TÜVRheinland®
Risktec

In partnership with
LIVERPOOL JOHN MOORES UNIVERSITY

MSc in Risk & Safety Management

Module Catalogue

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MSc overview

Students have the option of either enrolling to the Postgraduate Certificate, Postgraduate Diploma or the Masters Degree.

Successful Postgraduate Certificate and Postgraduate Diploma students have the opportunity upgrade to the Masters Degree.

Postgraduate Certificate (PgCert)

1 year — 60 credits

The six PgCert distance learning modules are:

- Principles of Risk Management
- Research Methods in Risk & Safety Management
- Hazard Identification
- Risk Analysis:
  - Risk Analysis - Cross sector,
  - Risk Analysis - Nuclear, *or*
  - Risk Analysis - Clean Energy
- Risk Reduction & ALARP
- Health, Safety & Environment (HSE) Management Systems

Postgraduate Diploma (PgDip)

2 years — 120 credits

The PgDip distance learning modules are the six PgCert modules plus:

- Bowtie Risk Management
- Emergency Response & Crisis Management
- Human Factors in Design and Operations
- HAZOP Study
- Incident Investigation & Analysis
- Safety/HSE Cases:
  - Safety/HSE Cases - Cross sector
  - Safety/HSE Cases - Nuclear, *or*
  - Safety/HSE Cases - Clean Energy

Master of Science (MSc)

3 years — 180 credits

The MSc programme comprises the twelve PgDip modules plus:

- Academic project (dissertation) of 15,000 words.

1 PgCert Modules

Principles of Risk Management

Purpose

The course provides an overview of risk management in the high hazard industries. It discusses the drivers for risk management, defines some of the fundamental terminology and introduces major risk management concepts, such as risk tolerability criteria and As Low As Reasonably Practicable (ALARP). The course briefly introduces some key risk assessment techniques and the situations in which they may be used. It considers the purpose and structure of an HSE/safety case and an HSE Management System (HSE MS). The course includes case studies of some significant historical accidents and their root causes, and evaluates the importance of safety leadership and organisational culture in preventing accidents.

Outline

- Drivers for risk management
- Definitions and terminology
- Elements of the risk management process
- Demonstration of ALARP
- Example tools, techniques and studies
- The HSE case (or safety case) and HSE management system
- Leadership, culture and behaviours
- Causes of major accidents

After completing the course you should be able to:

1. Deconstruct the risk management process into its constituent components
2. Contrast key risk management terms such as "hazard", "consequence" and "risk"
3. Evaluate the various drivers which cause organisations to manage risk
4. Demonstrate expertise in academic referencing

Research Methods in Risk & Safety Management

Purpose

This course provides a theoretical background for conducting postgraduate project work.

Outline

- Study skills review
- Introduction 'Why do research?'
- Defining the research problem
- Literature search and review techniques
- Research methodologies including statistical techniques, questionnaires and interviewing
- Project analysis and design
- Ethics in research
- Project planning
- Time management
- Gantt charts
- Presentation skills

After completing the course you should be able to:

1. Communicate findings, in an accepted format.
2. Assess previous research completed in an area.
3. Critically appraise research data and assimilate, integrate and discuss in a logical way.
4. Demonstrate compliance with appropriate ethical standards related to any research undertaken.
5. Produce an appropriate project description and specification.

Hazard Identification

Purpose

This course provides an understanding and awareness of the tools and techniques available for hazard identification, where they can be applied and what limitations may exist. Students will be introduced to the concept of HAZID, including the HAZID team and process. A range of other hazard identification techniques will also be introduced.

Outline

- Basic concepts
- Overview of hazard identification techniques
- Hazard identification through the project lifecycle
- Failure Modes and Effects Analysis (FMEA)
- Hazard and Operability (HAZOP) studies
- HAZID/checklist approach
- HAZID versus HAZOP
- Making recommendations

After completing the course you should be able to:

1. Assess the role of hazard identification in the risk management process
2. Critically review the tools and techniques available to carry out effective hazard identification at each lifecycle stage
3. Design a fit-for-purpose hazard identification study

Risk Analysis (Cross-sector)

Purpose

To provide a solid foundation of knowledge of risk assessment tools, with an emphasis on the concept of risk and qualitative risk assessment techniques.

Outline

- Identifying and recording hazards
- The risk assessment matrix
- Risk analysis and risk reduction through project or facility lifecycle
- Significance of environmental aspects; environmental risk assessment
- Human factors in design
- Health risk assessment (HRA)
- Security risk assessment
- Business and/or commercial risk assessment
- Quantitative risk assessment (QRA) techniques
- Safety Integrity Level (SIL) assessment
- Layers of Protection Analysis (LOPA)
- External hazards, good practice in risk analysis

After completing the course you should be able to:

1. Logically deduce the most appropriate risk assessment tool or technique to be used, depending on circumstances
2. Apply certain risk assessment techniques
3. Critically review example risk assessments and techniques

Risk Analysis (Nuclear)

Purpose

To provide a solid foundation for safety risk assessment approaches in the nuclear industry, with an emphasis on the concept of nuclear safety risk and deterministic and probabilistic safety assessment techniques.

Outline

- Introduction to safety risk assessment in the nuclear industry, including definitions of key terms
- Identifying and recording hazards to nuclear safety – radiological versus nuclear hazards; inventories, registers and schedules
- The nuclear safety risk assessment process (overview), including a comparison with conventional risk assessment
- Normal dose assessment (and criteria)
- Deterministic safety assessment (and criteria)
- Probabilistic safety assessment (and criteria)
- Severe accident analysis
- Radiological consequences analysis
- HAZAN (hazard analysis) approach
- Key outputs and uses of nuclear safety risk assessment
- Good practice in nuclear safety risk assessment

After completing the course you should be able to:

1. Understand the key features and outputs of nuclear safety risk assessment
2. Be able to critically review those elements of a nuclear safety case
3. Apply selected assessment techniques (at a high level, rather than in detail)

Risk Analysis (Clean Energy)

Purpose

To provide a solid foundation of knowledge of risk assessment approaches and how these may be utilised in the clean energy industry, with an emphasis on the concept of risk and qualitative risk assessment techniques.

Outline

- Understand the key features and outputs of nuclear safety risk assessment
- