

ATTACHMENT A: TO BE USED IN ANSWERING QUESTION 1**HAZARD IDENTIFICATION CHECKLIST**

This list is primarily for use during Preliminary Hazard Analysis and design reviews. It is intended to be thought provoking but has all the limitations of generic data. In no circumstances should it be considered complete or necessarily applicable to all systems.

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1 TOXIC MATERIALS

Possible Effects	Possible Causes
<p>Injury to:</p> <ul style="list-style-type: none">• Respiratory System• Blood System• Body Organs• Skin• Nervous System• Irritation of eyes, nose, throat, or respiratory passages.• Asphyxiation• Reduction in personnel efficiency or capabilities• Cancer• Destruction of vegetation and animal life.	<p>Gas which can be inhaled:</p> <ul style="list-style-type: none">• From leak or release from pressurised system• Evaporation of spilled liquid or from open container• Product of reaction between two or more chemicals• Product of combustion• Outgassing of gasses in confined spaces <p>Liquid or solid which can be ingested or absorbed:</p> <ul style="list-style-type: none">• Fine metal or other particulate matter• Food or other material taken in by mouth• Lack of skin protection• Inadequate personal cleanliness• Injected by high-pressure spray• Through an open wound <p>Inadequate oxygen for respiration due to:</p> <ul style="list-style-type: none">• High altitudes• Dilution by inert gases• Combustion that consumes all available oxygen• Insufficient ventilation if occupied, enclosed space• Atmospheric pollution by industrial, automobile, or other exhausts• Blockage of respiratory organs by particulate matter in air. <p>Use of food, cosmetic, or drug that is a carcinogen:</p> <ul style="list-style-type: none">• Contaminated food• Bacteria and viruses• Improper / unknowing use of drugs

2 PRESSURE

Possible Effects	Possible Causes
<p>High Pressure Injury:</p> <ul style="list-style-type: none"> • Eye or skin damage due to blown dirt or other solid particles • Whipping hoses hit personnel • Lung, ear, and other body damage by over-pressurisation • Cutting by thin, high-pressure jets <p>Container explodes, is ruptured (internal pressure) or crushed (external pressure):</p> <ul style="list-style-type: none"> • Blast effects • Fragments of ruptured container blown about <p>Leakage:</p> <ul style="list-style-type: none"> • Leaks in lines and equipment designed for lower pressures • Blowout of seals and gaskets • Release of toxic, corrosive, flammable, odorous, or high-temperature liquid or gas • Loss of system liquid or gas • Early fuel exhaustion • Loss of system pressure • Loss of lubricants • Contamination and degradation of materials • Slippery surfaces • Short-circuiting of electrical circuits and equipment • Displacement of air or other gas by liquid • Vibration and noise <p>Permanent deformation of metal containers</p> <p>Excessively rapid motion of hydraulically or pneumatically activated equipment, rams, pistons</p> <p>Unsecured container propelled about by escaping gas</p>	<p>Over-pressurisation:</p> <ul style="list-style-type: none"> • Connection to system with excessively high pressure • Regulator failure • Heated gases in close containers • Heating fluids with high vapour pressures • Water hammer (hydraulic shock) • Deep submersion • High acceleration of liquid system • Warming cryogenic liquid in a closed or inadequately ventilated system <p>Excessively high combustion rate for boiler, evaporator or other fired vessel</p> <p>Pressure relief failure:</p> <ul style="list-style-type: none"> • Incorrectly installed, incorrectly adjusted, not calibrated • No pressure relief valve or vent • Faulty pressure relief valve or vent • Relief inadequately sized • Relief valve operation not checked regularly by procedure <p>Failure at normal pressure:</p> <ul style="list-style-type: none"> • Deteriorated pressure vessel or lines • Inadequate connection • Failure or improper release of connectors • Inadequate restraining devices <p>Leakage:</p> <ul style="list-style-type: none"> • Reservoir losses • Overfilling of container • Erroneously open drain or connection • Inadequately fitted or tightened parts • Worn parts and connections • Fittings loosened by vibration • Cracks caused by structural failure • Porosity or other weld defect • Contact surfaces inadequately finished or dirty • Wrong type of gasket or seal • Cuts in seals, gaskets, or hoses • Hose holes caused by wear, kinking, or deterioration • Hole torn by impact

