TRAINING AND EVENTS FROM HSE

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NEBOSH HSE Certificate in Process Safety Management

Qualification guide for Learning Partners

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Qualification key features

Unit prefixes and title/s	Unit PSM1: Process safety management	
Assessment	Assessment Type Multiple-choice examination	Assessment Time 90 minutes
Modes of study	Taught (face-to-face) Open, distance, part-time or block release eLearning	
Notional learning hours	Taught hours: 28 hours Private study hours: 20 hours Assessment: 1.5 hours Total hours: 49.5 hours	
Qualification level and number of credits	SCQF Level 7 with 5 credits (Comparable to RQF Level 4)	
Entry requirements	It is recommended that learners should already have an underpinning knowledge of health and safety issues, and many will have gained another NEBOSH qualification (such as a NEBOSH General Certificate).	
Recommended minimum standards of English	Learners: International English Language Testing System 6.0 or higher Tutors: International English Language Testing System (IELTS) score of 7.0 or higher.	
Languages available	English	
Assessment dates/ registration	Monthly fixed date examinations. Registrations can be made at any time pre-course and up to 10 working days from the assessment date.	
Pass standards	A 'Pass' (score of 60% or higher) must be achieved in Unit PSM1.	
Qualification grades	Pass Refer	
Parchment issue	Issued within 20 working days of the results declaration date	

Qualification summary

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Introduction

The NEBOSH HSE Certificate in Process Safety Management provides your learners with a sound breadth of knowledge and understanding which will enable them to contribute to the management of process safety risks.

It is designed for people who work in process industries such as oil and gas refining, chemicals, plastics and pharmaceuticals manufacturing. It is suitable for managers, supervisors, safety representatives and health and safety advisors working within the process industries, both inside and outside the UK. It is not designed for chemical and process safety engineers experienced in the specification, design and maintenance of process plant.

The syllabus and accompanying course book have been developed by NEBOSH, in conjunction with Great Britain's Health and Safety Regulator, the Health and Safety Executive (HSE), and are based on published HSE guidance.

On completion of the course, your learners will have a good understanding of:

- Process safety management system establishment
- Asset management and maintenance strategies
- Safe start-up and shutdown of process plant
- Performance standards for safety critical systems and equipment
- Hazards and controls for chemical reactions; bulk storage of dangerous substances; fire and explosion
- Purpose and features of emergency plans

Syllabus development and review

The syllabus has been redeveloped by NEBOSH and the HSE following extensive consultation with key stakeholders, notably Learning Partners, employers, standards setting organisations, past and present learners and subject experts. NEBOSH would like to take this opportunity to thank all those who participated in the redevelopment of this qualification.

Notional learning hours

A programme of study needs to be based around a minimum of 28 taught hours and approximately 20 hours of private study for an overall total of 48 hours.

A full-time block release course would be expected to last for a minimum of four working days, and a part-time day release course would be spread over at least four weeks. For learners studying by open or distance learning, the tuition hours should be added to the recommended private study hours to give the minimum number of hours that this mode of study will require.

Teaching of syllabus content

Although the syllabus sets out the elements in a specific order, you can teach the elements in any order you feel is appropriate.

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Minimum standard of English requirements

The standard of English required by your learners studying for the Certificate in Process Safety Management must be such that they can both understand and articulate the concepts contained in the syllabus. We recommend that learners have reached a minimum standard of English equivalent to an International English Language Testing System (IELTS) score of 7.0 or higher in IELTS tests. It is important to stress that it is your responsibility to determine your learners' standards of proficiency in English.
Tutors who are based overseas and wish to deliver the NEBOSH HSE Certificate in Process Safety Management must have a good standard of English. They must be able to articulate the concepts contained in the syllabus. The Learning Partner must provide evidence of the tutor's standard of English when submitting the tutor's CV for approval. NEBOSH's requirement is for tutors delivering this qualification to have reached a minimum standard of English equivalent to an International English Language Testing System score of 7.0 or higher in IELTS tests.
More information on IELTS can be found on their website.

Achieving the qualification

The qualification has one unit assessment: a 90 minute online multiple-choice assessment. Sample assessment questions are available to download from the NEBOSH website.

