



**Post Collision
Fuel Fed Motor
Vehicle Fires**



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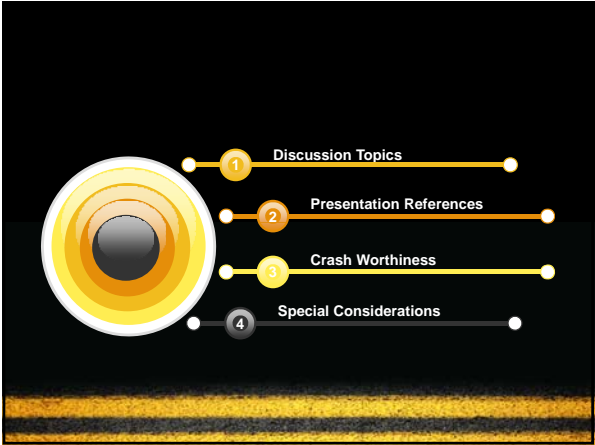
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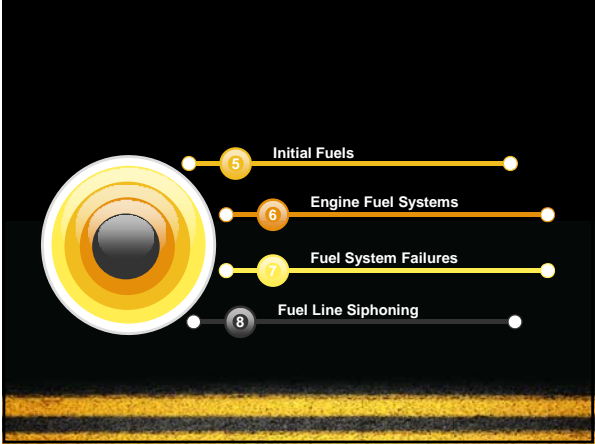


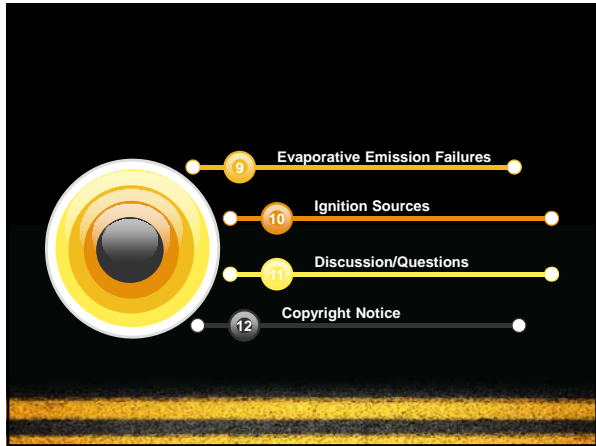
Post Collision Fuel Fed Fires

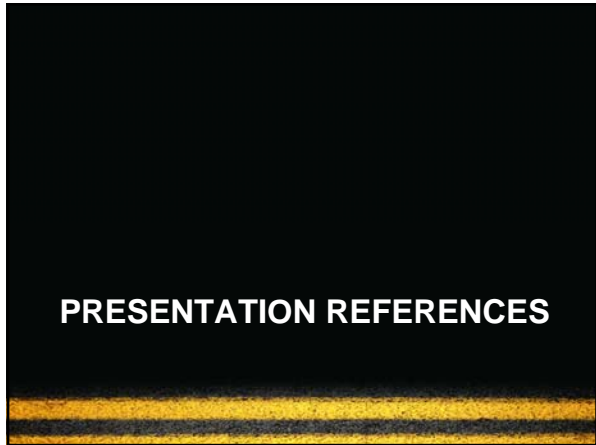


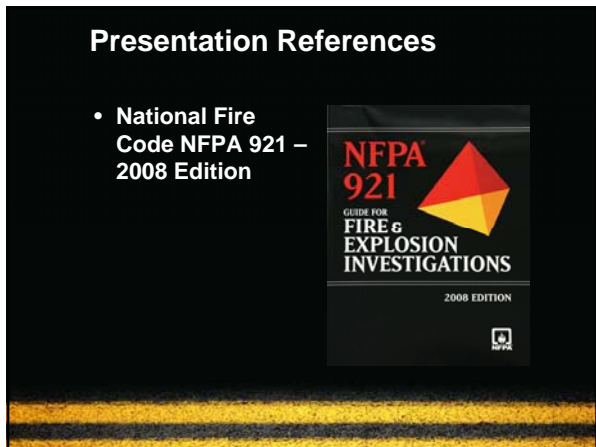
DISCUSSION TOPICS



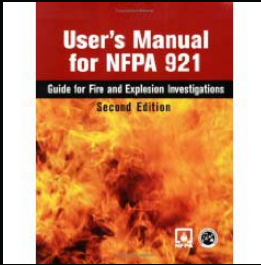








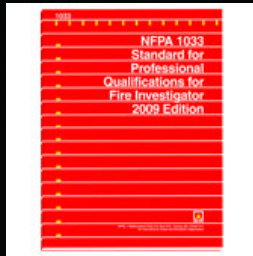
Presentation References



- NFPA User's Manual for NFPA 921 – Second Edition

Presentation References

- National Fire Code NFPA 921 – 2008 Edition



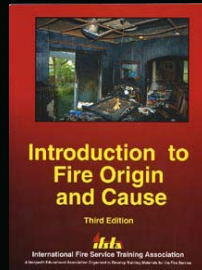
Presentation References



- NFPA Fire Protection Handbook – 20th Edition

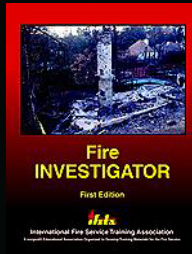
Presentation References

- IFSTA
Introduction to
Fire Origin and
Cause – Third
Edition



Presentation References

- IFSTA Fire
Investigator –
First Edition



Presentation References

- Federal Motor
Vehicle Safety
Standard 301 –
Fuel System
Integrity



Presentation References



- SAE Technical Paper 980561 – Automotive Fuel Line Siphoning: Causes, Consequences & Countermeasures

CRASH WORTHINESS

Crash Worthiness

- The science of minimizing the risk of serious injuries and fatalities in motor vehicle collisions.

Crash Worthiness

- Five principles of crash worthiness:

Crash Worthiness

- Five principles of crash worthiness:
 - Control crash/maintain occupant space
 - Restrain the occupants
 - Prevent ejection
 - Control energy/transfer energy
 - PREVENT FIRE


Crash Worthiness

- *Drennan v. General Motors – “General Motors agrees that it was a written goal of General Motors that the recommended level for fuel system performance is given for front, side and rear impacts and rollover premised on the concept that occupants involved in collisions which produced occupant impact forces below the threshold level of fatality should be free of the hazard of post collision fuel fed fires.”*

SPECIAL CONSIDERATIONS


Special Considerations

- Title history of the vehicle



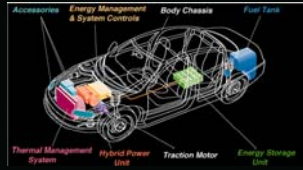
Special Considerations

- Maintenance history of the vehicle



Special Considerations

- Design and construction history of the vehicle



COMMON INITIAL FUELS

Common Initial Fuels

- Flammable liquids

Common Initial Fuels

- Flammable liquids
 - Gasoline
 - Alcohol
 - All season windshield fluid

Common Initial Fuels

- Combustible Liquids

Common Initial Fuels

- Combustible Liquids
 - Diesel
 - Motor oil
 - Transmission fluid
 - Brake fluid
 - Power steering fluid
 - Ethylene glycol
 - Hydraulic fluids
 - Lubricants

