Process, Plant and Equipment UP-TIME

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Safety in the Work Place			
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SEPARATION & SEGREGATION OF DANGEROUS GOODS

ABSTRACT
Separation and segregation of dangerous goods. Safe use of dangerous goods includes recognising when situations can arise where the consequence of a failure or error will result in danger to life, property or the environment. One of the methods used to minimise risk when dealing with dangerous goods is by separation and segregation. Keywords: Hazard, storage facility, control, emergency plan, MSDS, material safety data sheet.

DANGEROUS GOODS

Many of the chemicals we deal with each day are dangerous and need to be handled correctly and safely. A dangerous good is any gas, liquid or solid that has been classified and is listed in the Australian Code for the Transport of Dangerous Goods or other international equivalent Codes. Typically they are chemicals that destroy or have the potential to destroy life, property or the environment. They are classified and labeled as a dangerous good belonging to one of the categories shown in Table 1.

CLASS	CATEGORY	DESCRIPTION
1	Explosives	Fragment violently.
2	Gases	Are vapour or gas at atmospheric conditions.
3	Flammable liquids	Liquids able to be ignited and burn.
4	Flammable solids	Spontaneously combust or liberate flammable gases in contact with water.
5	Oxidisers	Release oxygen and may combust.
6	Poisonous	Cause death or injury to life if it enters into the body.
7	Radioactive	Emit radiation.
8	Corrosive	Cause damage to human tissue by chemical reaction.
9	Miscellaneous	Hazardous materials not fitting into one of the previous categories.

TABLE 1 Classes of Dangerous Goods

Some of the categories are further broken down into sub-classes that better define the risks associated with the materials. For example gases are sub-classified as flammable (Class 2.1), non-flammable and non-toxic (Class 2.2) and poisonous (Class 2.3).

Dangerous goods can also have multiple classifications. Once the primary classification is determined additional classifications are known as subsidiary risks. For example liquid air is classed as 2.2 (non-toxic gas) with a sub-class of 5.1 (oxidising agent).

Because many dangerous goods are transported internationally the United Nations have established an internationally accepted numbering system to indicate dangerous goods. The UN Number must appear on all transport documentation.

To assist with emergency situations involving dangerous goods a special coding system known as the Hazchem Code has been developed. The code's alphanumeric characters inform the emergency services of the immediate response actions needed to minimise hazards and restrict the spillage.

All this relevant information and a telephone number for emergency contact is displayed on the Hazchem Sign or label that accompanies transportation of the chemical. An example of a Hazchem sign is shown in Figure 1.

Figure 1 Sulphuric acid HAZCHEM sign

SAFE STORAGE PRACTICES

All hazardous substances must be stored 15 meters from boundary fences and from other buildings on-site. If a hazard does occur it is better to have a small problem removed from people than a large problem close to people.

A good phylosophy to adopt when storing dangerous good is to only store the least quantity necessary for a short period of time and make arrangements to replenish stocks often. An alternate approach is to properly store the required quantity in many small containers. If one container were to be spilt or ruptured only a small volume would be involved.

EQUIPMENT AND PLANT LAYOUT FOR IMPROVED MAINTENANCE

ABSTRACT
Equipment and plant layout for improved maintenance. Equipment reliability studies show that the likelihood of failure increases the more often machinery is disturbed. The chance of something being done wrong rises every time an item of plant is worked on. Nothing may go wrong the first time or the second time but with each additional disruption there is an increasing possibility that an error will be made. Simple, fast and uncomplicated access to individual items of plant and equipment means higher plant availability and longer time between failures. Keywords: safe ease of access, crane access.

THE NEED FOR SPEED

When production plant is down for maintenance, money is lost. Maintainers only want to work on the broken item and do not want to strip-out equipment that is operating properly to get to the part needing repair. Quick access for repairs and equipment change-outs minimise lost time. Shutdown times are reduced if ready access is available to plant and machinery. Equipment located and oriented for easy access during maintenance get better care.

New production plant can have a working life of 50 to 100 years and contain thousands of items of plant. There will be numerous maintenance activities during those years. If the time for each activity can be reduced by 1% by better equipment positioning and fast access then hundreds-of-thousands of man-hours will be saved.

