

Principles of Systems Engineering

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1a)

The nine stages of commissioning are as follows;

- 1 Planning – This phase includes the risk assessment process and ensuring the relevant documentation is in place. The management of resources also begins in this stage.
- 2 Mechanical Completion – The testing of mechanical, structural, electrical and piping systems.
- 3 P&ID Checking – A system check of the equipment and instrumentation by the commissioning team
- 4 Pre-commissioning – Tests and inspections are conducted on all systems and procedures and is recorded.
- 5 Commissioning – This is the phase after pre-commissioning when design process fluids are introduced to the systems and sub systems and brings the project in the commercial operation status.
- 6 Start Up – Where all systems and sub systems are operated and process fluids are introduced with the intention of making a product.
- 7 Initial Operation – Where the entire plant and all systems are running and fine tuning can be done.
- 8 Performance Testing – To check if the plant and system are operating according to their design operation.
- 9 Post Commissioning – The phase where adjustments can be made and routine maintenance is done. Operating data is collected and evaluated.

1b)

The six key elements to COSHH are;

- Assess – An assessment must be carried out to determine the potential the health risks on site.
 - Prevent – Exposure must be prevented or substituted to a process or substance less hazardous.
 - Control – Where you cannot prevent, there must be control of the exposure.
 - Maintain – Maintenance and testing of control measures
 - Provision – Information and training must be available to employees
 - Surveillance – Health surveillance must be carried out where exposure may lead to adverse health or disease.
- COSHH is important in industry as it ensures we can control the exposure to hazardous substances. It addresses the specific hazards that apply to substances, for example, routes of exposure, and the types of controls needed for example, ventilation systems.

2a)

2b)

Data governance is the practise of identifying important data across an organisation, ensuring it is of high quality and improving its value to the business

Data security ensures data is classified according to its sensitivity and safeguarding information and preventing data loss, for example, using Data encryptions and backing up information.

2c)

Four advantages of data management are;

Productivity – Productivity will increase due to better organisation, for example, employees have an easier time finding and understanding information.

Cost efficiency –Data management systems can help to avoid unnecessary costs and improve efficiency.

Security Risks – Proper management of data prevents it landing in the wrong hands.

Reduced Data loss – Reduce the risk of losing vital information. It also includes backing up the data.

3a)

Energy management is the strategy of adjusting and optimising energy, by modifying the systems and procedures in order to reduce the overall energy requirement per unit output, whilst maintaining or reducing total costs of producing the output from these systems and procedures.

Companies with energy management programmes generally achieve far greater savings than those without, because they review and manage energy use across the whole organisation regularly. The savings can then be used to invest in other parts of the business. It can also enhance your brand reduce operating costs and improve productivity.

3b)

A local or building management system is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. A cloud-based energy management differs to a local system in that it utilises wireless hardware, an online dashboard and an API. It offers consumption monitoring & analysis and the ability to control functions.

Below is a simple box diagram for a Home energy Management System

