Disclaimer

Phillips 66 does not claim that this presentation addresses all hazards associated with the handling and use of hydrocarbon solvents. Users are responsible to make their own analysis and to reach their own conclusions based on all data and information available to them, particularly as to the present and future legal requirements and their interpretation, the actual circumstances and conditions in which the products will be stored, handled and used, and the effect of these guidelines on operations, training and maintenance. Phillips 66 expressly disclaims any and all liability or responsibility for any loss or damage, however arising, which results directly or indirectly from the use of the data and comments made in this presentation.
The lowest temperature at which vapors above a volatile combustible substance will ignite in air when exposed to a flame.

The lower the flash point, the higher the vapor pressure and the more likely that a vapor will be present to ignite.
FLAMMABLE RANGE

- Vapors or gases in air are flammable only between certain concentrations
  - Lower Explosion Limit (LEL)
  - Upper Explosion Limit (UEL)
- The concentrations between these limits constitute the flammable range
  - Below the LEL, vapors are too lean to burn
  - Above the UEL, vapors are too rich to burn
  - Increased pressure (above atmospheric pressure) and increased temperature both widen the flammability range of typical hydrocarbons.

![Diagram of flammable range with LEL and UEL]

(-) % in air (+)
AUTO-IGNITION TEMPERATURE

- The lowest temperature at which the hydrocarbon will spontaneously ignite in a normal atmosphere without an external source of ignition

FLAMMABLE RANGE

- Vapors or gases in air are flammable only between certain concentrations
  - Lower Explosion Limit (LEL)
  - Upper Explosion Limit (UEL)
**ADDITIONAL TERMS**

- **Vapor Pressure**
  - Pressure exerted by a volatile liquid

- **Vapor Density**
  - A measure of the vapor’s density compared to air

- **Specific Gravity**
  - Ratio of the mass density of a material to that of water
  - Hydrocarbon liquids are generally lighter than water so they will float on water
HAZARDS

Two Main Hazards:
- Personnel Exposure
- Fire
PERSONNEL EXPOSURE

- Review SDS
- Know the Personnel Exposure Limits (PEL’s)
- Review Task to be preformed
- Implement good Engineering Controls
- Wear Personnel Protective Equipment
FIRE TRIANGLE / TETRAHEDRON
FIRE PREVENTION

- Fuel Segregation
  - Isolate fuel from incompatible materials and ignition sources

- Appropriate Ventilation
  - To maintain safe vapor levels

- Proper Storage Containers

- Create Inert Atmospheres
  - Too lean to burn (e.g. purge by Nitrogen)

- Blinding tanks
  - Blind – Flat flange without hole in the center
FIRE PREVENTION

⚠️ Adhere to:
- “Hot Work Permitting” procedures
- Area Electrical Classification meet codes

⚠️ Ensure Static Electricity is controlled
- Bond (ground) equipment
FIRE EXTINGUISHMENT

Eliminate Chemical Reaction
- Dry Chemical
  - Separates all 4 parts of tetrahedron
- Foam
  - Removes Oxygen
- CO2
  - Removes Heat
- Water
  - *Not recommended for extinguishing a hydrocarbon fire*
  - But may be used for cooling vessels or structures in the area

Emergency Action Plan
- Trained Responders
- Fire Resistant Clothing
Static Electricity – “The Invisible Enemy”

When handling liquid hydrocarbons, keep in mind you can generate static electricity with many activities, including:
- Pouring
- Pumping
- Filtering
- Mixing

Use of proper bonding and grounding will help protect employees
Hydrocarbon Unloading

Appropriate designed facility…

- Area classification
- Spillage containment
- Overfill protection
- Fire fighting provisions
- Access platforms
- Gas detection system
- Regulatory Requirements
- Permanent facilities grounded
Hydrocarbon Unloading

- Secure truck/railcar to prevent movement
- Ground truck/railcar and allow time for static to discharge prior to unloading
- Hoses shall be conductive
- Line sizes sufficient to avoid high velocities
- Avoid all ignition sources
- Adequate vapor recovery
- Constant operator attention
Hydrocarbon Storage

- Aboveground or underground pressure storage tanks
- Minimum distances from tanks to buildings and property lines vary with tank capacity
  - Check local, state, and national codes.
- Vapor return connections for vapor balancing
- Tanks fitted with vacuum relief and pressure relief
- Overfill & leak protection
- Tank, piping, and instrumentation materials shall be compatible with the product being used
Hydrocarbon Piping

- Piping connections shall be flanged or welded (ASME 31.3)
- Line sizes sufficient to avoid high velocities (NFPA 77)
- Properly grounded equipment, continuity bonds at all piping connections
- Remote operated emergency cut-off valve in the feed line
- Fixed fire fighting systems
MANAGEMENT PRACTICES

**Operating Procedures**
- Operating procedures for every type of operation
  - Procedures are audited
- Trained Operators
  - Emergency preparedness
  - Refresher training

**Maintenance**
- Routine inspection of facilities and instrumentation
  - Defects repaired ASAP
- Permit system to define:
  - Protection required
  - Conditions in which work shall be carried out

**Changes**
- Hazops Analysis
- Management of Change
CONCLUSION

- **Know the Product**
  - Review the SDS
- **Mitigate the Hazards**
  - Personnel Exposure
  - Fire Prevention
- **Train your Employees**
  - Handling
  - Storage