ELECTRIC MOTORS AND MECHANICAL DRIVES

At some time over the life of a facility it is likely every electric motor will be replaced at least once. Those that are hosed down, are in dusty environments or overloaded from intermittent changed process conditions will be replaced more often. Motors that weigh more than 20 kg (45 lb.) will need to be lifted with assistance from another person or by mechanical lifting device.

Close-coupled pump sets will be aligned a number of times throughout their operating life. There should be permanent maintenance access from both sides to allow the pump and motor to be shimmed and adjusted after a repair.

Drive belts, chains, pulleys and sprockets wear out and need replacing. Space is required around a machine to remove the guard or cover over the drive. Space for hands and fingers to mount the pulley or sprocket puller is needed as well as space to stand in front to remove them from the shaft.

Motors on equipment with shaft seals, packed glands or mechanical seals need to be mounted for quick access to those wearing parts. Motors mounted overhead need direct access to them.

THE COST OF ACCESS

There is nothing more frustrating to a maintenance tradesman than standing on the ground looking up at a motor or drive at the top of a bucket elevator or dust collector with no way to get access. How to get up there safely and work safely is his most important concern and one which should be addressed when equipment is designed and installed.

If safe access is not provided at the time of construction maintainers will make one of three choices. They will install permanent access themselves anyway. Or they will install temporary scaffolding that is removed when the job is done. (The cost of hiring and installing scaffold is expensive and if done often enough will cost more than a permanent structure.) Or they will take an unnecessary risk to save the hassle and time of putting up secure access.

CRANE ACCESS AND LIFTING

Big or heavy equipment can only be moved with mechanical assistance. Removing or replacing a big item needs the use of a crane or forklift. Heavy equipment positioned away from forklift access must have access by crane. This can be an overhead hoist, gantry arm, winch, or mobile crane.

The deeper into the plant a piece of equipment is located the larger the mobile crane needed to lift it. Larger mobile cranes are required, not because the item is necessarily heavy, but because the further a crane jib is extended the less it can carry at end of the jib.

Mobile cranes are sized on the maximum safe weight they can lift from the nearest lift point to the crane with a fully retracted jib. So a 10-tonne crane can only lift 10-tonne right beside itself. To lift 10 tonne located 10 meters from the crane would require a 100-tonne crane. To lift 100-kg (225 lb.) 50 meters away would also need a 100-tonne crane. The cost difference between hiring a 10-tonne or hiring a 100-tonne crane is massive.

GETTING ACCESS FROM BELOW

If plant and equipment have flanges, valves, assemblies, electrical or instrument items underneath them, then someone has to get under there to repair them.

Quality repairs underneath plant with reduced access or insufficient space to move easily is impossible. In addition the chance of injury to maintainers because they cannot move naturally or cannot avoid obstructions is increased. No one wants to lay in dirt,

If the supply pressure is low an in-line booster pump is installed at the supply point. The booster pump operates under the control of a pressure switch that detects a fall in pressure when a shower is put on and turns on the pump to boost pressure and flow to that required at the shower.

The water temperature from the safety shower must be comfortable for the human body. Typically the range is 15 – 35^{o} C. Water in pipes exposed to the sun will get hot. Good practice is to bury the piping at least 600 mm (2') underground where the temperature does not fluctuate greatly throughout the year. When burying pipes follow good excavation practices that keep the pipe in a safe, reliable condition.

Maintenance and Inspection

Recommend practice is to operate the shower weekly to prove it is working and available for use. Linkages can stiffen from the ingress of dirt or they have been incorrectly set up and do not work properly. Every twelve (12) months it is necessary to confirm the shower still meets minimum plumbing, flow and pressure requirements. Keep records of the inspection and fix problems immediately.

Showers mounted on steel structures with vibrations traveling through the mounting platform can turn themselves on. The situation is more likely if the shower is on an outside vibrating platform in the wind. Water dripping from showers and eyewashes is a common occurrence. In both cases it is necessary to tighten the linkages to remove looseness. Dripping water, failed lighting, poor signage and disconnected foot pedals are housekeeping issues to be reported to the maintenance department for rectification.

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