Fire Prevention

Objectives

Student will identify the benefits of home fire sprinklers.

Skills

- Student will demonstrate knowledge of how home fire sprinklers operate.
- Student will analyze cost benefits of home fire sprinklers.
- Student will examine and interpret the data on the performance of home fire sprinklers in reducing property loss and saving lives and advocate for their use.

Introduction

Eight of the ten leading causes of fires in the home can be traced directly to human actions—either error, carelessness or deliberate intent. To prevent unintentional fires, fire prevention experts suggest three approaches. Known as the "Three Es of Fire Prevention," they are 1) **E**ducation, 2) **E**ngineering and 3) code **E**nforcement.

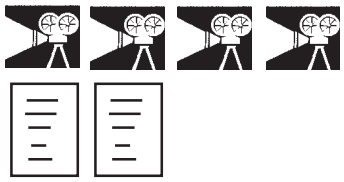
Smoke alarms are probably the first engineering solution one thinks of and children are taught to respond appropriately to a beeping smoke alarm from an early age. Fire sprinklers are the next level of fire protection available for the home. They have protected people and property in public buildings for over 100 years, but their value in a private home is less well known and myths about their function and reliability abound. The lessons in this unit dispel the myths about this technology.

Vocabulary

Abate - to put an end to, or to moderate
Codes - a system of principles or rules
Combustion - transformation of matter while releasing energy in the form of light and heat
Fire code - rules and standards that guide in the application of fire safety laws
Fire flow - water supply available to fight a fire
Fire sprinklers - fire suppression or control devices that operate automatically when activated by a fire, allowing water to spray over an area and making it more possible to escape from the building
Grade - the steepness of a hill
Myth - a popular belief unfounded in reality
Ordinance - a regulation adopted by a municipal government
Residence - a building used as a home
Sprinkler head - the portion of the home fire sprinkler that delivers water to extinguish a fire

A FIRE SPRINKLERS: MYTHS & REALITY

Materials provided:
- *Kindergarten Cop* video clip
- *Lethal Weapon 4* video clip
- *How Fire Sprinklers Work* video clip
- *Fire Sprinkler Demo* video clip
- *Home Fire Sprinklers Myths* fact sheet
- *Home Fire Sprinkler Realities* fact sheet



Teacher preparation:
- Review video clips prior to class
- Decide on debate guidelines
- Copy fact sheets sufficient for Affirmative and Opposition debate teams

Extended activities:
Other debates could argue these questions:

1) Should fire sprinklers be mandated in single family residences?

2) Should fire sprinklers be required by code or ordinance?

Top Ten Activity: Students in small groups create a "top ten" list of why they would choose to install sprinklers.

a class debate activity

Teacher-led discussion
- Show video clips from *Kindergarten Cop* and a *Lethal Weapon 4*.
- Follow with a class discussion on the performance of the sprinkler system in these video clips. Use discussion notes on pages 3 and 4.
- Show the short animation, *How Fire Sprinklers Work*, and the *Fire Sprinkler Demo* video clip.
- Discuss the vocabulary words.

Present these facts about home fires.
- Eight out of ten fire deaths in the US occur in the home.
- Every 74 seconds, a home burns.
- Sprinklers and smoke detectors together cut your risk of dying in a home fire by 82%.

Sprinkler myth debate
- The teams will debate the truth or fiction of common conceptions about home fire sprinkler systems.
- The affirmative position will build their debating points based on the *Home Fire Sprinkler Realities* fact sheet.
- The opponents will build their debate based on the *Home Fire Sprinkler Myths* fact sheet. (See *Teacher Notes* for a suggested debate process.)
- At the conclusion of the debate, the teacher should dispel any myths that remain about home fire sprinklers.