Common Initial Fuels

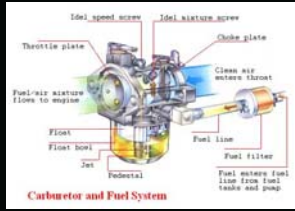
- Flammable gases

Common Initial Fuels

- Flammable gases
 - Propane
 - Natural gas
 - Hydrogen

ENGINE/FUEL SYSTEMS

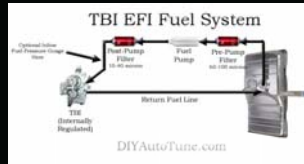
Engine Fuel Systems



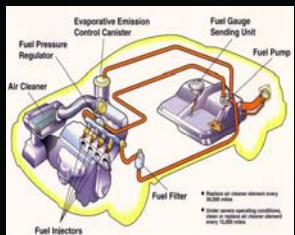
- Carbureted gasoline

Engine/Fuel Systems

- Throttle body injected (TBI) gasoline



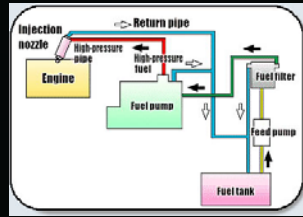
Engine/Fuel Systems



- Fuel injection gasoline

Engine/Fuel Systems

- Fuel injection diesel



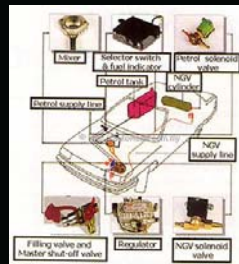
Engine/Fuel Systems

- Carbureted propane

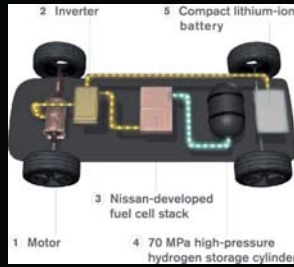


Engine Fuel Systems

- Carbureted natural gas



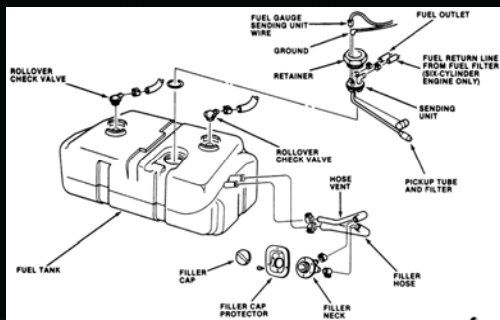
Engine/Fuel Systems



- Hybrid combination

FUEL SYSTEM FAILURES

Fuel System Failures



Fuel System Failures

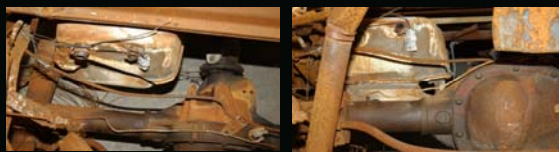


- Fuel system intrusions

Fuel System Failures



Fuel System Failures





Often, components of the vehicle itself become the intruding objects into the fuel system.



The impact may effect all possible alternative installation locations for the fuel tank.

Fuel System Failures

- Fuel line separations



Fuel System Failures



- Defective design and construction



The defective design and construction of the vehicle may not directly involve the fuel system itself.