The question paper consists of 40 multiple-choice questions; 10 of which are extended scenario questions. Each question is worth one mark and has one correct and three incorrect responses available. The question paper covers the whole syllabus with at least one question per

"We are delighted to collaborate with NEBOSH on the evolution of the Process Safety Management certificate. We hope that by combining our strengths, the qualification will continue to help significantly improve understanding and further reduce health and safety risks in the process industries."

- Chris Austin
Head of Training and Events, Health and Safety Executive (HSE)

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element. All questions are compulsory. It is a closed-book assessment, so learners will not be able to refer to their course book or notes.

Learners must achieve a 'pass' (60% or higher) in order to be awarded the qualification.

Date of assessment

Assessments are taken after completion of the course learning. Assessments are held monthly, with the assessment being available for a 24 hour period. Learners will be able to start their assessment at any time during this 24 hour window, but will have 90 minutes in total to complete their assessment.

More information, including upcoming assessment dates are available on the NEBOSH website.

Registration

The Learning Partner must register learners for the PSM1 unit assessment. Registration can be made at any time pre-course delivery, and up to 10 working days post-assessment.

Submission of the assessment

Learners will complete their assessment online, and submit their assessment through an online assessment platform for marking.

Identifying learners

The course tutor must be sure of the identity of all learners prior to qualification delivery. This should be done ahead of the training; on the day for classroom delivery; or, for distance or eLearning, verification can be undertaken remotely via webcam. This will involve checking photographic identification. Photographic evidence of identity includes driving licences, national identity cards and passports. If you are unable to identify the learner, then you should contact NEBOSH for further advice.

Marking

Assessments are marked by NEBOSH. Learners will receive a 'Pass' (60% or higher) or 'Refer' (59% or lower) for their assessments. It is your responsibility as a Learning Partner to provide your learners with more support in the event of a referral result, and register them for another date to re-sit their assessment.

Individual learner feedback

For more information on the assessment feedback provided for this qualification, please visit the NEBOSH website.

Results

We aim to issue results within 15 working days of the date of the assessment. Qualification parchments are issued normally within 20 working days of confirmation of the successful PSM1 unit.

Conflict of interest

If any of your staff, family or friends want to sit the qualification you must tell NEBOSH first. Further information can be found in the 'Instructions for Conducting Examinations' document on the NEBOSH website.

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Element		Recommended tuition hours
1	Process safety management	4
2	Management process risk	9
3	Process safety hazard control	10
4	Fire and protection emergency response	5

Minimum unit tuition time **28**

Recommended private study time **20**

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Learning outcome and assessment criteria

Learning outcome The learner will be able to:	Related Content	Assessment criteria
Advise on the difference between process safety and personal safety.	**1.1**	Define process safety and process safety management systems. Identify the differences between process safety and personal safety.
Advise on the importance of leadership in assigning roles, responsibilities and resources to improve safety standards and positively influence organisational culture.	**1.2**	Understand the role of leadership in process safety management.
Advise on the importance of organisational learning from lessons learned; incident investigations; benchmarking standards; and sources of process safety information.	**1.3**	Give the purpose of sharing lessons learnt; incident investigation findings; benchmarking standards; and sources of process safety information within an organisation.
Understand how 'change' should be managed to effectively reduce risks to people and plant.	**1.4**	Identify how change should be managed in order to effectively reduce risks to people and plant.
Help their organisation to understand the importance of worker and contractor consultation.	**1.5**	Identify the benefits and limitations of worker consultation in process safety. Define the roles and responsibilities of common worker consultation groups.
Advise on the importance of competence and training.	**1.6**	Define competence and its importance in process safety. Recognise the importance of training and development programmes in reducing process safety risk.

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Learning outcome The learner will be able to:	Related Content	Assessment criteria
Understand the purpose and importance of establishing a process safety management system.	**2.1**	Identify the purpose and importance of establishing a process safety management system Define the key elements of a process safety management system and how they are applied.
Recognise common risk management techniques to reduce process safety risk.	**2.2**	Define the principles of the risk assessment process. Identify common risk management techniques and how they are applied in process industries.
Understand what effective asset management, plant maintenance and inspection strategies would consider.	**2.3**	Know the importance of asset integrity management. Recognise how effective maintenance strategies for process plant should be developed.
Understand the essential nature of permit-to-work systems, and the key features that they should contain.	**2.4**	Give the role, function and operation of a permit-to-work system.
Recognise how shift handovers should be safely managed.	**2.5**	Understand the key principles of safe shift handover.
Help their organisation manage contractors.	**2.6**	Provide the principles of selecting, assessing and managing contractors.
Advise how operating procedures should be written and applied.	**3.1**	Know the purpose and requirements of standard operating procedures.
Recognise suitable control measures for an organisation's start-up and shut-down processes.	**3.2**	Identify suitable control measures that should be applied to ensure the safe start-up and shut-down of process plant.
Understand the importance of performance standards for safety critical systems and equipment.	**3.3**	Identify the necessity for performance standards for safety critical systems and equipment. Define the concept of 'FARSI' and how it is applied.

