

# INSTRUCTOR GUIDE

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## RINGS OF FIRE

Tire Fire Prevention and Suppression

### Lesson Plan 02

#### Tire History

<b><u>TOPIC:</u></b>	The History & Development of Tires
<b><u>LEVEL:</u></b>	I
<b><u>TIME:</u></b>	30 Minutes
<b><u>BEHAVIORIAL OBJECTIVE:</u></b>	
<b>Condition:</b>	Complete evaluation with 70% accuracy
<b>Behavior:</b>	The student will . . .  <ol style="list-style-type: none"><li>1. Provide a historical perspective to the waste tire storage problem in America.</li><li>2. Understand the chemical and structural evolution of the modern tire and how it impacts firefighting efforts.</li></ol>
<b>Standard:</b>	According to the referenced text
<b><u>REFERENCES:</u></b>	Slaughter, Rodney. "RINGS OF FIRE: Tire Fire Prevention and Suppression" California State Fire Marshal, June 2004.
<b><u>MATERIALS NEEDED:</u></b>	PC projector, projection screen, VCR, multimedia slide show on CD-ROM, speakers.
<b><u>PREPARATION:</u></b>	It's fairly obvious that the wheels of progress in the twentieth century rode a little smoother on air filled rubber tires. Imagine what our lives would have been like, or what our vehicles would've looked like if Charles Goodyear hadn't found a way to stabilize natural rubber through the vulcanization process? In this section we are going to learn about the history of tires so that we can understand why the storage problem exists. We are also going to learn about the tires chemistry and the conversion of that chemistry under fire conditions and how it impacts the environment.



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PRESENTATION	APPLICATION
<p>B. Goodyear experiments from 1830-1839</p> <ol style="list-style-type: none"><li>1. Natural rubber hardened by adding sulfur and treating with an acid gas.</li><li>2. Mixture accidentally lands on a stove and creates desired consistency</li></ol> <p>C. First used for tires by John Dunlop in Ireland 1888</p> <ol style="list-style-type: none"><li>1. Used a thin rubber sheet covered with fabric to make air filled tires for son's bicycle</li><li>2. Sells concept to Harvey du Cross, Jr. who starts Dunlop Rubber Company</li></ol> <p>D. Andre Michelin made first air filled tires for cars 1895</p> <ol style="list-style-type: none"><li>1. Developed for 350 mile race from Paris to Bordeaux</li><li>2. Numerous flats made it seem like it might not be useful</li></ol> <p>E. 1911 The Hardman Tire and Rubber Company produces first combination tire/tube</p> <ol style="list-style-type: none"><li>1. Air filled inner tube is surrounded by hardened rubber tube, reinforced with fabric</li><li>2. Patented in 1903</li></ol> <p>F. 1908 Frank Seiberling built a machine that cuts grooves in hard tire surface for traction</p>	<p>Rings of Fire Slide 03 Timeline</p>

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PRESENTATION	APPLICATION
<p>G. 1910 B.F. Goodrich Company adds carbon to reduce tire wear</p> <p>H. 1920 life expectancy of tire is 13,000 miles</p> <p>I. Answer: It depends on how much you pay for your tires but you can get up to 60,000 miles on new top of the line tires today</p> <p>J. Disconnection from Asian and South American Suppliers</p> <ol style="list-style-type: none"> <li>1. Answer: Beginning of WWII</li> <li>2. Goodyear Tire and Rubber Company</li> <li>3. Began making synthetic tires in 1937</li> <li>4. Patented man made substance called Chemigum</li> </ol> <p>K. By 1950 over half of all tires were man made rubber</p> <p>L. Today over 60% of a tire is synthetic</p> <p>M. 1954 First car offered with tubeless tire</p>	<p><b>Overhead Question:</b> What is the life expectancy of a tire today?</p> <p><b>Overhead Question:</b> What was going on historically that necessitated the making of synthetic rubber?</p>



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PRESENTATION	APPLICATION
<ul style="list-style-type: none"><li>6. Fatty acids</li><li>7. Clay, Carbon black and inert materials</li><li>8. Zinc Oxide and Titanium Dioxide</li></ul> <p>B. Fire Conditions</p> <ul style="list-style-type: none"><li>1. Volatile Organic Compounds</li><li>2. Polynuclear Aromatic Hydrocarbons (PAH's)</li><li>3. Carbon Monoxide</li><li>4. Heavy Metals</li></ul> <p>C. Westley Example</p> <ul style="list-style-type: none"><li>1. 141,000 lbs of Benzene</li><li>2. 70,000 lbs of PAH's</li><li>3. 10,000 lbs of Butadiene</li><li>4. 250,000 gallons of pyrolytic oil recovered</li><li>5. Oil flowing into creek ignited</li></ul>	<p>Rings of Fire Slide 06 Chemical Comp 2</p> <p>Rings of Fire Slide 07 Chemical Comp 3</p>

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PRESENTATION	APPLICATION
<p data-bbox="228 575 529 611">D. Oil Comparison</p> <ol data-bbox="326 793 1089 940" style="list-style-type: none"><li data-bbox="326 793 899 829">1. Used crankcase oil is a known carcinogen</li><li data-bbox="326 867 1089 940">2. From this comparison is there any doubt that a tire fire is a potential hazardous materials incident?</li></ol>	<p data-bbox="1125 468 1409 537">Rings of Fire Slide 08 Chemical Comp 4</p> <p data-bbox="1125 615 1455 753"><b>Instructors Note:</b> Compare data on slide between pyrolytic oil and used crankcase oil</p> <p data-bbox="1125 980 1455 1087"><b>Instructors Note:</b> Give summary and then read evaluation questions</p> <p data-bbox="1125 1163 1419 1232">Rings of Fire Slide 09 Tire History Questions</p>

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### **SUMMARY:**

Tires are obviously a difficult product to get rid of. Why would anyone decide to specialize in a collection of old and used tires to begin with? The answer is that there is allegedly money to be made from used tires. Many people began collecting used tires in the belief that one day there would be a market for this product. In the next section we will see what that market is and how many tires are being put to good purposes.

### **EVALUATION:**

1. Should water be used to fight a tire fire when rubber is naturally waterproof?

Answer: If the fire is small enough water works just great on cooling and extinguishing the small tire fire. However using water on large fully involved tire piles is usually not a good idea. Water and foam cannot Penetrate the fire and the cooling effect that you do provide will allow incomplete combustion, thereby releasing more pyrolytic oil than necessary.

2. How does the tires' grooves effect fire behavior?

Answer: Opens more surface area to flames and heat

3. What happens to air filled tires in a fire environment?

Answer: Air filled tires can expand in the heat of the fire and create mini- explosions.

### **ASSIGNMENT:**

None