Video Title	Scene Description
Kindergarten Cop, 1991 (Rated PG-13) Starring Arnold Schwarzenegger, Penelope Ann Miller	A fire begins in an elementary school. The fire alarm goes off and smoke begins to fill the hallway on the first floor. Detective John Kimble (Schwarzenegger) who is posing as a kindergarten teacher leads his students toward the exit. The hallway continues to fill with smoke; the sprinklers go off. Fire trucks arrive within 2 minutes. Det. Kimble goes up to the 2nd floor in search of someone. There is no smoke, fire damage or sprinkler evidence on the 2nd floor. Viewing this film for its overall fire awareness and safety should be considered, although there is violence at the end of the film that should be reviewed prior to classroom screening. *Discussion Notes:* • Is the performance of the sprinkler system realistic? Consider whether there are flames visible when the sprinklers initially go off throughout the 1st floor. • Why might the sprinklers on the 2nd floor not have gone off? • Is the response time of the fire department realistic? • Is this a fire drill as stated by the teacher? • Who gets wet when the sprinklers go off?

(go to page 4)

Video Title	Scene Description
Lethal Weapon 4, 1998 (Rated R) Starring Mel Gibson, Danny Glover Scene contains no gratuitous violence or inappropriate language.	Detectives Riggs (Mel Gibson) and Murtaugh (Danny Glover) go to a Chinese restaurant in search of information on a Chinese crime syndicate. To get attention, Riggs pulls the red fire alarm lever which sets off the sprinkler system. Riggs and Murtaugh joke around as if this is something they have done before. Sprinklers throughout the restaurant go off. *Discussion Notes:* • Do sprinklers go off when you pull a fire alarm lever? *(No)* • What makes a sprinkler head go off? When one sprinkler in a room goes off, do all in the room also go off? *(Sprinkler systems detect heat and will go off when the temperature in the room reaches a certain temperature.)* • Are there any consequences to pulling a fire alarm when there is no fire? *(Yes, pulling a false alarm has many consequences. First, it is illegal and punishable by law. Second, it is expensive to disrupt normal business and to activate fire professionals to respond to the alarm. And finally, it also puts others at risk because when the fire department is responding to the false alarm they are not available for other emergencies*

B ENGINEERING

Materials provided (Option 1):

- *Water Usage* video clip
- *Fire Sprinkler Timeline* video clip
- *Home Fire Sprinkler Work Sheet*

Teacher preparation:

- Review video clips prior to class
- Determine the number of home fires for the preceding year in your community. The fire department should have this information.
- Find out the per-gallon cost of water for your community.
- Prepare copies of the *Home Fire Sprinkler* Work Sheet.

a research and math activity (Option 1)

Review fire sprinkler information from Activity A.

Teacher-led discussion

- Present fire sprinkler facts (see *Teacher Notes*.)
- Brainstorm the potential advantages to home fire sprinklers and dispel any myths.
- View *Water Usage video clip and Sprinkler Timeline* video clip.

Calculate Water Use activity

- Have students complete the *Home Fire Sprinkler Work Sheet* and calculate water use in the event of a fire. They will compare water use and cost if the fire is extinguished by residential fire sprinklers versus fire suppression by the fire department.

Note: In the event that there were no house fires in your community in the prior year, use statistics from the fictitious town of Westhome, Oregon: 58 fires and $0.00221 per gallon cost for water.

- Follow the work sheet with a discussion of the students' conclusions about the comparative costs of residential fire sprinklers versus a fire department response to a residential fire.
- Brainstorm other savings that result from having home fire sprinklers installed.
- In some areas of the state, the availability of water is an issue.
- When planning a new home, would installing home fire sprinklers be a responsible choice?
- Would a city ordinance mandating home fire sprinklers be a good idea? Why or why not?

(go to page 6)

Materials provided (Option 2):

- *A (Prospective) Homeowner's Dilemma*
- *Grade: How Steep it Is!*

an analyis and discussion activity (Option 2)

Problem to be analyzed and discussed—short summary below. See the *Teacher Notes* for a complete description of this problem; an explanation of the meaning of "grade" is included.

A home owner wants to build a 3,800 square foot home at the top of a hill without a water supply adequate to fight a house fire. A further consideration is that the driveway exceeds the 10% grade maximum that is the upper limit for the local fire department trucks to access the house.

Give students all the necessary figures for the four possible options available to the home owner and ask them to decide which option they would choose and why.

