Ethanol- Alternative Fuel

Know Before You Go!!

A Firefighters Approach

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Crawford Wiestling

Objectives

The student will be able to;
- Identify the purpose for Ethanol based fuels.
- Identify how Ethanol based fuels are produced.
- Identify the growth of Ethanol production facilities across the U.S.
- Identify the hazards located at an Ethanol facility.
- Identify the shipping methods of Ethanol based fuels.
- Identify a firefighters response to an Ethanol emergency.

Everyone Goes Home

16 Firefighter Life Safety Initiatives

These are the ones we will cover in this program:

1. Define and advocate the need for a cultural change within the fire service relating to safety; incorporating leadership, management, supervision, accountability and personal responsibility.
2. Enhance the personal and organizational accountability for health and safety throughout the fire service.
3. Focus greater attention on the integration of risk management with incident management at all levels, including strategic, tactical, and planning responsibilities.
4. All firefighters must be empowered to stop unsafe practices.
5. Develop and implement national standards for training, qualifications, and certification (including regular recertification) that are equally applicable to all firefighters based on the duties they are expected to perform.

Program Design

This program is designed to give you a basic understanding of the Ethanol production process and hazards

Scenario

In a quiet little town of less than 1000 population located the Midwest sits a facility which produces a “bio fuel” call “Ethanol”. The facility supplies jobs to some in the community and is located only a few hundred yards from other facilities. The local fire department is a volunteer fire department with 20 members. They have training to the Awareness level in hazardous materials with a hand full at the Operational level. So what if??
What are some of the issues here?

• Water supply??
• Chemical Hazards??
• Economic Impact to the community??
• What else??

What is E-85?

• Ethanol is a clean burning high octane fuel.
• Ethanol is grain alcohol produced from corn.
• Ethanol is mixed with gasoline for consumer use. The mixture is:
  – 85% Ethanol
  – 15% Gasoline
• Today in the U.S. there are more than 4 million vehicles are “flexed fueled” for E-85 use.

Why Ethanol Based Fuels??

Benefits of using Ethanol

Production

• There are 8 steps to the production of E-85.
• 2 Types of processes are used.
  • Dry Milling
  • Wet Milling
• Dry Milling is the most common production type utilized.
Dry Milling Process

Wet Milling Process

Ethanol Production is the U.S.

History of Ethanol Production

Growth in Minnesota

Biorefinery Locations in US

Dry Milling Process

Wet Milling Process

Ethanol Production is the U.S.

History of Ethanol Production

Growth in Minnesota

Biorefinery Locations in US
Economic Impacts of Ethanol

The Hazards at an Ethanol Facility

Chlorine- Water Treatment

Ammonia Storage

Carbon Dioxide
Pre- Incident Planning Basics

- This plan is a firefighters look at the hazards within a facility or storage area.
- Some items identified in a pre-plan:
  - Address.
  - Facility/area site & floor plan.
  - FD access routes- primary & secondary.
  - Chemical stored & shipped.
  - Hazards of those chemicals.
  - Fire protection systems.
  - Water supply issues.
  - Pre-fire considerations and operational planning.

NFPA 1620 Recommended Practice for Pre-Incident Planning
Steps to complete a Pre-plan

- Contact the facility manager or shipper.
- Meet them on-site for a tour.
- Ask them what they feel the risks/fire hazards are for responding.
- Recommend training with the FD and facility personnel.

What needs to be Pre-Planned?

Facilities
- Identify chemical hazards.
- Identify the process hazards.
- Identify the quantities stored.
- Identify the water supply.
- Identify the foam needed- NFPA 11 Specifies .10gpm/sqft to .16gpm/sqft. We will re-visit this latter.
- Identify protection considerations for the area community.

Storage Facilities/ Areas
- Identify the quantities stored. Daily.
- Identify shipping routes.
- Identify FD access routes to the storage area.
- Identify the water supply challenges.
- Identify the foam needed- NFPA 11 Specifies .10gpm/sqft to .16gpm/sqft. We will re-visit this latter.
- Identify protection considerations for the area community.