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Learning outcome The learner will be able to:	Related Content	Assessment criteria
Recognise hazards associated with the use of steam and water in the process industries; and suitable control measures to reduce risk.	**3.4**	Recognise the hazards associated with the use of steam and water within the process industries. Recognise suitable control measures that should be applied to reduce the risks associated with the use of steam and water within the process industries.
Recognise hazards associated with the use of electricity and static electricity in the process industries; and suitable control measures to reduce risk.	**3.5**	Recognise the hazards associated with the use of electricity and static electricity within process industries. Recognise suitable control measures that should be applied to reduce the risks associated with the use of electricity and static electricity within process industries.
Recognise the risks associated with dangerous substances in the process industries.	**3.6**	Recognise the physical forms of dangerous substances and how these can determine process risk.
Recognise hazards associated with chemical reactions; and suitable protective measures to mitigate the consequences of a thermal runaway reaction.	**3.7**	Recognise the hazards associated with chemical reactions. Recognise suitable protective measures that should be applied to mitigate the consequences of a thermal runaway reaction.
Recognise hazards associated with bulk storage of dangerous substances; and suitable control measures to reduce risk.	**3.8**	Recognise the hazards associated with the bulk storage of dangerous substances. Recognise suitable control measures that should be applied to reduce the risks associated with bulk storage of dangerous substances.

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Learning outcome The learner will be able to:	Related Content	Assessment criteria
Recognise fire and explosion hazards within the process industries.	**4.1**	Identify how fire and explosions can occur in process industries.
Recognise suitable control measures to minimise the effects of fire and explosion in the process industries.	**4.2**	Give suitable control measures that should be applied to reduce fire and explosion risks.
Recognise dust explosion hazards; and suitable control measures to prevent and minimise explosion.	**4.3**	Identify the principles of dust explosion and how they can occur. Identify suitable control measures that should be applied to prevent and minimise explosion.
Contribute towards the development and maintenance of an organisation's emergency plan.	**4.4**	Give the purpose, features and requirements for the implementation of an emergency plan.

Use of the term 'incident'

There are various terms that can be used interchangeably when referring to incidents. This includes accident (generally used when there has been actual harm/ill-health/damage caused) or near miss/close call (generally used when there has been the potential for harm/ill-health/damage to be caused but it did not actually occur in that instance).

NEBOSH has, therefore, adopted the approach taken in the 'Occupational health and safety management systems' (ISO 45001) standard in that an incident is: *An event that happens in the workplace that causes (or has the potential to cause) harm, injury, ill-health or damage.*

When the term 'incident' is used in an assessment, the context of the question and other supporting information will provide context for the term. For example, if a question in a scenario-based assessment is asking about the outcome of an incident, information will be provided in the scenario to give context. This could be something like 'the worker fell from a ladder and broke their leg'.

The term 'accident' may still occur in the syllabus if this is a recognised term or part of a title, eg, Reason's model of accident causation.

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Element 1: Process safety leadership	
1.1	**Process safety management meaning** • The distinction between process safety vs personal safety • 'Process safety' as: - 'a blend of engineering and management skills focused on preventing catastrophic accidents and near misses, particularly structural collapse, explosions, fires and toxic releases associated with loss of containment of energy or dangerous substances such as chemicals and petroleum products' (Energy Institute definition adapted from the Center for Chemical Process Safety of the American Institute of Chemical Engineers) • 'Process safety management system' as: - 'An organisation's management system intended to prevent major incidents arising out of the production, storage and handling of dangerous substances' (definition adapted from the Health and Safety Executive's *HSG254: Developing process safety indicators: A step-by-step guide for chemical and major hazard industries*)
1.2	**Process safety leadership** • The importance of leadership teams being fully aware of the hazard and risk potential of their processing activities and their possible impact on safety, reputation and business risk • Board level visibility and the promotion of process safety leadership as being essential in developing a positive safety culture • For process safety management (PSM) critical positions, the necessity to define and assign process safety responsibilities • The reasons for holding to account all individuals with PSM responsibilities, regardless of their position within an organisation • The provision of adequate resources (human, financial and physical) being made available and the consequences of failing to provide them • Meaning of, and reasons, for establishing process safety objectives and targets that are routinely reviewed with performance on them, made publically available • Commitment to continuous improvement with regards to process safety performance
1.3	**Organisational learning** • The significance of learning lessons from incidences of actual or potential consequence • The reasons for and benefits of incident investigations • Documented management processes in place to ensure the retention of corporate knowledge pertaining to process safety management (ie. original design specification and plant modifications) • Arrangements with other relevant organisations in the sharing of lessons learnt and the adoption of such learning within process safety management systems

