEVE, the following conditions must exist.

1. A liquid must be present.
2. The liquid must be in a tightly closed container.
3. The temperature of the confined liquid must be above its boiling point at atmospheric pressure.
4. There must be structural failure of the container.

EVALUATION:

A written quiz.

ASSIGNMENT:

To be determined by instructor(s).