Major Transportation Routes
- Identify the methods of shipping.
- Identify the chemicals being shipped.
- Identify the containers.
- Identify the water supply challenges.
- Identify the foam needed- NFPA 11 Specifies .10gpm/sqft to .16gpm/sqft. We will re-visit this latter.
- Identify protection considerations for the area community.

Pre-plan Example
Pre-plan Example for spills

Ethanol in Use

Which Vehicle Runs on E-85??

Ethanol in Use

Type or Grade of Ethanol

• E-10 10% Ethanol, 90% Gasoline
• E-20 20% Ethanol, 80% Gasoline
• E-85 85% Ethanol, 15% Gasoline

Know Before You Go!!
Physical Properties - States of Matter

Solid, Liquid & Gas

- Solid to a Liquid: Melting Point
- Liquid to a Gas: Boiling Point
- Gas to a Liquid: Condensing
- Liquid to a Solid: Freezing Point
- Solid directly to a vapor: Sublimination

Important Terms

- Vapor Pressure: Pressures exerted on a container by a liquid in the vapor space.
- Vapor Density: Comparison of the weight of a vapor to the equal amount of air. Video Ex.
- Specific Gravity: Comparison to the weight of a liquid to the equal amount of water.
- IDLH: Immediately Dangerous to Life and Health - The maximum from which a worker could escape without any impairing symptoms or irreversible health effects with 30 minutes.

Why is all of this technical stuff important?

Important Terms (cont.)

- LEL: Lower Explosive Limit, the lower limit at which a fuel and air mixture of a flammable can be ignited.
- UEL: Upper Explosive Limit, the upper limit at which a fuel and air mixture of a flammable can be ignited.

Polar: Water miscible, has the ability to mix with water.
Non-Polar: Will not mix with water.

Chlorine

- Synonyms: Molecular Chlorine
- LEL: N/A
- UEL: N/A
- IDLH: 10 PPM
- I.P.: 11.48 ev
- Vapor Pressure: 6.8 atm
- Vapor Density: 2.47
- Flash Point: N/A
- Routes of Entry: Inhalation, Ingestion, Absorption, Skin and Eye contact.

Ammonia Hazards

- Synonyms: Aqua ammonia
- LEL: 15%
- UEL: 28%
- IDLH: 300 PPM
- I.P.: 10.18 ev
- Vapor Density: .6
- Vapor Pressure: 8.5 atm
- Routes of Entry: Inhalation, Ingestion, Absorption, Skin and Eye contact.
Carbon Dioxide Hazards
- Synonyms: Carbonic Acid Gas
- LEL: N/A
- UEL: N/A
- IDLH: 40,000 PPM
- I.P.: 13.77 ev
- Vapor Density: 1.53
- Vapor Pressure: 56.6 atm
- Routes of Entry: Inhalation & Skin and Eye contact.

Sulfuric Acid
- Synonyms: Battery Acid
- LEL: N/A
- UEL: 7.6%
- IDLH: 7.6%
- I.P.: N/A ev
- Vapor Density: 4.0
- Specific Gravity: 1.4
- Flash Point: -45 °F
- Routes of Entry: Inhalation, Ingestion, Skin, and Eye contact.

Sodium Hydroxide
- Synonyms: Caustic Soda, Lye, Soda Lye
- LEL: N/A
- UEL: N/A
- IDLH: 10 mg/m³
- I.P.: N/A
- Vapor Pressure: 6.6 atm
- Flash Point: N/A
- Routes of Entry: Inhalation, Ingestion, Skin, and Eye contact.

Gasoline
- Synonyms: Light Petroleum Distillate
- LEL: 3.3%
- UEL: 7.6%
- IDLH: 10 mg/m³
- I.P.: N/A ev
- Vapor Density: 4.0
- Specific Gravity: 0.72
- Flash Point: -45 °F
- Routes of Entry: Inhalation, Ingestion, Skin, and Eye contact.

Ethanol Hazards
- Synonyms: Ethyl alcohol
- LEL: 3.3%
- UEL: 19%
- IDLH: 3300 PPM
- I.P.: 10.47 ev
- Vapor Density: 1.5
- Specific Gravity: 0.72
- Flash Point: 56.6 atm
- Routes of Entry: Inhalation, Ingestion, Skin, and Eye contact.

