Hazard Identification

Typical Hazard Issues & Loss Events

Property/Energy Form	Hazard Issues & Loss Events
General Properties	
Solids	• Dust, static, engulfment, plugging,
Liquids	• Splashing, overflow, overpressure, spray, mist, static,
Gases	• Overpressure, exposure, monitoring, oxygen displacement.
Vapor Density	• Heavy vapors may accumulate near ground level and displace air in subterranean locations (vaults, cellars). • Lighter vapors may accumulate along roof lines or in the tops of equipment.
pH	• Personnel exposure (acid or caustic burns) • Acid gas release potential. • Potential latent degradation of equipment following acid gas release.
Vapor Pressure	• High vapor pressure liquids may evaporate readily. • Vapor cloud issues in addition to liquid spill issues. • Heating of high vapor pressure liquids may lead to excess pressure in equipment.
Boiling Point	• Low boiling liquids may boil and generate vapors under even mild heating conditions. • High boiling liquids may attain high temperatures in the liquid state, creating personnel exposure and equipment damage hazards.
Melting Points	• Materials normally handled as liquids may solidify at ambient or process temperatures, depending on melt point—resultant pluggage and other handling/safety concerns if phase change occurs. • Materials normally handled as solids may liquefy at ambient or process temperatures, depending on melt point—resultant spillage, flow, splashing, leakage and other handling/safety concerns.

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Viscosity or “Stickiness”	• High-viscosity or “sticky” materials may more readily cause burns if contacted with skin or clothing. • High-viscosity or “sticky” materials may be more susceptible to plugging or build-up/coating along equipment surfaces. Also, can lead to equipment jamming or sticking (potential employee injury if equipment moves unexpectedly when unjammed). • High-viscosity or “sticky” materials may be more difficult to cool and/or mix to control reactions. • Low-viscosity or “slippery” materials may spill more readily, be more susceptible to splashing, and may be more difficult to contain/control during spills. • Low-viscosity or “slippery” materials may lead to equipment “slipping” or moving unexpectedly (potential injury if equipment moves unexpectedly).
Extreme Operating Temperatures	• Equipment fatigue/failure. • Exacerbated corrosion. • Exposure issues—tissue burns or freezing. • Equipment rupture from thermal expansion of blocked-in fluid.
Elevated Pressures	• Liquids may be released as high velocity leak or spray. • Liquefied materials under pressure may undergo rapid phase transition (BLEVE)
Vacuum	• Potential for equipment collapse. • Potential for contaminants to enter system from leaks.
Solubility	• Affects emergency response, fire water runoff issues, and environmental cleanup.
Potential Energy	• Stacked containers may fall or topple. • Surge/spillage from elevated bulk storage or process vessels—i.e., inability to cut off "energy."
Kinetic Energy	• Impingement and erosion damage. • "Water Hammer" damage. • Personnel injury from sudden leak or line opening or other exposure.
Fire Hazards	
Flammable Gases, Liquids, or Dusts	• Readily ignited during any release scenario. • Flash Fire. • Potential explosion. • Rapid vapor cloud formation (flammable gases/liquids).
Combustible Liquids or Dusts	• May be ignited under appropriate conditions. • Fuel other fires. • Liquids may still generate significant flammable vapors under elevated temperatures and/or in enclosed structures/vessels.
Pyrophoricity	• Fire upon contact with air/atmosphere.