Fuel System Failures

- Environment of use



Fuel System Failures

- Absence of or failure of fuel pump cut-off switch

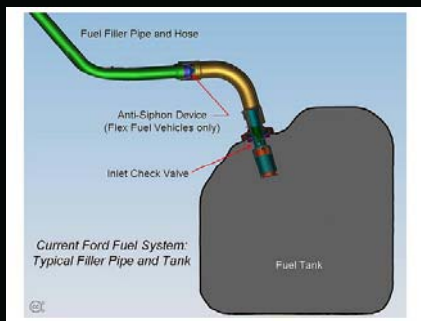


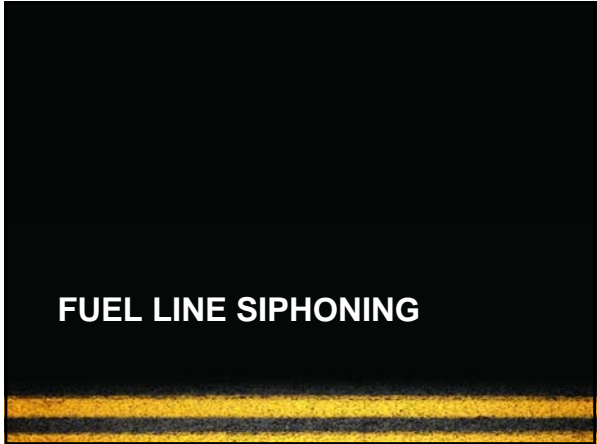
Fuel System Failures

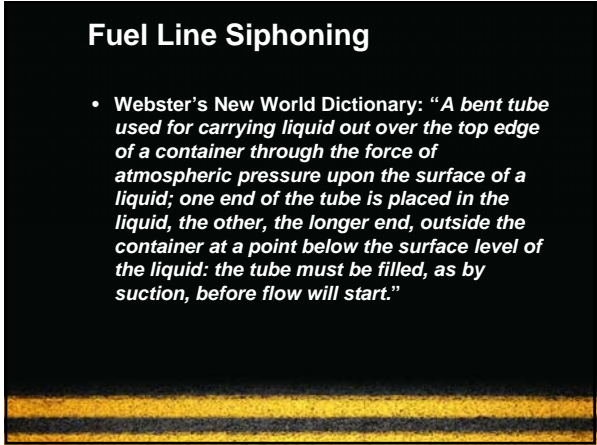


- Absence of or failure of fuel filler neck rollover valve

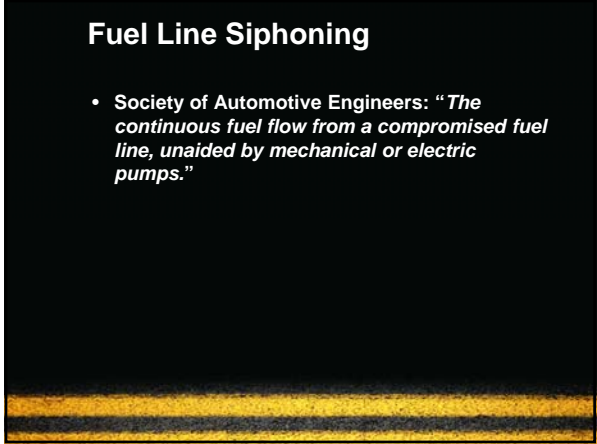
Fuel System Failures





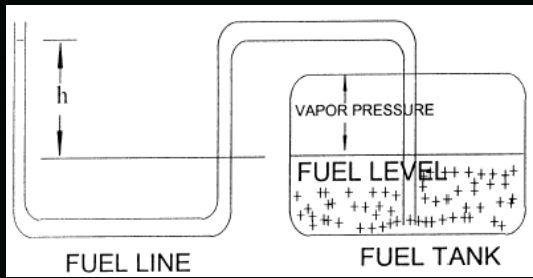


- Webster's New World Dictionary: *"A bent tube used for carrying liquid out over the top edge of a container through the force of atmospheric pressure upon the surface of a liquid; one end of the tube is placed in the liquid, the other, the longer end, outside the container at a point below the surface level of the liquid: the tube must be filled, as by suction, before flow will start."*



- Society of Automotive Engineers: *"The continuous fuel flow from a compromised fuel line, unaided by mechanical or electric pumps."*

Fuel Line Siphoning



Fuel Line Siphoning

- Vulnerable fuel lines

Fuel Line Siphoning

- Vulnerable fuel lines
 - Return line
 - Supply line
 - Vapor line

Fuel Line Siphoning

- Pre-requisite conditions

Fuel Line Siphoning

- Pre-requisite conditions
 - Absence of anti-siphon devices or countermeasures
 - Location of the fuel line compromise is below the level of the fuel inside the fuel tank
 - Presence of residual fuel tank vapor pressure/sufficient atmospheric pressure

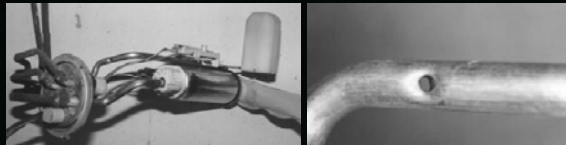
Fuel Line Siphoning

- Anti-siphon devices and countermeasures

Fuel Line Siphoning

- Anti-siphon devices and countermeasures
 - One-way check valves
 - Flow disrupters
 - Fuel line configuration