2 PRESSURE (Continued)

Possible Effects	Possible Causes
<p>Low Pressure:</p> <ul style="list-style-type: none">• System inoperable• Implosion of pressure vessel• Inadequate air for respiration• Physiological damage (atelectasis) <p>Pressure Changes:</p> <ul style="list-style-type: none">• Compressive heating• Joule-Thomson cooling• Physiological disturbances (cramps, the bends)• Condensation of moisture	<p>Low Pressure:</p> <ul style="list-style-type: none">• Compressor or pump failure• Condensation or cooling of gas in a closed system• Decrease in gas volume due to combustion in a closed system• Inadequate design against implosion forces• Increased altitude <p>Pressure changes:</p> <ul style="list-style-type: none">• High gas compressor• Rapid Expansion of gas• Rapid change of altitude• Rapid rise toward surface from underwater• Explosive decompression• Changes of temperature

3 HEAT AND TEMPERATURE

Possible Effects	Possible Causes
<p>High Temperature:</p> <ul style="list-style-type: none"> • De-stabilisation, deterioration of stored explosives • Burns to personnel • Reduced personnel efficiency and errors • Heat cramps, strokes, and exhaustion • Reduced relative humidity • Ignition of combustibles • Charring of organic materials • Reduced strength of metals and other materials • Melting of metals and thermoplastics • Distortion and warping of parts • Weakening of soldered seams • Peeling of finishes, blistering of paint • Expansion causing binding or loosening of parts • Decreased viscosity of lubricants • Increased evaporation and leakage of liquids (fuels, lubricants, toxic liquids) • Increased gas diffusion • Increase in stored gas pressure • Increased reactivity • Breakdown of chemical compounds • Premature operation of thermally activated devices • Increased electrical resistance • Opening or closing of electrical contacts due to expansion • Changes in other electrical characteristics <p>Low Temperature:</p> <ul style="list-style-type: none"> • Frostbite or cryogenic burns • Icing of operating equipment • Freezing of liquids • Condensation of moisture and other vapours • Reduced viscosity of liquids • Gelling of oils and lubricants • Reduced reaction rates • Increased brittleness of metals • Loss of flexibility of plastics and organic metals • Contraction effects, especially opening of cracks in metals • Jamming or loosening of moving parts due to contraction • Delayed or loosening of moving parts due to contraction • Delayed ignition in furnaces and combustion chambers • Combustion instability in engines • Changes in electrical characteristics 	<p>High Temperature: Generation or absorption of heat from:</p> <ul style="list-style-type: none"> • Heat engine operation • Fire or explosion • Other exothermic chemical reaction • Electrical heating • Solar heating • Aerodynamic or other vehicular friction • Friction between moving parts • Internal friction due to repeated bending or other work process such as repeated impacts • Gas compression • Biological or physiological processes • Welding, soldering, brazing or metal cutting • Weather • Organic decay processes • Nuclear reaction • Immersion in hot fluid • Lack of insulation from thermal sources • Inadequate heat dissipation capacity or cooling system failure • Hot spots due to coolant fluid circulation being obstructed. <p>Low Temperature: Loss of heat because of:</p> <ul style="list-style-type: none"> • Mechanical cooling of refrigeration processes • Heat loss by radiation, conduction, or convection • Cold climate or weather • Endothermic reactions • Rapid evaporation • Immersion in cold fluid • Presence of cryogenic liquid • Presence of cryogenic liquid • Gas expansion • Joule-Thomson effect

3 HEAT AND TEMPERATURE (Continued)

Possible Effects	Possible Causes
Temperature Variations: <ul style="list-style-type: none">• Dimensional changes, especially in metals• Cycling fatigue of metals• Pressure changes in confined gases and liquids• Variations in stresses	Temperature Variations: <ul style="list-style-type: none">• Stopping and starting of heat engines and other powered equipment• Diurnal heating and cooling• Gain and loss of heat due to changes in radiation, conduction or convection