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Element 1: Process safety leadership	
	• Purpose of benchmarking and how this tool is used across similar organisations to identify best practices and drive process safety improvement (ie. management of change, asset integrity and process safety culture) • Sources of process safety management information: - internal to the organisation (eg, inspection, audit and investigation reports, maintenance records) - external to the organisation (eg, manufacturers' data, legislation, EU (European Union) HSE (Health and Safety Executive), OSHA (Occupational Safety and Health Administration), trade associations and professional bodies eg IChemE (Institution of Chemical Engineers) and the Energy Institute; International, European and British Standards, ILO (International Labour Organisation) and other authoritative texts, IT sources, Chemical Safety Board, Hydrogen Tools
1.4	**Management of change** • Management of change: - formal documented system developed to identify required modifications - the requirement for a full hazard and risk analysis exercise on implications of change (ie. prevent the introduction of new hazards or unknowingly increasing the risk of existing hazards) - process for all changes to be authorised by competent persons and where safety critical devices are to removed, sanctioned and signed off by senior management - all changes to process plant and/or design correctly documented for process knowledge retention - consult and inform those affected by the changes (both operational and changes of key workers) - training programmes implemented where necessary
1.5	**Worker engagement** • The benefits and limitations of consultation with workers and contractors on all applicable process hazards and associated controls, policy development and process safety performance • Types of consultees, their role and responsibilities: - safety committees - discussion groups - safety circles - departmental meetings - email and web-based forums • Necessity of including workers and workplace representatives when (re)developing procedures, safe systems of work and undertaking risk assessments and incident investigations • Why engagement with workers should be given a high priority by senior management and arrangements for engagement appropriately managed and compliance audited against.

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Element 1: Process safety leadership	
1.6	**Competence** • Understanding of what is meant by 'competence' (ie. 'the ability to undertake responsibilities and to perform activities to a relevant standard, as necessary, to ensure process safety and prevent major accidents. Competence is a combination of knowledge skills and experience and requires a willingness and reliability that work activities will be undertaken in accordance with agreed standards, rules and procedures' Source: Operational Delivery Guide produced by COMAH Competent Authorities) • The role of competence in safe working and behaviours • The development and implementation of systems (including the use of training and competency matrices or frameworks) to ensure that all levels of management possess the appropriate level of process safety knowledge and expertise • Training and development programmes applicable to process safety risk: - standard - non standard emergencies

Element 2: Management of process risk	
2.1	**Establishing a process safety management system** • Reasons for developing an integrated and comprehensive process safety management system, including compliance obligations • The key elements of a process safety management system (with reference to the Health and Safety Executive's the Plan – Do – Check – Act model): - policy (Plan) - planning (Plan) - implementation and operation (Do) - checking and corrective action (Check) - management review (Act) - continual improvement (Act) • 'License to operate' authorisation and dealing with regulators (safety cases) • The purpose and typical content of Major Accident Prevention Policies (MAPPs) • Differentiation between leading and lagging process safety performance indicators and their development and implementation as part of an assurance framework • Auditing 'compliance' with process safety management system objectives and the identification of opportunity for improved performance.