CODE ENFORCEMENT AND ADVOCACY

Materials provided:
- *Scottsdale, AZ, Report*
- *Fire Sprinkler Timeline* video clip
- *Advocacy Interview* video clip

Teacher preparation:
- Review video clips prior to class
- Review *Teacher Notes.*
- Make copies of the Scottsdale, AZ, report sufficient for the class.

About advocacy:
Students should be encouraged as they work on their advocacy presentations to consider:
1) what the main message of the advocacy piece will be.
2) what the intended purpose of the advocacy piece is…
   a. to dispel myths about home fire sprinklers?
   b. to educate about a successful home fire sprinkler ordinance?
   c. to convey an opinion about the amount of water saved by sprinklers?
   d. to encourage adoption of a sprinkler ordinance?

an advocacy activity

Teacher-led discussion
- Discuss fire codes/ordinances—what they are, why they are important, who is responsible for them in Oregon, how fire code becomes law, and why fire codes change. (See *Teacher Notes*)

Advocacy activity

Students will research the effects of a city ordinance requiring home fire sprinklers and advocate for an ordinance requiring their use in new construction in their community.
- View *Sprinkler Timeline* video clip.
- Discuss the role of advocacy.
- View video clip, *Advocacy Interview*.
- Break the class into small groups and distribute copies of the Scottsdale, Arizona, report. This is a summary of a published study of fifteen years of data on the benefits of home fire sprinklers.
- Students may choose to:
  1) write letters to either the mayor, city council or fire chief
  2) develop a PowerPoint presentation for community groups
  3) write a letter to the editor of their local paper

TEACHER NOTES

FIRE STATISTICS*

Fire kills more people in the United States annually than all natural disasters combined. In fact, more than 4,000 individuals perish in fires each year and, on an average day, four children will die from fire.

Most fire deaths occur in the very place that people feel safest—their own homes. Most at-risk are the very young and older adults, who may have difficulty making a quick escape.

Home fires often happen at night when people are sleeping. In less than four minutes, a room can become engulfed in flames before anyone awakens. Quick facts:

- Eight out of ten fire deaths in the US occur in the home.
- Every 74 seconds, a home burns.
- Sprinklers and smoke detectors together cut the risk of dying in a home fire by 82%.

FIRE ENGINEERING

(Smoke alarms and home fire sprinklers)[1]

Although smoke alarms are essential in every household, they're designed to detect, not control, a fire. Home fire sprinklers complement the detectors' work, providing a way to fight flames immediately. In less time than it would take most fire departments to arrive on the scene, home fire sprinklers can contain and even extinguish a fire. There's less damage, and less chance of deadly smoke and gases reaching the home's occupants.

BENEFITS OF HOME FIRE SPRINKLERS

Fire sprinklers are mandatory in most public buildings, and people are now demanding the same level of protection for their homes. Home fire sprinklers:

- save lives
- reduce property loss
- can help cut homeowners' insurance premiums
- decrease fire damage by as much as two-thirds in homes with fire sprinklers

Many communities across the U.S. are seeing impressive results from installing home fire sprinklers in all new construction. Two examples: In Cobb County, Georgia, there has not been a single fire fatality in homes protected with home fire sprinkler systems since the program began in 1980. And in Scottsdale, Arizona, the fire loss hit a ten-year low in 1992, despite a nearly thirty percent population growth in the city the previous decade. In dramatic fashion, these communities are proving that home fire sprinklers save lives and property.

[1] Home Fire Sprinkler Coalition statistics

A TEACHER NOTES

THE DEBATE PROCESS

Select two teams to debate the value of home fire sprinklers: the Affirmative Team will be in favor and the Opposition Team will be against. Time limits for opening arguments and rebuttals should be set in advance and firmly adhered to.

Time to prepare Background sheets about home fire sprinklers are included in this unit. One presents myths about sprinklers; the other presents realities about them. The teams may research other material to support their position.

Opening arguments The debate will begin with an opening argument by the Affirmative Team. They will present as much of their argument and evidence as possible. Evidence should be documented, supported and well prepared.

The Oppostion Team presents their opening argument next. Objections should be carefully documented. Typically, the Opposition Team will be defending the status quo which, in this exercise, is the absence of home fire sprinklers.