Fuel Line Siphoning



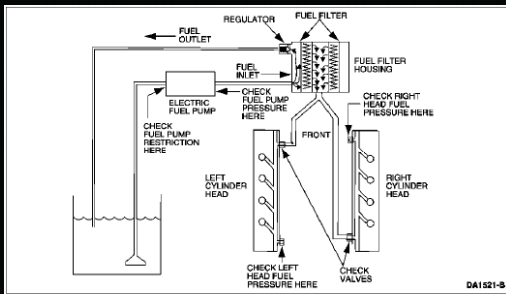
Fuel Line Siphoning



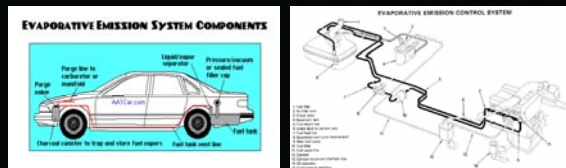
Fuel Line Siphoning



Fuel Line Siphoning



Fuel Line Siphoning



EVAPORATIVE EMISSION FAILURES

Evaporative Emission Failure



Evaporative Emission Failures

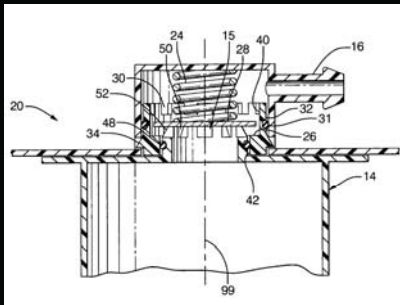


- Evaporative emission system intrusions

Evaporative Emission Failures

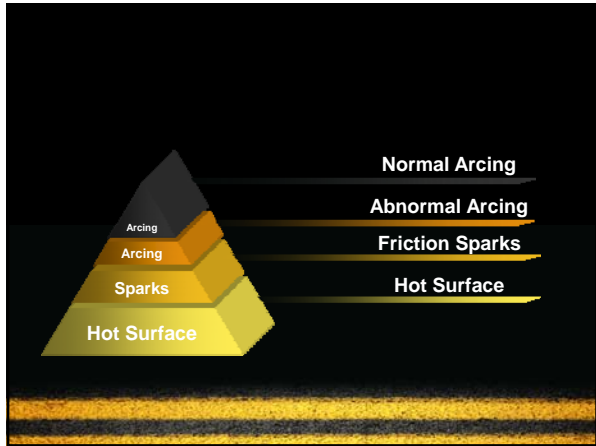
- Defective vapor rollover valve



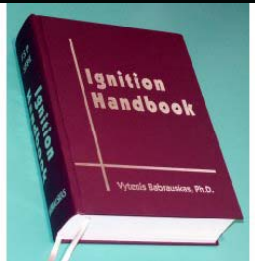


As mechanical devices, vapor rollover valves are subject to a number of mechanical failures.

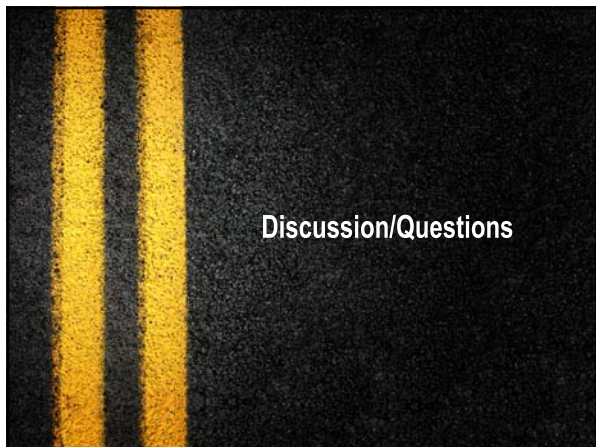
IGNITION SOURCES



Ignition Sources

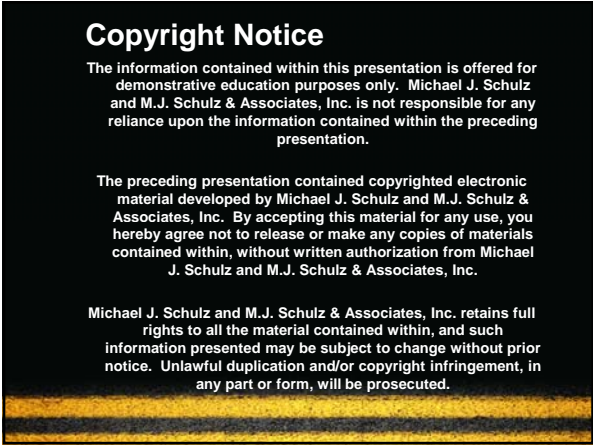


- SFPE Ignition Handbook



Discussion/Questions





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