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Element 2: Management of process risk	
2.2	**Risk management techniques used within the process industries** • The meaning of hazard, risk and the importance of proportionality when assessing and controlling risk • The purpose and use of risk assessment • The differences between qualitative, semi-quantitative and quantitative risk assessment processes and where they are indicatively used within a process environment • The theory of risk control using barrier models (barrier between hazard and hazard realisation) • The concept of hazard realisation – for example loss of containment leading to ignition; leading to explosion or fire; leading to damage or injury • How risk management tools are applied in process safety risk identification and assessment (Bowtie, HAZOP, HAZID, Event trees, What-if Analysis and FMEA), application in project phases from concept, design, start-up • The concept of as low as reasonably practicable (ALARP) • Hierarchy of risk controls: - inherent safety - elimination (including minimised inventories) - substitution - segregation and spacing of process and plant - engineering controls and the adoption of passive control over active ones - administrative controls (procedural; behavioral) - PPE - emergency response
2.3	**Asset management and maintenance strategies** • Consideration of integrity standards at design stage inclusive of designing for maintainability and ease of inspection • Consequences of failing to manage the integrity of assets • Selection of plant and equipment suitable for the operating environment • Asset integrity throughout the lifecycle, with inspection, testing and maintenance regimes based on manufactures recommendations and findings of risk assessments • Plant maintenance documentation and recording requirements for inspection, maintenance, aging, life extension and obsolescence • Different risk based maintenance and inspection strategies available: - planned preventative - condition monitoring - breakdown / failure based • The importance of, and reason for, the risk based calibration of instrumentation

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Element 2: Management of process risk	
2.4	**Role and purpose and features of a permit-to-work system** • The purpose and effective use of a permit-to-work system, including how they link to method statements and task analysis • The key features of a permit-to-work: - scope of work - duration of work - known hazards and reference to risk assessments - isolation of energy sources; process equipment (lock out, tag out 'LOTO') - link to other open permits - specification of persons accepting permits and verification of their understanding of the risks and control measures - emergency controls - specific controls (ie. gas testing) • Interfaces with adjacent plant or simultaneous operations • Interfaces with contractors • Types of permit and the circumstances when they would be typically used ie: - hot work - cold work - electrical work • The benefits and limitations of both electronic and paper based permit-to-work systems • Typical circumstances when a work permit-to-work would not be required
2.5	**Safe shift handover** • Two-way with both participants taking joint responsibility • Competence of those involved in handovers – technically astute but also effective communicators • Shift handover must be: - given the highest priority - conducted face to face - undertaken using accurate verbal and written communication - based on analysis of the information needs of incoming workers - given as much time as necessary to allow for questioning, explanation and clarification • Typical practical examples of information shared during shift handover, including physical demonstration of plant state

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Element 2: Management of process risk	
2.6	**Contractor management** • Scale and identification of contractor use within the processing industries • Procedures for the selection of contractors • Periodic review of contractor health and safety performance and compliance with tender documentation • Contractor induction, indicative content and the obligation to provide information relating to site hazards and risks • Siting of contractors accommodation • Contractor ownership, site supervision and representation • Auditing of contractors health and safety compliance, before (method statements etc) during and after work is undertaken • Contractor responsibilities including handover of buildings, plant and equipment

Element 3: Process safety hazard control	
3.1	**Operating procedures** • What is meant by the term 'safe operating envelope' with reference to common parameters • Purpose of operating procedures, types and who should be involved in their development • What should be included within operating procedures • Requirement for written procedures to be clearly understood by the end user • Verification systems to ensure that operating procedures remain current and accurate • Limitations of operating procedures and potential consequences of deviating from them • Importance of responding to alarms
3.2	**Safe start-up and shut-down** • Types of start-up and shutdown: planned, unplanned, emergency, staged and delayed • A pre-start-up safety review to confirm: - that any modifications meet appropriate management of change requirements - post pressure testing, plant has been suitably drained and dried of contaminants blanks removed and drain valves, sample points and relevant vents closed ready for service - visual inspection of plant to determine that all work has been completed - all alarms, trips and pressure reducing valves (PRVs) are in working order - when required (ie. new plant or changes, full training given to relevant workers and contractors) • Necessity for alarm systems to be in full working operation and designed to alert, inform and guide the operators, allowing for diagnosis of problems • Software and control systems fully operational