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Flash Point	• Materials handled above their flash point may readily ignited, including release scenarios. • Hot surfaces above the flash point may act as an ignition source.
Vapor Pressure	• Liquids with higher vapor pressures can readily generate vapor clouds—liquid spills may also present vapor cloud issues.
Combustible Materials of Construction	• Serve as fuel during a fire scenario. • Spread fire or contribute to fire intensity.
Surface Area	• Materials with large surface areas (such as fine powders and metal packings in columns) can be ignited more easily than bulk materials. • Potential for metal fire—extreme temperatures, special extinguishing needs.
Combustion By-Products	• Toxic offgasses. • Contaminated fire water runoff.
Explosion Hazards	
Lower/Upper Explosion Limits (LEL/UEL)	• Materials with low LELs can form explosive mixtures with only small releases. • Materials with a broad LEL-UEL range can form explosive mixtures under a broad range of conditions and release scenarios • Potentially explosive conditions may exist inside or outside of process equipment—under both normal and abnormal operating conditions.
Confined Areas	• Effects of explosion may be increased by confined areas.
Cold Ambient Temperatures	• Effects of explosions may increased by exremely cold temperatures.
Elevated Process Temperatures	• Increased temperatures expand LEL-UEL range (including lowering of the LEL.
Ignition Sources	
Static Electricity	• Static electricity charges may build-up on process materials (e.g., flaked resins, toluene), equipment (e.g., plastic-lined drums), or personnel. Discharge of the static electricity may generate a spark sufficient to ignite flammable materials and atmospheres.
Electrical Classifications	• Different classifications may present electrical ignition hazards. • A vapor release could initiate in an area classified for flammable vapors but could migrate into an unclassified area.
Hot Surfaces	• Surfaces above autoignition temperatures may lead to ignition.

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Flames, Sparks, Hot Gases, and Other Sources	• Any of the following potentially could ignite combustible or flammable materials/atmospheres: flames, mechanical sparks, electrical sparks, hot gases, chemical reactions, electromagnetic waves, ionizing radiation, lightning, transient currents, ultrasonics, adiabatic compression, shock waves.
Reactivity/Stability Issues	
Phase or Composition Change Instability	• Potential shock sensitivity or other instability issues if material becomes dry or changes phase. • Consider areas such as dead legs, sample ports, where material may accumulate and dry out or change phase.
Thermal Instability	• Bulk self-heating. • Decomposition into toxic or flammable by-products. • Thermal explosion. • Operations that could potentially generate heat need to be considered: storage (hot spots), drying, mixing/blending, conveying, melting/heating. • Nearby hot surfaces or other heat sources need to be considered: compressor exhausts, steam lines, ambient temperatures, air conditioning/ventilation, ductwork, etc.
Shock Sensitivity	• Potential detonation. • Operations that could generate physical shock/abrasion hazards need to be considered: conveying/ transportation, mixing/blending, size reduction, filtering, cutting, packaging, etc.
Exothermic Reaction	• Self-generating reaction and resultant "run-away" reaction. • Potential equipment overpressure. • Inadequate heat transfer (e.g., cooling water) system capabilities during normal or upset conditions may lead to run-away reactions.
Component/Gas Evolution Reactions	• Pressure buildup and subsequent overpressure. • Gas/vapor exposure issues.
Self-Polymerizing Ability	• Run-away polymerization, potential excess heat and/or pressure build-up.
Water Reactivity	• Potential explosion or energetic reaction on contact with water or high humidity. • Steam, condensate, and cooling water systems may present hazards. • Fire fighting response may present hazards.
Toxicity Hazards	
Acute Effects	• Short term exposures may cause health effects. • Proper PPE needs to be considered.
Chronic Effects	• Long term or frequent exposures, even to low concentrations, may cause health effects. • Proper PPE needs to be considered.
IDLH Levels	• Any release that could lead to exposure at IDLH levels could result in severe injury or death.

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Carcinogen	• Any exposures potentially could lead to health effects. • Proper PPE needs to be considered.
Exposure Routes and Effects	• Influence selection of PPE.
Inventory	• Larger inventories may involve releases with offsite effects.
Environmental Issues	
Priority Pollutant	• Potential significant effects if spilled to water.
Hazardous Air Pollutant	• Potential permit exceedance issues. • Personnel/environmental receptor exposure issues.
Listed or Characteristic Hazardous Waste	• Spilled material, including spilled product, may become a hazardous waste when spilled—impacts response and clean-up actions.
Oil or Petroleum	• Water spill hazard. • Subject to SPCC and/or Facility Response Plans
Aquatic Toxicity	• Spills to water may have significant impacts on aquatic organisms.
Density and Solubility	• Ability of material to float, sink, or dissolve in water may impact response and clean-up actions.
Offsite Receptors	• Nearby neighbors or businesses may be affected by a release. • Sensitive environmental receptors, such as endangered species, parks, and recreation areas, may be impacted by a release.