Second arguments The debate continues with the Affirmative Team presenting the rest of their argument, countering the opposition arguments with more evidence and documentation.

The Opposition Team counters any new arguments from the Affirmative Team.

Rebuttals During rebuttals teams summarize arguments and clarify positions. Allow time for first and second rebuttals. The opposition goes first and continues the attack on the affirmative argument. They should end with a summary of the weaknesses of the affirmative's case. The opposition should close its second rebuttal by asking for a vote for their side.

The Affirmative Team should restate their issues, answer the opponent's attacks and summarize the issues to be addressed by the opponents. They should end their second rebuttal by asking for a vote for their side.

Questions Opponents may ask questions during the opening arguments (but not during the first or last minutes of them) and not at all during rebuttals. The questioner should stand and wait for the speaker to acknowledge them. The speaker may say "no thank you" or answer the question. The exchange will be included in the speaking time.

End of debate and voting At the end of the debate the rest of the class will vote on the teams' presentations. Teams may be evaluated on: 1) Most convincing argument; 2) Reasoning and logic; 3) Most persuasive evidence; 4) Good communication style; 5) Effective and personable delivery.

B TEACHER NOTES

A (PROSPECTIVE) HOMEOWNER'S DILEMMA

A steep hill and an inadequate water supply A homeowner wants to build a 3,800 square foot home at the top of a steep hill with a street access grade of 15%. The available water supply to fight a house fire is inadequate. The city water department has told the home owner that water storage for the lot is 50 feet below grade and they can only supply domestic water at approximately 25 gallons per minute.

A pump with a back-up power supply is a possibility The grade is too steep to supply water for a hydrant without a pump. The cost of the pump is approximately $200,000. An emergency power supply would also be needed at the home owner's expense. Annual maintenance costs, exact amount unspecified, would also be necessary.

Fire department requirements to fight a fire The fire department apparatus cannot respond to a grade that is steeper than 10%. The fire department also depends on a water supply being available at the property. Any structure larger than 3,600 square feet requires a fire flow (water supply) of 1,700 gallons per minute. The grade can be reduced to 10%, but it will be at the homeowner's expense. (See the next page for a further discussion of grade.)

The home owner has several options:

a) Provide a grade of less than 10% and a 200,000 gallon water tank for fire suppression at a cost of $500,000.

b) Provide a grade of less than 10% and a hydrant with pump and backup power for a cost of $400,000.

c) Look for another place.

d) Provide a home fire sprinkler system and maintain current grade at a cost of $1.50 per square foot ($1.50 x 3800 = $5700).

Which option makes the most sense for this home owner?

B TEACHER NOTES

GRADE: HOW STEEP IT IS!

When you're winded hiking uphill, it's **steep**.

When you're slipping downhill, it's **steep-steep**.

When you're easing down sideways, it's **steep-steep-steep**.

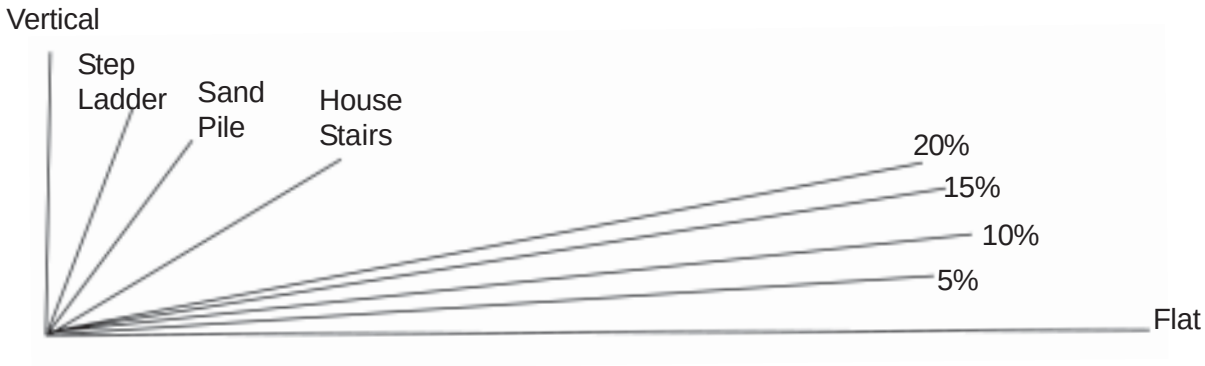
When sliding down on your bottom, it's **steep-steep-steep-steep**.

