HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Acoustic Energy	Equipment noise Ultrasonic cleaners	Reciprocating motion equipment Irregular motion of rotating parts Irregular or cyclic motion during transportation Pneumatic or hydraulic shock (water hammer) Vibrating tools Misaligned equipment in motion Lack of vibration isolators Loose or undersized mountings Bottoming or failure of shock mounts Pump or blower cavitation High-velocity fluid hitting a surface or object that can vibrate Sonic booms and other shock waves Explosion and violent ruptures Scraping of hard surfaces against each other Lack or failure of sound isolation devices such as mufflers Escaping high-velocity gas	Cracking and breaking of brittle materials Loosening of bolts or other fastened parts Breakage of lead wires, filaments, and supporting parts Personnel fatigue Inability to read instruments or to activate controls Color fading Damage to hearing Interference with communications Decreased corrosion resistance Metal fatigue and other changes in crystalline structure Involuntary reaction to sudden loud noise Static electricity generated between susceptible surfaces Chattering of spring-type contacts, valves, and pointers Loss of calibration of monitoring devices and other instruments Possible false readings on pointer-type devices Crazing and flaking of finishes

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Toxic/Corrosive/Reactive Materials	Acetone Fluorides Carbon monoxide Lead Ammonia and compounds Asbestos Trichlorethylene Dusts and particulates Pesticides/herbicides/insecticides Bacteria Beryllium and compounds Chlorine and compounds Decontamination solutions Sandblasting Cyanides Metal plating Arsenic Mercury Acetylene Methane Chromates Acid Caustics "Natural" chemicals (soil, air,water) Acids Bases Organic solvents Heavy metals *Note: See SARA Title III "List of Extremely Hazardous Chemicals"*	Insufficient ventilation in occupied, enclosed space Atmospheric pollution by industrial, automobile, or other exhausts Ingestion of toxic or contaminated materials or food Outgassing of gases at low pressures in confined spaces Drum corrosion Breech of containment due to material failure, overpressurization, thermal stress, corrosion, chemical reaction, mechanical damage, etc.	Effects on nervous system (narcosis, anesthesia, paralysis, nerve damage) Annoyance or nausea caused by foul odors Reduction in personnel efficiency or capabilities Destruction of vegetation Irritation of eyes, nose, throat, or respiratory passages Loss of containment Damage to: • Respiratory system • Blood system • Body organs • Skin damage (dermatitis)

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Flammable Materials	Cellulose (plastics) Packing materials Rags Gasoline (storage and in vehicles) Coolant oil Diesel fuel Grease Hydrogen (including battery banks) Gases (other) Solvents Wood Methane Ethane Kerosene Fuel oil Hydrazine, monomethyl Hydrazine Coal Cleaning agents Lubricants Welding gases Paints and varnishes Hydraulic fluids	Combustible mixture with initiating source such as: • Open flame: – Welding processes and flame cutting – Matches, smoking – Gas heaters – Fired-process equipment and furnaces – Nearby fires • Sparks – Electrical equipment – Static discharges – Lightning – Mechanical (hot solid particles) – Chemical (carbon particles in exhausts)	Heat and high temperature effects Loss of oxygen Production of toxic gases and smoke Production of corrosive materials Destruction of material and resources Burns to personnel Explosions Equipment rendered inoperative Carbonization and contamination of material

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Flammable Materials (cont'd)	Elastomers (seals and gaskets) Furnishings and upholstery Plastics Refuse and trash Other organic materials Normally nonflammable metals in finely powdered form: • Aluminum • Magnesium • Titanium • Iron Afterburning of products of combustion of engine operations or incomplete combustion of organic materials	Combustible mixture heated to autoignition temperature by: • External heat sources: – Electrical heaters or hot plates – High-wattage electronic equipment – Boilers, radiators, steam lines, and equipment – Exhaust stacks and manifolds – Hot process equipment – Friction (mechanical, aerodynamic) • Inadequate dissipation of chemical reaction heat (spontaneous ignition): – Oily rags – Sawdust, excelsior – Subbituminous coal, lignite, peat – Powdered plastics Adiabatic compression of flammable gas mixture Hypergolic mixtures Pyrophoric reactions with air Reactions with water-sensitive materials Enriched oxygen atmospheres	