4 EXPLOSIVES AND EXPLOSIONS

Possible Effects	Possible Causes
<p>Blast effects:</p> <ul style="list-style-type: none"> • Over-pressures • Container rupture • Collapse of nearby containers • Damage to structures, equipment and vehicles • Propagation of other explosions <p>Fragmenting effects:</p> <ul style="list-style-type: none"> • Holing of nearby containers, equipment and vehicles • Impact of pieces against personnel, equipment, vehicles and structures • Dispersion of burning, hot, combustible or corrosive materials <p>Heat effects:</p> <ul style="list-style-type: none"> • Dispersion of toxic materials • Injury to personnel 	<p>Inadvertent activation by electrical current, heat, electromagnetic radiation, lightning or other static electricity, impact or fire of:</p> <ul style="list-style-type: none"> • Explosives • Combustible gases in containers or confined spaces • Fine dusts or powders • Combustible gases or liquids: <ul style="list-style-type: none"> - In high concentrations - In presence of strong oxidisers - At high temperature <p>After burning of confined combustion products</p> <p>Delayed combustion in a cold firing chamber</p> <p>Ignition of hydrogen produced by battery charging</p> <p>Warming a cryogenic liquid in a closed system</p> <p>Warming a liquid with a high vapour pressure in a closed container</p> <p>Ignition of sensitive gases, such as acetylene</p> <p>Contact between water or moisture and a water-sensitive material such as molten sodium, potassium or lithium; concentrated acids or alkalis; or similar substances.</p> <p>Activation of confined solid propellants that are: cracked, defective, improperly bonded, at excessive temperatures, have excess oxidiser or burning catalyst.</p> <p>Defective solid propellant motor case.</p> <p>Fuel, lubricant, or solvent in contact with strong oxidiser.</p>

5 ELECTRICAL AND ELECTRONIC

Possible Effects	Possible Causes
<p>Electric Shock</p> <p>Thermal effects:</p> <ul style="list-style-type: none"> • Burns • Degradation of performance • Overloading and burnout of equipment • Ignition of combustibles • Melting of soldered connections • Degraded reliability • Softening and melting of plastics • Circuit breakers, fuses and cut-outs opening deactivating equipment <p>Arcing and sparking causes:</p> <ul style="list-style-type: none"> • Ignition of combustibles • Build-up and welding of contacts • Surface damage to metals • Interference with electrical equipment operation • Electrical noise and cross talk <p>Inadvertent activation of the product or a device:</p> <ul style="list-style-type: none"> • Untimely equipment starts • Endangering personnel working on or in equipment supposedly inoperative • Safety breaks inadvertently activated <p>Electrical system failure, making:</p> <ul style="list-style-type: none"> • System inoperative in hazardous situation • Safety Equipment inoperative • Release of holding devices • Detection and warning devices inoperative • Interruption of communications 	<p>Accidental contact with live circuit through:</p> <ul style="list-style-type: none"> • Touching bare conductor • Inadequate insulation • Cutting through insulation • Deteriorated insulation • Defective assembly of electrical tool or appliance • Erroneous connection • Lightning strike <p>High IR losses</p> <p>Inadequate cooling</p> <p>Overloads</p> <p>Short circuits caused by:</p> <ul style="list-style-type: none"> • Inadequate or deteriorated insulation • Erroneous connection • Bare conductors touching • Dirt, contamination, or moisture • Corrosion • Excessive or loose particles of solder or cut wire • Bent connector pins • Component failure • Improper wiring • Improper mating of connectors • Lightning strike <p>Gaseous gap between conductors caused by:</p> <ul style="list-style-type: none"> • Loose connection • Opening of switches, relays, circuit breakers and similar devices • Electric arc welding • Lack of bonding or grounding • Deteriorated or inadequate insulation

5 ELECTRICAL AND ELECTRONIC (Continued)

Possible Effects	Possible Causes
Explosion of: <ul style="list-style-type: none">• Batteries• Circuit breakers, transformers, and similar equipment• Capacitors	Stray current from: <ul style="list-style-type: none">• 'Sneak' circuit• Cross-connection• Personnel error• Misapplied test equipment power• Static electricity discharge• Coupling Malfunction caused by: <ul style="list-style-type: none">• Power source failure• Power surge opening fuse or circuit breaker• Component failure• System overloading Short-circuit Operator error Lightning strike Short circuiting Present of liquid or contaminants which disassociate violently when current passes through Burning/heat due to resistance at contacts or connections

