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PRESENTATION REFERENCES

Presentation References

Presentation References

Presentation References

- IFSTA
  Introduction to Fire Origin and Cause – Third Edition

- IFSTA Fire Investigator – First Edition

- 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:
  – 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

• 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
  - Diesel
  - Motor oil
  - Transmission fluid
  - Brake fluid
  - Power steering fluid
  - Ethylene glycol
  - Hydraulic fluids
  - Lubricants
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
Often, components of the vehicle itself become the intruding objects into the fuel system. The impact may affect 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
Fuel Line Siphoning

- 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

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

• 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
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
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