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Explosive/Pyrophoric Materials	Caps Primer cord Dynamite Powder metallurgy Dusts Hydrogen (including battery banks and water decomposition) Nitrates Electric squibs Peroxides-superoxides Solvents Ordnance or munitions systems Oxidizers Any fuel system High-pressure equipment Cryogenic liquid system Highly reactive materials Compression Monopropellants Acetylene Propane Methane Ozone Other gases (e.g., carbon monoxide) Nitro-compounds (e.g., nitro methane and nitro glycerine)	Activation of: • Explosives • Propellants in containers or cases • Combustible gases in confined spaces • Fine dusts and powders • Combustible gases or liquids: – In high concentrations – In presence of strong oxidizers – At high temperatures Activation of confined solid propellants that are: • Cracked, defective, contain voids, improperly bounded, at excessive temperature, have excess oxidizer or burning catalyst Afterburning of confined combustion products Delayed combustion in a firing chamber Hot soaking of solid propellants Overpressurization of boilers, accumulators, or other pressure vessels Failure of compression device such as an engine or compressor cylinder	Rupture of pressurized container Blast, causing: • Overpressures (impulse energy) • Collapse of nearby containers • Damage to structures and equipment • Propagation of other explosions Fragmentation, causing:

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Explosive/Pyrophoric Materials (cont'd)		Warming of closed cryogenic (or other) system containing highly volatile fluid Fuel, lubricant, or solvent in contact with a strong oxidizer Ignition of hydrogen from battery or fuel cell charging Contact between water or moisture with water-sensitive materials such as molten sodium, potassium, or lithium; concentrated acids or alkalis; or similar substances, especially in containers or other restricted volume	

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Electrical Energy	Battery banks Diesel units High voltage lines Transformers Wiring Switchgear Underground wiring Cable runs Service outlets and fittings Pumps Motors Heaters Power tools Small equipment Thermoelectric power Fuel cells Lightning Static electricity Solar cells	Accidental contact with live circuit through: • Erroneous connection • Faulty connector or connection • Touching bare conductor • Cutting through insulation • Inadequate insulation • Deteriorated insulation • Defective electrical tool or appliance Lightning strike Short circuit caused by: • Erroneous connection	Shock:
Electrical Energy (cont'd)		Breakdown of dielectric • Stray currents from: • Lightning strikes • Static electricity discharge • Inductive or capacitive coupling • Misapplied test equipment power • Cross-connections • Electrostatic discharge • Electrolytic action Power source failure caused by: • Failure of basic energy converter • Power surges causing fuse opening or circuit breaker activation • System overloading • Short-circuiting	Discharges in air may cause: • Ignition of combustibles • Surface damage to metals and other materials • Buildup and welding of contacts

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Thermal Energy • High temperature	Convection Heavy metal weld preheat Exposed steam pipes Electric heaters Fire boxes Leading melting pot Electric wiring and equipment Furnaces Plasma-arc torch Any fuel-consuming process Exothermic chemical process Solar energy Moving parts	Fire or explosion Other exothermic chemical reaction Heat engine operation Nuclear reaction Electrical resistance losses Inductive heating Friction between moving parts Internal friction due to repeated bending or repeated impacts Gas compression Exposure to sun or artificial light Inadequate heat dissipation capacity Hot spots due to coolant fluid being blocked Cooling system failure Welding, soldering, brazing, or metal cutting Proximity to operations involving large amounts of heat (radiation, convection, conduction) Immersion in hot fluid	Ignition of combustibles Initiation of other reactions Increased reactivity Melting of metals and thermoplastics Charring of organic materials Reduced strength of metals and other materials Distortion and warping of parts Weakening of soldered seams Increased evaporation rate of liquids (fuels, lubricants, toxic liquids) Expansion causing binding or loosening of parts Increased gas diffusion Reduced relative humidity Increased absolute humidity Breakdown of chemical compounds Burns to personnel Reduced personnel efficiency Heat cramps, strokes, and exhaustion Peeling of finishes, blistering of paint Decreased viscosity of lubricants Increased electrical resistance Changes in other electrical characteristics Softening of insulation and sealants Opening or closing of electrical contacts due to expansion