E-85 & Ethanol Motor Fuels / Biodiesel Blends

<table>
<thead>
<tr>
<th>Material</th>
<th>Current Name</th>
<th>New Name</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasohol, with no ethanol</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
</tr>
<tr>
<td>Gasohol, not more than 15% ethanol</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
</tr>
<tr>
<td>Gasohol/ethanol blends with more than 15% ethanol</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
<td>Gasohol, UN1203</td>
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<tr>
<td>Diesel fuel, B-10 and B-20</td>
<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
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<tr>
<td>Diesel fuel, B-10 and B-20</td>
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<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
<td>Diesel fuel, NA1993 or Diesel, NA1993</td>
</tr>
</tbody>
</table>
Marking & Placarding Multi-Compartment Cargo Tanks

Physical Indicators Of Likely IDLH

Risk Based Response

Know Before You Go!!

What Is Safe?

• All Of These Guidelines Have One Thing In Common — Remain Below These Values And The Exposure Is Considered Safe To The Average Healthy Adult By All Information That Is Known By Today’s Health And Safety Professionals.

What Is Unsafe?

• A General Rule For Responders Should Be That If The Material Has Been Released From Its Container, Assume That An Unsafe Atmosphere May Exist And Some Form Of PPE Is Required.

What Is Dangerous?

• When Concentrations Continue To Increase Above Unsafe Levels, There Is A High Potential For Life-threatening Injuries Or Death To Occur. This Concentration Level Is The IDLH

• There Are Four General IDLH Atmospheres:
  - Toxic
  - Flammable
  - Oxygen Deficient
  - Oxygen Enriched

Physical Indicators Of Likely IDLH

• Outside Or Open Air Environment
  – Visible Vapor Cloud
  – Release From A Bulk Container Or Pressure Vessel
  – Large Liquid Leaks

• Inside Or Limited Air Environment
  – Below Grade Rescues Or Release
  – Confined Spaces
  – Artificial Or Natural Barriers
Physical Indicators Of Likely IDLH

- Biological Indicators
  (Using Your Common Sense!)
  - Dead Birds, Discolored Foliage, Sick Animals
  - Physical Senses And “Street Smarts” — Be Aware Of Strong Odors And Other Sensory Warnings
  - Hazmats With A Potential For Quick And Rapid Harm
    - Poison Gases
    - Explosives and Some Oxidizers
    - Materials With Very Low IDLH Values
  - Firefighting Overhaul Operations

Hazards when Responding to Ethanol Based Fuels

- Firefighting Overhaul Operations

What happens when you add water?

- The water miscible
  Ethanol mixes with the added water.
- The Hydrocarbon
does not mix.
- The new mixture has the hydrocarbon on the surface as the Specific Gravity is less than water.

What happens when you add water? (cont.)

- In this state, the hydrocarbon vaporizes off first, leaving the alcohol/water mixture.
- The alcohol/water mixture looks like a clear murky solution.

Product Given Time to Settle
What happens when you add water? (cont.)

- When burning, the hydrocarbon burns normally.
- Visible flame is produced along with black smoke from any unburned carbon particles.

What then happens when the hydrocarbon is gone?

- After the hydrocarbon is burned off only the alcohol/water is left.
- At this point you are dealing with an alcohol fire.
- IN DAYLIGHT, there is little to NO visible flame or smoke.
**Video Example**

- Ethanol test done by Bruce Roed, MNSCU

**E-85 Test**

**Identifying the Hazard**

**How can I identify the hazard**

- Look
- Listen
- Monitoring- 4-gas
- Old fashion technique- Straw Broom

**Look- Placards**

CAUTION- There is no standard of how it is being done

"The federal government contributes to the emergency response confusion, especially when it comes to placarding for transportation. While pure ethanol must carry the 1170 placard, there are three different placards for use with ethanol/gasoline blends — 1203 (gasoline containing up to 20% ethanol), 1987 (ethanol containing up to 5% gasoline), and 1993 (approved for varying concentrations of gasoline/ethanol).” – Bulk Transporter

Find this article at: http://www.bulktransporter.com/mag/transportation_ethanol_poses_critical/index.html

**Thermal Cameras**

- Thermals will be able to identify the difference in the heat of the flames
- May not be as apparent as one would think. Use caution and careful evaluation.
4- Gas Monitors

- A 4-gas monitor will identify:
  - LEL- Flammable
  - O2- Oxygen
  - CO- Toxic
  - H2S- Toxic
- They come in many different shapes and sizes.
- The BASIC operations are IDENTICAL.