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Element 3: Process safety hazard control	
	• Plant shut-down: - undertaken in accordance with shut-down procedures - assessment and planning of the impact of plant shut-down on adjacent plant or shared services
3.3	**Safety critical performance standards** • Reasons for performance standards for both safety critical systems and items of equipment • In relation to safety critical performance standards, the relevance of the elements of 'FARSI': - **F**unctionality - **A**vailability - **R**eliability - **S**urvivability - **I**nterdependency
3.4	**Utilities** • Uses of steam within the processing industries • Properties of saturated and superheated steam • Steam hazards and associated controls: - thermal expansion - prevention of the formation of vacuums - water in steam lines (water hammer) • Water hazards and associated controls - vacuum formation during draining operations - hydrostatic testing and weight - cooling towers – legionella and water-vapor fog • Characteristics of inert gases and its associated hazards • Industrial uses of inert gases to include: - providing inert atmospheres and purging - blanketing of storage tanks - uses as a fire-fighting agent - pipeline freezing operations - nitrogen use as back up instrument air
3.5	**Electricity and static electricity** • Principles of electricity: basic circuitry for current to flow: relationship between voltage, current and resistance • Hazards of electricity: - voltage, frequency, duration, resistance, current path • Electric arcs and sparks (ignition hazards) and how they can occur during normal operations • How electrostatic charges are generated

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Element 3: Process safety hazard control	
	• Control of electrostatic charges - bonding and grounding • Planning for power outages: - use of generators and uninterruptible power sources (UPS) to provide emergency power
3.6	**Dangerous substances** • Physical forms of dangerous substances and how these can determine risk potential • Meaning of explosive, oxidising, flashpoint, flammable (and combustible) liquids and gas categories
3.7	**Reaction hazards** • The effects of temperature, pressure and catalysts on rates of chemical reactions • Meaning of the terms 'exothermic reaction' and 'endothermic reaction' • Meaning of the term 'thermal runaway reaction', the likely process causes and possible consequences of occurrence • Protective measures commonly used to mitigate the consequences of a thermal runaway reaction: - containment within a reactor (tested and designed to withstand maximum generated pressure) - crash cooling - drowning and quenching of reactor contents - emergency venting or dumping of reactants (ie. to scrubber systems, knock-out drums and flare stacks).
3.8	**Bulk storage operations** • Hazards and risks including overfilling, effects of vacuum, overloading of foundations and failure modes for tank shells and associated pipe work (creep, stress, thermal shock and brittle fracture) • Siting of tanks (distance from people, property and other tanks containing dangerous substances) and ventilation requirements • Filling of tanks - overfilling, alarms, and tanker connections • Floating roof tanks (both external and internal roof types), landing the roof, sinking the roof, rim seal fires and failures • Fixed roof storage tanks, pressure and vacuum hazards (ref 3.4) • Bunding of storage tanks including volume and area sizing, construction and valving arrangements • Protection from extreme weather • Hazard potential of lightning strikes and suitable control measures • Chemical warehousing to consider: - assessment and understanding of potential chemical hazards present - siting, location and security of warehousing - minimised inventories - separation and segregation of dangerous goods - control of ignition sources

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Element 4: Fire and explosion protection	
4.1	**Fire and explosion hazards** • Fire triangle and modes of heat transfer – conduction, convection and radiation • Typical ignition sources • Upper flammable (explosive) limit, lower flammable (explosive) limit and the risk from working within these limits (ie. Flammable or explosive range) • Mechanisms for, and the possible consequences of: - jet fires, pool fires - Boiling Liquid Expanding Vapour Cloud Explosion (BLEVE's), Confined Vapour Cloud Explosions (CVCE's) and Unconfined Vapour Cloud Explosion (UVCE's)
4.2	**Fire and explosion control** • Leak and fire detection systems, including gas and vapour detectors, spot, line, flame, and heat detection systems • Passive fire protection, including passive fire protection of structures and equipment • Active fire protection systems, including manual and automatic operation features • Zoning and hazardous area classification, including selection of suitable ignition protected electrical and mechanical equipment and critical control equipment • Explosion protection systems including: - atmosphere control - pressure relief and explosion venting - automatic explosion suppression systems - automatic isolation - flame arrestors - active and passive isolation • Benefits and limitations of chemical, foam and inert extinguishing systems • Examples of fire protection systems for tank farms • Mitigation of lightning strikes
4.3	**Dust explosions** • Why dust explosions occur • Primary and secondary explosions • Prevention of dust explosions to include: - an assessment of the risk and likelihood of explosion occurring - dusts replaced with granular or paste type products - prevention of explosive atmospheres by inerting - dust extraction systems and the necessity for good housekeeping practices