6 VIBRATION AND NOISE

Possible Effects	Possible Causes
Effects on personnel:	Irregular motion of rotating parts
<ul style="list-style-type: none"> • Fatigue • Inability to read instruments or to activate controls • Involuntary reaction to sudden loud noise • Injury to hearing ability • Raynaud's disease • Interference with communications 	Bearing deterioration and misalignment
Damage to equipment:	Irregular or cyclic motion
<ul style="list-style-type: none"> • Metal fatigue and other changes in crystalline structure • Loosening of bolts or other fastened parts • Breaking of lead wires, laments, and supporting parts • Crazeing and flaking of finishes 	Loose or undersized mountings
Chattering of spring-type contacts, valves and pointers	Pump or blower cavitation
Possible false readings on pointer type devices	Reciprocating motion
Static electricity generated between plastic surfaces	Vibrating tools
	Misaligned equipment in motion
	Lack of vibration isolators
	Scraping of hard surfaces against each other, bottoming or failure of shock mounts or absorbers
	Fluid dynamics:
	<ul style="list-style-type: none"> • Escaping high-velocity gas • High-velocity fluid hitting a surface or object that can vibrate • Pneumatic or hydraulic shock (water hammer) • Aerodynamic flutter or buzz • Jet engine exhaust • Sonic booms and other shock waves
	High amplified music or other sounds
	Explosions or other violent ruptures
	Lack or failure of sound isolation devices such as mufflers

7 RADIATION

Possible Effects	Possible Causes / Sources
<p>Ionising:</p> <ul style="list-style-type: none"> • Tissue damage • Degradation of electronic equipment and changes to their characteristics • Degradation of material strength • Radioactive contamination <p>Microwave / Radio Frequency:</p> <ul style="list-style-type: none"> • Heating of metals and tissue by induction • Cataracts or other eye injury • Interference with operation of other electronic equipment • Activation of sensitive electro explosives <p>Infrared Radiation:</p> <ul style="list-style-type: none"> • Undesirable heat gain or temperature rise • Increased temperature in enclosed space • Overheating • Skin burns • Charring of organic materials • Initiation of flammables <p>Visible Light:</p> <ul style="list-style-type: none"> • Temporary blindness • Deterioration of photosensitive material <p>Ultraviolet Light:</p> <ul style="list-style-type: none"> • Vision damage and other eye injuries • Skin burns • Deterioration of rubber, plastics and other materials • Ozone or nitrogen oxide generation • Decomposition of chlorinated hydrocarbons • Colour fading of fabrics etc. <p>Laser:</p> <ul style="list-style-type: none"> • Personnel injury • Equipment damage <p>Electromagnetic Pulse:</p> <ul style="list-style-type: none"> • Damage to electrical/electronic components, equipment and systems. • Loss of magnetically stored data • Lack of communications 	<p>Ionising:</p> <ul style="list-style-type: none"> • Inadequate containment of radioactive materials • Accidental exposure to ionising source • Inadvertent production of rays by radar, communications or TV components operating at potentials over 15,000V • Use of x-ray equipment • Nuclear reaction • Betalights <p>Microwave / Radio Frequency:</p> <ul style="list-style-type: none"> • Radar and communications equipment operation • High Power microwave equipment operation • Other microwave generator operation (ovens) <p>Infrared Radiation:</p> <ul style="list-style-type: none"> • Flames • Solar radiation • Infrared heaters • Highly heated surface • Lasers <p>Visible Light:</p> <ul style="list-style-type: none"> • Strong sunlight • High-intensity light and flashlamps • Electric arcs <p>Ultraviolet Light:</p> <ul style="list-style-type: none"> • Sunshine • Electric welding arcs • Germicidal lamps • Lasers • Photocopying machines <p>Laser:</p> <ul style="list-style-type: none"> • Inadequate / improper means of excluding access to beam path • Failure of control or optical systems • Beam reflection <p>Electromagnetic Pulse:</p> <ul style="list-style-type: none"> • Inadequate exposure controls • Control system failure • Inadequate shielding and grounding

8 MECHANICAL HAZARDS

Possible Effects	Possible Causes
Part of body caught in pinchpoint	Guard or barrier not provided Guard removed Design of guard inadequate Lack of interlock Failure of interlock Interlock bypassed
Cuts, scratches, and puncture wounds	Sharp points and edges Rough surfaces Ejected parts and materials Broken parts
Bruises and crushed or broken bones	Fall from an elevated position Impact by moving equipment or part Falling objects, covers, or parts Toppling or overturning of unstable products Part of body caught in pinchpoint
Strain	Excessive weight for person to lift Awkward object to lift