Correction when monitoring for Ethanol

<table>
<thead>
<tr>
<th>Component</th>
<th>LEL% of Methane</th>
<th>Ethanol Correction Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Butane</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>24</td>
<td>0.92</td>
</tr>
<tr>
<td>Ethanol</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>18</td>
<td>2.2</td>
</tr>
<tr>
<td>Limestone</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>25</td>
<td>2.2</td>
</tr>
<tr>
<td>Methane</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>25</td>
<td>2.2</td>
</tr>
<tr>
<td>Methane</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Calibration- Methane
Ethanol Correction Factor
What is the actual reading when at 10%?

Toxic Gas Sensors

- There are other types of sensors in a monitor.
  - CO
  - Cl2
  - NH3

Photo-Ionization Detectors (PID)

- New emerging technology within the past 10 years.
- Excellent in identifying a wide range of chemicals.
- Requires a higher level of knowledge to interpret the readings.

Listening

- As the fire on the surface is burning it is heating the liquid.
- The water will "boil" as the alcohol is burned.
- You will may hear a distinct "boiling" sound.
Monitoring for Firefighters

- The very simple approach. If it “beeps” back away.
- For the following sensors use the following placards.

**CO**
- Low
- High

**TOXIC**

**H2S**
- Low
- High

- PID

An old way to identify a “safe” approach.

- When you suspect a alcohol based fire in daylight conditions.
- You can not identify if the spill area is on fire.
- Then use the following:
  - Thermal imaging camera
  - Listen type broom
  - Listen for the sound of boiling liquid.

Straw Broom

- Approach from the upwind and uphill side of the spill.
- Hold the broom out in front of your close to the surface.
- Move the broom side to side covering the width of the spill area.
- Watch for any ignition of the straw.

Holy C#@&

Look Closely at the Surface Street

Look at the fire on the Street.
The Airport Crash Truck gives it a try!

When all Else Fails, Water

Implementing a Response

Know Before You Go!!

Implementing a Response

The Eight Step Process

These Eight Functions Typically Follow An Implementation Timeline At The Incident.
The Elements Are:
1) Site Management And Control
2) Identify The Problem
3) Hazard And Risk Evaluation
4) Select Personal Protective Clothing And Equipment
5) Information Management And Resource Coordination
6) Implement Response Objectives
7) DECON And Clean-up Operations
8) Terminate The Incident

PPE Needed
Simple way to identify what to wear

ALWAYS wear your turnout gear and SCBA!!

Turnout Gear and SCBA

Chemical Protective Suit, SCBA

Setting the Hot, Warm and Cold Zones

Same incident-
Any new thoughts on what is Safe??

Start with the Dot guide- Gasoline

Pure Ethanol

Train Derailment in Elk River
Fire Response

- Identify the type of product: gasoline vs E85.
- Choose the proper foam.
- Apply as any other class B type of fire.

Are all Class B foams the same?
Let's look at the Class B foam issue.

Foam

Know Before You Go!!

Foam & Ethanol based fuels

Ethanol Foam Tests

What Does this all mean to me?

The Simple Version of the Results

UL Definitions

Type 5 Application
- Type 5 application is not intended for use on liquids, gases, or as a direct application to a surface or as a direct application to a surface.

Type 5 Application
- Agent applied directly to the surface of a burning liquid bed.
- Technique allows for stopping and reducing growth of the agent when applied to the fire.

Pre-application
- Allows for testing one of other assimilated
- Pre-application is not recommended for using the agent in other fire control areas.

Technical Summary of Results:

1. Only Alcohol Resistant products (AR-AFFF) are capable of extinguishing any of the top six fire tests.
2. Only Type II foam was successfully extinguished with the fewest number of tests. The AR-AFFF required a higher application rate to extinguish the fire.
3. All the foam types that were capable of extinguishing the extinguishment properties, only the AR-AFFF was capable of also extinguishing the heat in the exposed portion of the test.
4. Only the AR-AFFF was capable of extinguishing all of the top six fire tests. AFFF had to only apply a Type II discharge scenario.
5. Only the AR-AFFF was capable of extinguishing the analog type with no-assisted analog scenario. Each test method tests the extinguishing potential of the agent applied to the fire.