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Element 4: Fire and explosion protection	
	- avoidance of ignition sources, including the selection of appropriately rated electrical and non-electrical equipment • Mitigation of dust explosions to consider: - explosion relief venting - explosion suppression and containment - plant siting and construction
4.4	**Emergency preparedness** • Purpose of an emergency plan • Development of an emergency plan: - identification of possible scenarios and response required based on probability of occurrence and consequence - selection of onsite and offsite workers or agencies to be involved in plan development - resources required based on likelihood and consequences of events occurring - external emergency response and their availability - availability of onsite and offsite medical facilities - requirement for both onsite and offsite emergency plans • Content of an emergency plan: - systems for warning and alerting workers on site, neighbouring facilities and emergency services - delegation of responsibilities in the event of an emergency - expertise of teams involved in emergency response (both internally and externally to the organisation) - evacuation and shelter arrangements - emergency shut down of plant and services - consideration of vulnerable people - systems for accounting for site workers • Information management during emergencies, including liaison with the media • Theoretical training – table-top exercises and simulations in testing incident response • Competency of emergency responders and command team • Practical emergency scenario testing – familiarity with emergency alarms, evacuation routes, safe havens, shelters and drills • Provision of information to the public who may be effected by an onsite emergency

Glossary

Glossary

Term	Definition	Source
As low as is reasonably practicable (ALARP)	*ALARP means that the risk hasn't just been reduced, but is now at the lowest level that can be achieved without incurring disproportionate costs (costs can be financial, time, effort and inconvenience).*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Asset	*An item of equipment or an area of production plant.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Asset integrity	*The ability of the equipment (asset) to operate as intended effectively and efficiently over its entire lifespan while ensuring the health and safety of those exposed to it, including the environment.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Barriers	*Controls that can be put in place between the initiator (the triggering event) to either prevent if from happening or to mitigate the outcome. Also see Bow-Tie model and Hazard realisation.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Bow-Tie model	*Used with 'hazard realisation'. As you work through the hazard realisation then 'barriers' can be identified that can be placed between the initiator (the triggering event) to either prevent it from happening or to mitigate the outcome. These can be termed, 'lines of defence' or 'layers of protection' and are exactly that – actions that, if implemented, could prevent the initiating event from resulting in a release or harm, or mitigating the consequences should it occur.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Classification of hazardous places (zones)	*Hazardous places are classified in terms of zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere: Zones 0-2 relate to gas/vapours/mists and Zones 20-22 to dusts.*	HSE Books, ISBN: 978-0-7176-6616-4 Dangerous substances and explosive atmospheres, Approved Code of Practice and guidance, L138

Glossary

Term	Definition	Source
Competence	*"The ability to undertake responsibilities and to perform activities to a relevant standard, as necessary, to ensure process safety and prevent major accidents. Competence is a combination of knowledge skills and experience and requires a willingness and reliability that work activities will be undertaken in accordance with agreed standards, rules and procedures".*	COMAH Competent Authority, Inspection of Competence Management Systems at COMAH Establishments (Operational Delivery Guide)
Contractor	*"A contractor is anyone you get in to work for you who is not an employee".*	HSE Books Managing contractors, A guide for employers, HSG159
Endothermic	*A reaction is called endothermic if energy (heat) is absorbed during the reaction.*	HSE Books, ISBN: 978-0-7176-1051-8 Designing and operating safe chemical reaction processes, HSG143
Exothermic	*A reaction is called exothermic if energy (heat) is released during the reaction.*	HSE Books, ISBN: 978-0-7176-1051-8 Designing and operating safe chemical reaction processes, HSG143
Explosion relief venting	*One or more deliberate points of weakness are included in process plant; it they are of suitable size and in the right place, they will safely vent an explosion with the plant.*	HSE Books, ISBN: 978-0-7176-2726-4 Safe handling of combustible dusts; Precautions against explosions, HSG103
Explosive	*A substance has the risk of exploding in the right mixture with oxygen and if sufficient energy is available.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Event tree analysis	*Used to evaluate the mitigation measures that will operate after an event. The process starts with an initiating event and works forward in time to see what protective measures will operate. Each control will either be a success or a failure and, in this way, branches are built up on tree.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Failure Mode and Effects Analysis (FMEA)	*A study often used to brainstorm how a component or a system might fail, the potential effects/consequences of those failures, existing safeguards against those failure modes and whether more should be in place.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3

