

Types of JSA

1. Physical Job safety analysis

JSA which deals with mechanical failure, falling, skidding etc., are classified thus

2. Chemical Job safety analysis

JSA which deals with chemicals like flammables, combustibles, explosives etc., are classified thus

High pressure and high temperature operations

Install and operate the equipment within suitable barricade, if required, using appropriate safety accessories and operating in full compliance with local safety codes and rules.

Establish training procedures to ensure that any person handling the equipment knows how to use it properly.

Maintain the equipment in good condition and establish procedures for periodic testing to be sure that the vessel remains structurally sound.

Reactions involving highly reactive compounds such acetylene, butadiene, dioxane, ethylene oxide, oxygen and all strong oxidizing agents, must be handled cautiously. Close attention must also be given to any reactions that might release sudden surges of heat and pressure, and to any by-products or end-products suspected to have explosive or detonating properties. It is always advisable to run preliminary experiments using small volumes of reactants when starting work with new or unfamiliar materials. The amounts can be increased later after it has been shown that the reaction proceeds smoothly with no indication of erratic or explosive behavior.

The maximum pressure and temperature at which any reactor or pressure vessel can be used will depend upon the design of the vessel and the materials used in its construction. Since all materials lose strength at elevated temperatures, any pressure rating must be stated in terms of the temperature at which it applies. Catalog listings for Parr reactors and pressure vessels show the maximum allowable working pressure at 350 °C for vessels made of Type 316 stainless steel (except certain high pressure/high temperature units which are rated at 500 °C). Pressures are shown in pounds per square inch gage pressure (psig) and in bars. The table of Pressure Rating Factors shown below provides a set of multipliers which can be used to convert pressure ratings for T316SS vessels from 350 °C to higher or lower temperatures. It can also be used to determine the pressure rating for a vessel of the same design made of a material other than T316 stainless steel.

MATERIALS OF CONSTRUCTION

Type 316 Stainless Steel is an excellent material for use with most organic systems. A few organic acids and organic halides can, under certain conditions, hydrolyze to acetic, formic and other organic acids that are routinely handled in T316SS. T316SS is not normally the material of choice for inorganic acid systems. At ambient temperatures it does offer useful resistance to dilute sulfuric, sulfurous, phosphoric and nitric acids which readily attack T316SS in higher concentrations and temperatures. Halogen acids attack all forms of stainless steel rapidly, even at low temperatures and in dilute solutions. T316SS offers excellent resistance to surface corrosion by caustics, but this is misleading. Caustics can cause stress corrosion cracking in stainless pressure vessels. This phenomenon begins to appear at temperatures just above 100 °C and has been the most common cause of corrosion failure in stainless laboratory vessels. T316SS does offer good resistance to ammonia and to most ammonia Nominal Chemical Composition compounds.

Zirconium offers excellent resistance to hydrochloric and sulfuric acids but, as with Hastelloy B-2, oxidizing ions such as ferric, cupric and fluorides must be avoided. Zirconium also offers good resistance to phosphoric and nitric acids, and to alkaline solutions as well.

Lethal dose and lethal concentration

LD stands for "Lethal Dose". LD_{50} is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. The LD_{50} is one way to measure the short-term poisoning potential (acute toxicity) of a material.

Toxicologists can use many kinds of animals but most often testing is done with rats and mice. It is usually expressed as the amount of chemical administered (e.g., milligrams) per 100 grams (for smaller animals) or per kilogram (for bigger test subjects) of the body weight of the test animal. The LD_{50} can be found for any route of entry or administration but dermal (applied to the skin) and oral (given by mouth) administration methods are the most common.

Chemicals can have a wide range of effects on our health. Depending on how the chemical will be used, many kinds of toxicity tests may be required.

Since different chemicals cause different toxic effects, comparing the toxicity of one with another is hard. We could measure the amount of a chemical that causes kidney damage, for example, but not all chemicals will damage the kidney. We could say that nerve damage is observed when 10 grams of chemical A is administered, and kidney damage is observed when 10 grams of chemical B is administered. However, this information does not tell us if A or B is more toxic because we do not know which damage is more critical or harmful.