9 FLAMMABILITY AND FIRES

Possible Effects	Possible Causes
<p>Injury to Personnel:</p> <ul style="list-style-type: none"> • Burns • Toxic gas and smoke inhalation • Other heat and high-temperature effects • Deprivation of oxygen for breathing <p>Destruction of material and resources:</p> <ul style="list-style-type: none"> • Carbonisation and contamination of material • Equipment rendered inoperative <p>Damage to the environment:</p> <ul style="list-style-type: none"> • Production of corrosive contaminants • Destruction of wildlife and vegetation • Production of airborne particulate matter 	<p>Fuel / Oxidizer mixture with ignition source:</p> <p>Fuels:</p> <ul style="list-style-type: none"> • Heating fuels • Engine fuels • Paint and varnishes • Solvent and cleaning agents • Wood and wood products • Welding and process gases • Lubricants • Rubber and plastics • Furnishings and upholstery • Clothing • Refuse and trash • Vegetation • Other organic materials • Hydraulic and coolant fluids • Normally low-combustible materials in the presence of strong oxidisers or high temperatures • Normally non-flammable metals in finely powdered form • Hydrogen from charging batteries • Products of incomplete combustion of organic materials <p>Oxidisers:</p> <ul style="list-style-type: none"> • Oxygen in air • Oxidising compounds • Oxidising gases • Lightning strikes <p>Ignition Source:</p> <ul style="list-style-type: none"> • Open flames • Arcs and sparks • Hot surfaces • Lightning strikes • Spontaneous ignition • Adiabatic compression • Hypergolic mixtures • Pyrophoric mixtures • Water-sensitive reactive materials

10 CHEMICAL REACTIONS

Possible Effects	Possible Causes
<p>Corrosion:</p> <ul style="list-style-type: none"> • Material degradation • Reduction in strength • Binding of moving surfaces, nuts and other parts • Loss of resiliency in springs • Surface roughness • Contamination of the system • Changes in physical and chemical properties • Holing of containers • Failures of load-bearing structures • Failures of electrical connections <p>Chemical:</p> <ul style="list-style-type: none"> • Explosions • None explosive exothermic reactions • Hot gases • Material degradation • Swelling of organic materials <p>Fire (see checklist for Flammability and Fires)</p> <p>Oxidation (other than by air):</p> <ul style="list-style-type: none"> • Increased reactivity of combustibles • Easier ignition of flammables • Normally low flammable materials may burn easily • May cause violent or explosive reactions • Partner in hypergolic reactions • Corrosion of metals • Deterioration of rubber, plastics or other organic materials <p>Replacement, chemical:</p> <ul style="list-style-type: none"> • Exothermic reactions • Explosions • Violent spraying of corrosive material 	<p>Leakage of corrosive or reactive substances</p> <p>Condensation of atmospheric moisture</p> <p>Gases released from industrial processes</p> <p>Acids resulting from combustion</p> <p>Smog</p> <p>Incompatibility of materials</p> <p>Salt atmosphere or salt used for ice melting on roads</p> <p>Acids created by lightning</p> <p>Damaged protective surfaces</p> <p>Electrolytic action (dissimilar metals)</p> <p>Stray electrical currents</p> <p>Ground moisture</p> <p>Moisture from respiration or vegetation</p> <p>Presence of humidifying equipment</p> <p>Flooding or immersion</p> <p>Temperature of compound raised to point reaction begins</p> <p>Presence of suitable catalyst</p> <p>Ultraviolet radiation</p> <p>Heavy shock</p> <p>Chemical combination involving an oxidant such as:</p> <ul style="list-style-type: none"> • Oxygen or ozone • A halogen or halogen compound • Oxidising acids and their salts • Nitrates, chlorates, perchlorates, hyperchlorites, chromates • Higher valence compounds of mercury, lead, selenium and thallium • Fluorine and water • Sodium and water • Nitric acid and water