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Thermal Energy (cont'd)		Lack of insulation from thermal sources Organic decay processes Capacitive heating Cooler bypassed	Premature operation of thermally activated time-delay devices
• Low temperature	Any heat-removal process Refrigerating or cryogenic systems Autorefrigeration of compressed or liquified gases	Cold climate or weather Endothermic reactions Exposure to heat sink Mechanical cooling processes Gas expansion Joule-Thomson effect Rapid evaporation Immersion in cold fluid Inadequate heat supply Heat loss by radiation, conduction, or convection	Reduced reaction rate Frostbite or cryogenic burns Freezing of liquids Icing of operating equipment Condensation of moisture and other vapors Reduced viscosity Gelling of lubricants Increased brittleness of metals Loss of flexibility of organic materials Contraction effects, especially opening of cracks in metal Delayed ignition in furnaces and combustion chambers Combustion instability in engines Changes in electrical characteristics Jamming or loosening of moving parts due to contraction Delayed operation of thermally activated time-delay devices

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Kinetic Energy • Kinetic-Linear	Scraping equipment Cars Trucks Buses Forklifts Carts Dollies Conveyors Earth removal equipment Railroad Surfaces Obstructions Shears Presses Crane loads in motion Pressure relief valve blowdown Power-assisted operations	Acceleration: • Vehicle, body, or fluid being set into motion or increasing speed • Any falling body or dropped object • Vehicle on downgrade • Uncontrolled loss of altitude or height • Impact of another body • Force applied against an unrestrained body • Turbulence: clear air, thunderstorm, thermal, terrain • Sudden violent maneuver • Sudden valve opening in a pressure system Deceleration:	Injury to personnel A person may be: • Hit by an object set in motion by a sudden change in velocity • Thrown against a hard surface during sudden deceleration • Thrown backward during sudden forward acceleration • Thrown against ceiling in a sudden drop or maneuver Overloading and deformation of structural members
• Kinetic-Rotational	Centrifuges Motors Pumps/fans Cafeteria equipment Laundry equipment Gears Shop equipment (grinders, saws, brushes, etc.) Floor polishers Robot-assisted operations Turbines		

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
Potential Energy • Pressure – High pressure	Boilers Heated surge tanks Autoclaves Test loops and facilities Gas bottles containing compressed gases Pressure vessels Coiled springs Stressed members Gas receivers Hydraulic systems Pneumatic systems Cryogenic systems Pressurized containers Compressors	Overpressurization Connection to excessively high pressure system Excessively high combustion rate in combustion chamber with restricted exhaust passage No pressure relief valve or vent Faulty pressure relief valve or vent Heating gases in closed containers Heating fluids with high vapor pressures Warming cryogenic liquids in a closed or inadequately vented system Impact Blast Failure or improper release of connectors Inadequate restraining devices High acceleration of liquid system Water hammer (hydraulic shock)	Container ruptured or crushed Blast Fragments of ruptured container blown about Unsecured container propelled by escaping gas Eye or skin damage due to blowing dirt or other solid particles Whipping about of hoses Increase in chemical reaction rate Increase in burning rate Lung and ear damage Cutting by thin, high-pressure jets Shock Leaks in lines and equipment designed for lower pressures Blowout of seals and gaskets Permanent deformation of metals Excessively rapid motion of hydraulically or pneumatically activated equipment

HAZARD IDENTIFICATION GUIDESHEET

HAZARD	EXAMPLE SOURCES	INITIATING EVENT	POTENTIAL CONSEQUENCES
– Low pressure	Vacuum Systems	Inadequate design against implosion forces Rapid condensation of gas in a closed system Decrease in gas volume by combustion Cooling of hot gas in a closed system Draining without adequate venting	Unbalanced forces Pressurized vessel collapses Pressurized vessel bursts Increased leakage if differential pressure increases
• Mass/gravity/height	Stairs Lifts Cranes Bucket and ladder Trucks Slings Hoists Elevators Jacks Scaffolds and ladders Crane cabs Pits Excavations Elevated doors Suspended loads		