Therefore, to compare the toxic potency or intensity of different chemicals, researchers must measure the same effect. One way is to carry out lethality testing (the LD_{50} tests) by measuring how much of a chemical is required to cause death. This type of test is also referred to as a "quantal" test because it measures an effect that "occurs" or "does not occur".

LC stands for "Lethal Concentration". LC values usually refer to the concentration of a chemical in air but in environmental studies it can also mean the concentration of a chemical in water.

According to the OECD (Organisation for Economic Cooperation and Development) Guidelines for the Testing of Chemicals, a traditional experiment involves groups of animals exposed to a concentration (or series of concentrations) for a set period of time (usually 4 hours). The animals are clinically observed for up to 14 days.

The concentrations of the chemical in air that kills 50% of the test animals during the observation period is the LC_{50} value. Other durations of exposure (versus the traditional 4 hours) may apply depending on specific laws.

Acute toxicity is the ability of a chemical to cause ill effects relatively soon after one oral administration or a 4-hour exposure to a chemical in air. "Relatively soon" is usually defined as a period of minutes, hours (up to 24) or days (up to about 2 weeks) but rarely longer.

In nearly all cases, LD_{50} tests are performed using a pure form of the chemical. Mixtures are rarely studied.

The chemical may be given to the animals by mouth (oral); by applying on the skin (dermal); by injection at sites such as the blood veins (i.v.- intravenous), muscles (i.m. - intramuscular) or into the abdominal cavity (i.p. - intraperitoneal).

The LD_{50} value obtained at the end of the experiment is identified as the LD_{50} (oral), LD_{50} (skin), LD_{50} (i.v.), etc., as appropriate. Researchers can do the test with any animal species but they use rats or mice most often. Other species include dogs, hamsters, cats, guinea-pigs, rabbits, and monkeys. In each case, the LD_{50} value is expressed as the weight of chemical administered per

kilogram body weight of the animal and it states the test animal used and route of exposure or administration; e.g., LD₅₀ (oral, rat) - 5 mg/kg, LD₅₀ (skin, rabbit) - 5 g/kg. So, the example "LD₅₀ (oral, rat) 5 mg/kg" means that 5 milligrams of that chemical for every 1 kilogram body weight of the rat, when administered in one dose by mouth, causes the death of 50% of the test group.

If the lethal effects from breathing a compound are to be tested, the chemical (usually a gas or vapour) is first mixed in a known concentration in a special air chamber where the test animals will be placed. This concentration is usually quoted as parts per million (ppm) or milligrams per cubic metre (mg/m³). In these experiments, the concentration that kills 50% of the animals is called an LC₅₀ (Lethal Concentration 50) rather than an LD₅₀. When an LC₅₀ value is reported, it should also state the kind of test animal studied and the duration of the exposure, e.g., LC₅₀ (rat) - 1000 ppm/ 4 hr or LC₅₀ (mouse) - 5mg/m³/ 2hr.

Inhalation and skin absorption are the most common routes by which workplace chemicals enter the body. Thus, the most relevant from the occupational exposure viewpoint are the inhalation and skin application tests. Despite this fact, the most frequently performed lethality study is the oral LD₅₀. This difference occurs because giving chemicals to animals by mouth is much easier and less expensive than other techniques. However, the results of oral studies are important for drugs, food poisonings, and accidental domestic poisonings. Oral occupational poisonings might occur by contamination of food or cigarettes from unwashed hands, and by accidental swallowing.

Safe handling and operation of materials and machinery

1. Only those materials and machines which meet the essential requirements on safety & health be put into service.
2. All parts of a machine which cause danger of a person being trapped or cut must be equipped with guards or protective devices.
3. The operations for adjustment , cleaning, greasing and repairing must be performed with the machine turned off and the power source disconnected.
4. Loose clothing, loose hair or jewellery etc., must be avoided while operating a machine.
5. Every machine must be equipped with emergency stoppage mechanisms that make it possible to stop the machine safely under emergency.
6. Every person who uses a machine has to receive proper training and information on the risk that the work involves.
7. The danger zones of the machines must be marked with warnings and signs.
8. Proper illumination should be provided.
9. Operators should read and adhere to manufacturers operating manual and instructions.
10. Proper housekeeping/maintenance.