11 ACCELERATION

Possible Effects	Possible Causes
<p>Injury to personnel. A person may:</p> <ul style="list-style-type: none"> • Be hit by an object set in motion inadvertently • Hit a hard surface during a sudden start or change in velocity • Hit a sharp edge or point when startled • Fall or be thrown backward during sudden forward acceleration • Loss his or her balance under centrifugal force • Be thrown against the ceiling of a vehicle in a sudden drop or other falling manoeuvre • Fall to the ground or other hard surface • Be hit by an impacting fragment or missile <p>Overloading, deformation and failure of structural members</p> <p>Deflection of piping</p> <p>Deflection and bottoming of shock isolated parts and springs</p> <p>Cracking or breaking of lines or equipment by impact of high-velocity fragments</p> <p>Breakage of cables, ropes, chains and pins by sudden overloads</p> <p>Fracture of brittle materials</p> <p>Opening or closing of hinged parts, doors or panels</p> <p>Seating or unseating of spring-loaded valves or electrical contacts</p> <p>Shorting of closely spaced electrical parts</p> <p>Bending of bimetallic strips, thus changing instrument readings and calibration</p> <p>Pressure surges in liquid systems (water hammer)</p> <p>Sloshing and loss of liquids from open containers</p> <p>Loss of fluid pressure</p>	<p>Acceleration:</p> <ul style="list-style-type: none"> • Vehicle, body, or fluid being set into motion or increasing speed • Outside force applied against an unrestrained body • Any falling body or dropped object • Vehicle on a downgrade • Uncontrolled loss of altitude or height • Impact by another body • Turbulence or motion over rough terrain • Sudden valve opening in a pressure system • Centrifugal motion • Sudden reaction by a surprised person <p>Deceleration:</p> <ul style="list-style-type: none"> • Vehicle, body or fluid decreasing speed or being stopped • Impact due to: <ul style="list-style-type: none"> - Hitting another body, a structure or the terrain - A falling body being arrested - Inadequate shock-absorbing materials or devices - Sudden closing of a valve in a fluid system with high velocity flow - Friction or other resistance to motion <p>Failure to accelerate or decelerate:</p> <ul style="list-style-type: none"> • Inadequate or loss of motive power • Friction or drag • Failure of an unlatching or restraining mechanism to release • Loss, failure or inadequate braking capacity • Wet, oily or other slippery surfaces

12 HUMAN FACTORS

Causes of Primary Errors

1. Inability to concentrate because of unsafe condition of equipment.
2. Critical components installed incorrectly.
3. Untimely activation of equipment
4. Controls activated in wrong order
5. Error or delay in reading instruments.
6. Failure to note critical indication.
7. Vibration and noise cause irritation and inability to read meters and settings and to operate controls.
8. Error or delay in use of controls.
9. Control setting by operator not precise enough
10. Controls broken by excessive force

13 MISCELLANEOUS HAZARDS

Possible Effects	Possible Causes
<p>Contamination:</p> <ul style="list-style-type: none"> Increased friction and binding between sliding surfaces Clogging and blocking of lines, valves, regulators, filters, nozzles, orifices Scoring and abrading of closely fitted moving surfaces Erosion of lines and equipment by large particles in fluids Spring contraction prevented by large particles between coils Contamination of potable liquids Destruction of vegetation and marine life Source of odours Interference in seating of valves Flammable particles compressed in air could ignite Accumulations of flammable contaminants could ignite Deterioration of fluids Resilient materials punctured Electrical leakage through dirty insulation Reduction in lubricity Induces corrosion <p>Lubricity:</p> <ul style="list-style-type: none"> Slips and falls Loss of control of a moving vehicle Loss of friction for braking Loss of friction for traction <p>Odour:</p> <ul style="list-style-type: none"> Annoyance, leading to tendency to make errors Reduced ability to withstand other adverse environmental conditions Nausea 	<p>Airborne dirt or other environmental particles</p> <p>Leakage or spillage of petroleum or its products, solvents or other deleterious material</p> <p>Polymerisation</p> <p>Washer water from oil and chemical process or storage tanks</p> <p>Misalignment or poor fitting of parts</p> <p>Discharge from industrial processes or plants</p> <p>Internal combustion engine exhaust</p> <p>Particulate matter from cutting and grinding</p> <p>Cuttings and pieces of organic fibres</p> <p>Plastic and elastomer fragments</p> <p>Process residues</p> <p>Filtration system overload or failure</p> <p>Metal particles from moving surfaces in contact</p> <p>Corrosion</p> <p>Windborne particulate marcer</p> <p>Surface material hard and very smooth</p> <p>Water, oil or other lubricant on a smooth, hard, flat surface</p> <p>Presence of water on a greasy surface</p> <p>Ice on a horizontal surface</p> <p>Characteristic of a material</p> <p>Leak or spill of an odorous fluid</p> <p>Products of a chemical reaction</p> <p>Breakdown of molecules when heated</p> <p>Voiatilisation of material when heated</p> <p>Rotting material</p> <p>Release of a volatile material from a mixture</p> <p>Outgassing from a porous material of a substance used in its manufacture.</p>