WHAT DOES "GRADE" MEAN?

Grade can be defined as the steepness of a hill, or how high up you go as you progress horizontally.

WHAT DOES THE GRADE "NUMBER" MEAN?

A grade of 0% is exactly flat. For the sake of comparison, the grade of typical stairs in a house is 60%. A pile of sand from a dump truck usually creates a pile of about 70% grade. In the example at the top of this page a **steep** trail would be about 15% grade and a **steep-steep-steep-steep** grade would be about 60%. A 10% grade is the maximum that most fire department equipment is able to negotiate. The chart below illustrates some grades.



Discussion of grades courtesy of Desert Foothills Land Trust Web site and Jim Blackburn: http://www.dflt.org/awareness/steep.htm

TEACHER NOTES

WHAT ARE FIRE CODES?

Fire codes are a set of rules and standards that guide home and business owners, institutions and organizations, and the local fire service in the application of fire safety laws.

Codes govern what happens in a building such as the occupant capacity, how many exits there should be, the presence of smoke alarms and fire sprinklers and signs to indicate exits. Codes also govern how many people can attend an outdoor assembly, how to store flammable/combustible materials, handling of fireworks, and rules for outdoor burning.

WHY ARE FIRE CODES IMPORTANT?

Fire code developers continually research methods to make environments safer. Fire codes are designed to increase the chances that people will survive a fire. Code developers develop outreach programs to promote the application and use of effective and uniform fire and life safety laws.

WHO IS RESPONSIBLE FOR OREGON FIRE CODE?

Within the Oregon Office of State Fire Marshal is a small department with a big name—Codes and Technical Services Unit. The Codes Unit is responsible for developing, editing and interpreting state fire-related problems.

The Codes and Technical Services Unit works closely with the Building Codes Division (another state agency that regulates building construction guidelines). Building codes say certain buildings must have sprinklers; fire codes tell how, where and what kind of sprinkler has to be installed.

HOW DOES FIRE CODE BECOME LAW?

Model fire codes are developed at the national level and, when they are adopted by a governmental jurisdiction such as a state, they become law. The Oregon Fire Code has gone through a process that makes it a law.

Oregon fire code sets a statewide minimum standard—local fire districts may adopt and amend the state code as long as any changes are more stringent.

WHY DO FIRE CODES CHANGE?

Fire codes change periodically because building construction and building materials change. Also, an incident of destruction or tragedy can drive a change to fire code—people learn from tragic experiences and fire codes often evolve in reaction to a disaster.

Home Fire Sprinkler Myths

Homeowners are often reluctant to install sprinklers because of misconceptions about their operation.

Myth #1
The water damage from sprinklers is worse than a fire.

Myth #2
Sprinklers go off accidentally, causing unnecessary water damage.

Myth #3
Sprinklers are ugly.

Myth #4
When one sprinkler goes off, they all go off.

Myth #5
Smoke sets off a sprinkler.

Myth #6
Home fire sprinklers are expensive.

A Home Fire Sprinkler Realities

(Myth #1: The water damage from sprinklers is worse than a fire.)

Reality: The truth is, a sprinkler will control a fire with a tiny fraction of the water used by fire department hoses because a sprinkler activates during the early stages of a fire before the fire department can arrive. Automatic sprinkler systems spray water only in the immediate area of the fire, usually with just one sprinkler operating. As a result, the fire is kept from spreading, and widespread water damage is avoided.

(Myth #2: Sprinklers go off accidentally, causing unnecessary water damage.)

Reality: The odds are 1 in 16 million per year that a sprinkler will accidentally discharge because of a manufacturing defect. One study concluded that sprinkler accidents are generally less likely and less severe than mishaps involving standard home plumbing systems. And, despite the “sight gags” on television sit-coms, cigarette smoke is not enough to trigger sprinkler operation. Home fire sprinklers are at least as reliable as home plumbing systems.