Extinguishing Agent Synopsis

<table>
<thead>
<tr>
<th>Extinguishing Agent</th>
<th>Fuel Class</th>
<th>Usage</th>
<th>Ability to Wet</th>
<th>Ability to Foam</th>
<th>Ability to Insulate</th>
<th>Affinity to Carbon</th>
<th>Indentation to Carbon</th>
<th>Socket with Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Cone A Foam</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFFF</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR-AFFF</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firefighter</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

@ Poor @ Average @ Excellent
How Foam is Made.

100 Gallons of 3% foam
3 Gallons of foam concentrate
97 Gallons of water

Foam Application Rate- NFPA 11

<table>
<thead>
<tr>
<th>Foam Type</th>
<th>Minimum Application Rate</th>
<th>Minimum Discharge Time (min)</th>
</tr>
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<tbody>
<tr>
<td>Protein and Sililicone</td>
<td>0.50</td>
<td>15</td>
</tr>
<tr>
<td>ARF, FPF, and alcohol-resistant AFFF or FFFP</td>
<td>0.15</td>
<td>15</td>
</tr>
<tr>
<td>Alcohol-resistant foam</td>
<td>0.15</td>
<td>15</td>
</tr>
</tbody>
</table>

Consult manufacturer for listings on specific products

Hydrocarbon 15 0.10 4.1 AFFF, FFFP, and alcohol-resistant AFFF or FFFP
Hydrocarbon 15 0.16 6.5 Protein and fluoroprotein

Foam Concentrate Usage

<table>
<thead>
<tr>
<th>Water Flow</th>
<th>Foam Conc. %</th>
<th>Foam Conc. Flow</th>
<th>Foam Conc. Usage 15 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 GPM</td>
<td>3%</td>
<td>10.5 GPM</td>
<td>157.5 gal.</td>
</tr>
<tr>
<td>350 GPM</td>
<td>6%</td>
<td>21.0 GPM</td>
<td>315 gal.</td>
</tr>
<tr>
<td>500 GPM</td>
<td>3%</td>
<td>15.0 GPM</td>
<td>225 gal.</td>
</tr>
<tr>
<td>750 GPM</td>
<td>3%</td>
<td>22.5 GPM</td>
<td>337.5 gal.</td>
</tr>
<tr>
<td>1000 GPM</td>
<td>3%</td>
<td>30.0 GPM</td>
<td>450 gal.</td>
</tr>
</tbody>
</table>

Master Foam Streams

Remember Surface Area not Volume

- The calculation of foam needed is about surface area of the spill not the depth.
- A 1 million gallon tank fire can be much easier than a rolled over tank truck depending on the area the spill covers.

Is your foam supply large enough to support a master stream?

What Foam Do I Select

- In today’s fire service we have many different choices.
- Class B AR-AFFF is the best choice.
- Look to a foam which gives you the most “bang for your buck”.
- There are combination A & B foams on the market.
  - Some do not work on alcohols thus don’t have the “AR” prefix.
  - Some work but don’t have an “AR” prefix.
- The A/B foams have made initial response and knock-down a simple process.

Consideration When Selecting Foam

- Today, when selecting a foam look to purchase one which is “Environmentally friendly”.
- Perflourochemicals (PFC’s) which are harmful to the environment and have contaminated drinking water systems.
- Class B foams have or have had PFC’s in them.
- The MPCA is in the process of evaluating this issue and expect further action on the issue.
Field Test New Foam Products!!

Utilize large scale test facilities

Class B Foams

• Any AR-AFFF foam will work on the Ethanol based fuels.
• There are many large national foam producers who have test data on Ethanol based fuels.
• Choose the one which is used in your area due to the issues of mixing different brands of foam.

