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EHSEC

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Occupational Health and safety risk management



In France, since November 2002 each company must have a document where occupational health and safety risks are identified and analyzed, and mitigation is identified and carried out

Many documents available (good practices, regulations, indicators, etc.)

but

There is a need for a general approach

Analysis of occupational health and safety risks



Sources of danger



High energies (provided to, contained in items)

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High energies

- which feed the equipment
- obtained by transformation
- stored, potential or residual

- Electric energy
- Pressure energy from fluids (pneumatic energy (compressed air), hydraulic energy (pressurised water), pressurised steam/gas, etc.)
- Potential mechanical energy (mass in height position, spring, ...)
- Kinetic energy (masses, surfaces and aggressive forms in motion, projection of material, ...)
- Thermal energy (and cooling energy)
- Chemical energy (flammable or explosive products)
- Light or radiation energies (dazzling light, high radiations, ...)
- Magnetic energies
- Strong and discontinuous sound energy (detonation, ...)

• ...

Sources of danger





Toxic or pathogenic products

Used or produced by the equipment or stored in its environment

- Present in the atmosphere (gases, aerosols, vapors, dusts)
- Present on surfaces (liquids, solids)

Characteristics of the product:

- Paths of toxicity:
 - Dermal toxicity
 - Toxicity by inhalation
 - Toxicity by ingestion
- Types of toxicity:
 - Chemical or physical toxicity (ammonia, hydrochloric acid, ..., mercury, lead, cadmium, ..., asbestos, combustion products, ...)
 - Biological (bacteria (legionella, ...), protozoa (amoebas, ...), prions, viruses, parasites, venoms, toxins)
- Effects :
 - carcinogenic, mutagenic, reprotoxic
 - Infections, allergies, diseases

Sources of danger





Unsuitable quantity of vital element

- Sub-oxygenation or over oxygenation:
 - Confined work areas
 - Work under water
 - Work at high altitude
 - Presence of gas
 - Presence of liquids presenting a danger of drowning
 - Presence of solids presenting a danger of burial
 - Presence of dust presenting danger of asphyxia
- Dangers : anoxia, asphyxia

Sources of danger





Elements, situations that can divert the energy (potential or kinetic) of the person against herself



- Condition of floors and spaces (slippery floor, uneven floor, obstacles in traffic area, etc.)
- Condition of spaces (congested space, obstacles at human height, protruding or cutting parts, rough surfaces, etc.)
- Differences of level (pits, stairs, elevators, walkways, balconies, ladder, sloping floor, etc.)
- etc.

Sources of danger





Dangerous working conditions and environments

Working environments that may have an impact on health

- Atmospheric conditions (weather, humidity, drought)
- Sound ambience (continued)
- Bright atmosphere (insufficient illumination, dazzling illumination)
- Thermal ambience (exposure to high temperatures or low temperatures)
- Vibrations
- Radiation (ionizing, electromagnetic, optical)
- Hyperbaric (>0,1 bar)
- etc.

Working conditions that may have an impact on health

- Work on screen
- Uncomfortable positions
- Manual handling operations (mass handling)
- Situations of stress (dangers, time, psychological pressure, etc.)
- Rhythm of work (fatigue, sleep disorders)
- etc.



Dangerous working conditions and environments

Working situations that may have an impact on <u>safety</u> (pre or post-accident)

- Movement of the person via transportation (road, rail, air, sea/river, ...)
- Circulations of persons or machineries
- Hot points due to the intervention (oxy-cutting, sawing, grinding, welding)
- Projections provided by the intervention (oxy-cutting, grinding, welding, blowing, sandblasting, high-pressure cleaning)
- Equipment incompatible with the characteristics of the intervention area (explosive atmosphere, flammable elements, ...)
- Obstructing the avoidance of a hazard (lack of visibility or audibility, insufficient or faulty measuring equipment, restricted area, fatigue, stress)
- Insufficient means of communication (post-accident hazard)
- Isolated work (post accident hazard)

Analysis of occupational health and safety risks



Risks to personal health & safety - definition



Risks to personal health - definition



Severity of danger



(Probability)

Causes of accidents



Risk Factors for errors and inappropriate actions

Work organization :

- Documentation or procedures that are absent, incorrect, incomplete, not updated, in a foreign language, ...
- Reduced safety conditions (unidentified responsible for access to the intervention zone, lack of risks analysis and mitigation, etc.)
- Failure to identify equipment
- Isolated work
- co-activity
- inadequate training and experience (outsourcing, ...)
- Stress, tiredness (working hours, ...)
- etc.

Risk Factors for errors and inappropriate actions

Conditions of intervention:

- Scuba gear, gloves or other bothersome PPE ...
- Restricted area
- Uncomfortable positions, binding postures
- Insufficient lighting, reduced visibility, stroboscopic effect
- Noise prejudicial to communication
- Unsuitable or inadequate tools
- etc.

Scenario of occurrence of the dangerous event



Determine scenario of occurrence of the dangerous event and its probability

Vulnerability of the person



Occurrence and consequences of an event



Frequency of occurrence

Probability of occurrence of dangerous situation considering experience and preventive risk control (maintenance, operating procedures and control, logistic, organisation, competences, knowledge of dangerous situations and scenarios, ...)

Severity of danger

Intensity of danger, dose/amplitude, isolation devices (separation)

Vulnerability-level

PPE/CPE, Number of persons simultaneously exposed, safety procedures and devices (lockout, markup, signalling, ...), distance to danger, avoidances, Logistic equipment, organisation, competences, ...

Vulnerability-presence

Time/frequency of exposure

Analysis of occupational health and safety risks



Defence barriers



Lockout systems : Examples



From French Standard NF X60-400

Defense barriers against harmful working conditions



Periodic loop of risk ranking



Assessment of occupational Health and Safety risks

How to quantify the risks to prioritize them ?





General model



Analysis of occupational health and safety risks



Reduce the consequences of dangers



Insect bites etc.

Implementation for industrial site (Combined-Cycle Power Plant)

IDENTIFICATION OF DANGERS						SEVERITY, VULNERABILITY AND CONSEQUENCES					
Work place	Concerned personnel	Activities	Classes of dangers	Dangers	Comments	Protection to reduce the severity of the danger	Protection to reduce vulnerability (distance, PPE, CPE,)	Severity of the danger with existing protections	Number of persons exposed simultaneously	Consequences of danger with existing protections	

DANGER OCCURRENCE AND EXPOSURE TO DANGER							RISK	CONTROL TO IMPLEMENT	RESIDUAL RISK	EMERGENCY ACTIONS
Causes of danger	Risk factors	Prevention to reduce inadvertant actions, their effects and failure modes occurrrence	Frequency of the dangerous situation (with existing prevention)	exposure duration (/frequency)	Frequency of the danger based on exposure	Uncertainty on the frequency of the danger	Criticality (level of risk)	Additional control to implement	Residual risk	Emergency actions
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Outputs