(Myth #3: Sprinklers are ugly.)

Reality: Modern residential sprinklers are inconspicuous and can be mounted flush with walls or ceilings. Some sprinklers can even be concealed. And, just like regular plumbing, pipes can be hidden behind ceilings or walls.

(Myth #4: When one sprinkler goes off, they all go off.)

Reality: Each sprinkler protects an area beneath it. When heated by fire, the sprinkler above the area with the fire activates. Only the sprinkler closest to the fire will activate, spraying water directly on the fire. The other sprinklers, unheated by fire, do not activate. Ninety percent of fires are contained by the operation of just one sprinkler.

(Myth #5: Smoke sets off a sprinkler.)

Reality: Sprinklers activate when they are heated by fire, not by smoke.

(Myth #6: Home fire sprinklers are expensive.)

Nationally, on average, home fire sprinkler systems add 1% to 1.5% of the total building cost in new construction. Not only do fire sprinklers save lives, they reduce property loss and can even help cut homeowner insurance premiums. They save fire department resources for other uses as well.

B Home Fire Sprinkler Work Sheet

Name of your city

_____

Number of home fires in your city in past year

_____

Cost of water per gallon

_____

This exercise will compare the AMOUNT of water used and the COST of that water to extinguish a home fire under two different scenarios—a home fire with home fire sprinklers and a home fire that was extinguished by the fire department.

Before beginning, determine the number of home fires in your city for the past year (contact the local fire department for statistics) and the cost of water per gallon (contact public works).

A fire sprinkler uses, on average, 341 gallons of water to control a fire. Firefighters use, on average, 2,935 gallons of water to control a fire. (Based on a 15-year study of fire sprinkler effectiveness in Scottsdale, Arizona.)

CALCULATE WATER USE

If the fire was extinguished by firefighters

number of home fires x 2,935 = _____ (a)

If the fire was extinguished by home fire sprinkler

number of home fires x 341 = _____ (b)

Gallons saved if home fire sprinklers had been in place

figure (a) minus figure (b) = _____

CALCULATE WATER COST

Fire extinguished by firefighters

figure (a) x cost per gallon = _____

Fire extinguished by home fire sprinkler

figure (b) x cost per gallon = _____

Money saved if home fire sprinklers had been in place

figure (a) minus figure (b) = _____

SCOTTSDALE, AZ, REPORT 15 YEARS OF DATA

In Scottsdale, Arizona, a sprinkler ordinance was implemented on January 1, 1986.

- 41,408 homes, more than 50 percent of the homes in Scottsdale, are protected with home fire sprinkler systems.
- There were 49 fires in single-family homes with fire sprinkler systems: There were no deaths in sprinklered homes.
- 13 people died in homes without sprinklers.

LESS FIRE DAMAGE

There was less damage in the homes with sprinklers:

- Average fire loss per sprinklered incident: $2,166.
- Average fire loss per unsprinklered incident: $45,019.

REDUCED WATER DAMAGE

Only the sprinkler closest to the fire will activate, spraying water directly on the fire. 90% of fires are contained by just one sprinkler.

According to the *Scottsdale Report*, there was less water damage in the homes with sprinklers:

- Sprinkler systems discharged an average of 341 gallons of water per fire.
- 2,935 gallons of water per fire were released by firefighter hoses.

COST

Recent technology breakthroughs make sprinklers more affordable and easier to install in homes. On a national average, they add only 1% to 1.5% of the total building cost. In Scottsdale, the average cost is less than $.80 per square foot.

ACCIDENTAL DISCHARGE

Each sprinkler is individually activated by heat. Despite “sight gags” on television sit-coms, cigarette smoke will not trigger sprinkler operation. The likelihood that a sprinkler will accidently discharge because of a manufacturing defect is extremely rare.

APPEARANCE

Modern home fire sprinklers are inconspicuous and can be mounted flush with walls or ceilings. Some sprinklers can even be concealed. Like regular plumbing, pipes can be hidden behind ceilings or walls.