Foam Test A & B- October 15, 2008

Test conducted at Flint Hills Resources- Rosemount, MN
• Class A & B Foam
• Tested at 1%, 3% & 6%.
• Hydrocarbon Fires
• Ethanol (E-95) Fires
Extinguished ALL fire types at each percentage.
FULLY Biodegradable!

Which of the two should I use?

• Look to use a Class B AR-AFFF foam over the A/B foams.
• The AR-AFFF foams will have longer dehydration time and are more suitable for the applications.
• The A/B foams are good for the initial knockdowns as this is what might be on the front line engine.

Foam Application Challenges

• Training

• Real life
  – If no containment:
    • No film forming seal
  – Then alternatives are:
    • Class A foam
    • Emulsifiers
Quote

“A crash truck carrying 3,000 gallons of AFFF and applying it at 500 to 1000 gpm can knock the heck out of a fire. But with ethanol involved, you might as well leave the crash trucks at home. The way we fight flammable liquid fire has to change.”

David White, President, Fire & Safety Specialist, Inc. July- August 2007 issue of Industrial fire World.

Spill Response

- Follow your current departmental operating Guidelines.
- Recommendations:
  - IF you suspect a spill with an Ethanol based fuel which is over 85%.
  - THEN treat as an Ethanol spill not a gasoline spill.
- Read the MSDS and follow the recommendations

Spill Response

- Use resource materials to identify the exact type of product it is.
- Don all firefighter protective gear including SCBA.
- Approach with caution.
- If there is no life threats, stay back and take a defensive position.

Use caution with some information

Closers Look

Other Information

Properties of Fuel Ethanol

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor density</td>
<td>Ethanol vapor is denser than air and tends to settle in low areas, whereas gasoline is lighter than air.</td>
</tr>
<tr>
<td>Solubility</td>
<td>May dissolve in water but may not stay in solution from the gasoline phase.</td>
</tr>
<tr>
<td>Flash point</td>
<td>A fuel ethanol blend is less than a gasoline phase hot as a gasoline phase cold, but is easily ignited, especially in a fuel rich environment.</td>
</tr>
<tr>
<td>Autoignition point</td>
<td>Alcohol and ethanol blends are reported to be more autoignition point.</td>
</tr>
<tr>
<td>Conductivity</td>
<td>Ethanol and ethanol blend conduct electricity. Oxides, no normal, is an electrical insulator.</td>
</tr>
<tr>
<td>Toxicity</td>
<td>Ethanol is less toxic than gasoline or methanol. Carbonyl compounds are still present in ethyl alcohol, but are less of a concern. Ethanol, is considered to be potentially carcinogenic.</td>
</tr>
<tr>
<td>Flammability</td>
<td>Inert temperatures (271, 289, vapor is more flammable than gasoline phase). However at normal temperatures, E85 vapor is less flammable than gasoline, because of the higher autoignition temperature of E85.</td>
</tr>
</tbody>
</table>
### A Basic Response Checklist

**Receipt of Call & Responding**
- Attempt to Gather Chemical Name
- Identify current weather conditions
- Identify safe route of approach. Upwind & Uphill.
- Safely drive to the incident location and provide a size-up once on-scene.
- Make contact with caller or facility representative.

### A Basic Response Checklist- Fire

**Initial Actions**
- Stay back (1000 feet) from the scene and recon.
- Full turnout gear and SCBA.
- Product/Container is on Fire
- Protect exposures
- IF no threat to Life or Property, let it burn
- IF suppression actions are needed, create a spill containment area and use AR-AFFF.
- Daylight: APPROACH WITH EXTREME CAUTION!! Flames may not be visible.

### A Basic Response Checklist- Spill

**Initial Actions**
- Stay back (1000 feet) from the scene and recon.
- Full turnout gear and SCBA.
- Spill Only
- Safely create spill containment area.
- Identify leak source.
- IF safe, attempt to shutdown leak.
- Vapor suppression- use AR-AFFF.

### Summary

- We identified the Ethanol production growth in the United States.
- Looked at a Ethanol production facility and the hazards which exist within the gates of the facility.
- Identified the chemical hazards around production and end use.
- Identified some basic response criteria for the identification of the hazard for a safe response.

**Most Importantly**

BE SAFE!!

### Contact Information

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### Questions

Thank You

Know Before You Go!!