Glossary

Term	Definition	Source
Flammable	*The property of a substance (usually gas or liquid (or the vapour above the liquid)) to ignite when sufficient energy is applied in the form of heat.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Flashpoint	*The minimum temperature at which a liquid, under specific test conditions, gives off sufficient flammable vapour to ignite momentarily on the application of an ignition source.*	HSE Books, ISBN: 978-0-7176-6616-4 Dangerous substances and explosive atmospheres, Approved Code of Practice and guidance, L138
Hazard and Operability (HAZOP) study	*An advanced risk assessment technique first used by Imperial Chemical Industries (ICI) in the UK in the 1960s. It is a very thorough analysis of a process to identify ways in which the process could deviate from its design intention, in order for controls to be developed. It is usually chaired by an independent HAZOP leader and involves a multidisciplinary team of designers, engineers, safety professionals, operators in the area and other specialists.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Hazard Indentification (HAZID)	*A structured, team-based approach to identify hazards, their potential consequences, and requirements for risk reduction before changes are made to existing processes and plant. This is sometimes carried out during a workplace inspection but can be carried out at a desk using software. A HAZID study considers the process safety hazards as well as the non-process hazards such as transport and manual handling. These hazards are then used to feed the risk assessment process.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Hazard realisation	*In hazard realisation, the assessor looks at 'the worst-case scenario' to understand the potential consequences of the hazard so that controls can be implemented in the form of barriers.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Lagging indicators	*Reactive measures that look at failures such as the number of injuries, near misses and spills which are reported, or excursions where plant is operated outside of the intended operational envelope.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3

Glossary

Term	Definition	Source
Leading indicators	*Proactive measurements of conditions that monitor process safety management before something goes wrong and to see if things are operating as intended.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Lower explosion limit (LEL)	*The minimum concentration of vapour in air below which propagation of a flame will not occur in the presence of an ignition source. Also referred to as the lower flammable limit or lower explosive limit.*	HSE Books, ISBN: 978-0-7176-6616-4 Dangerous substances and explosive atmospheres, Approved Code of Practice and guidance, L138
Oxidising	*The property of a substance to readily accept electrons from another substance.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Permit-to-work system	*A formal recorded process used to control work which is identified as potentially hazardous. It is also a means of communication between site/installation management, plant supervisors and operators and those who carry out the hazardous work.*	HSE Books Guidance on permit-to-work systems, A guide for the petroleum, chemical and allied industries, HSG250
Process safety	*A blend of engineering and management skills focused on preventing catastrophic accidents and near misses, particularly structural collapse, explosions, fires and toxic releases associated with loss of containment of energy or dangerous substances such as chemicals and petroleum products. These engineering and management skills exceed those required for managing workplace safety.* *(Adapted from Centre for Chemical Process Safety of the American Institute of Chemical Engineers)*	'Process Safety and the ISC' (June 2014) CCPS, Guidelines for Process Safety Metrics (John Wiley and Sons, 2009) ISBN: 978-0-470-57212-2
Safe operating envelope	*The limits of the operating conditions under which a process can take place safely. Typically, process limits are established by setting upper and lower levels for a range of parameters.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3

Glossary

Term	Definition	Source
Safe operating procedure / Standard operating procedure (SOP)	*A document step-by-step instruction on how to conduct specific parts of the operating process. It sets out the way a certain task or activity is done so that mistakes which might lead to a situation where the safe operating envelope could be breached are avoided. The overall purpose of the SOP is to identify and maintain the operating parameters such as pressure limits, temperature range, flow rates etc at the required safe level.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Shift handover	*The terms used to describe the transfer of information between a shift of workers who are leaving work and incoming new shift of workers.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3
Thermal runaway reaction	*A reaction that is out of control because the rate of heat generation by an exothermic chemical reaction exceeds the rate of cooling available.*	HSE Books, ISBN: 978-0-7176-1051-8 Designing and operating safe chemical reaction processes, HSG143
Upper explosion limit (UEL)	*The maximum concentration of vapour in air above which the propagation of a flame will not occur. Also referred to as the upper flammable limit or the upper explosion limit.*	HSE Books, ISBN: 978-0-7176-6616-4 Dangerous substances and explosive atmospheres, Approved Code of Practice and guidance, L138
What-if analysis	*In 'what-if' analysis of risk realisation, the assessor asks, "what-if" and then digs deeper to look at the true potential of an incident.*	NEBOSH Process Safety Management Book ISBN: 978-1-913444-43-3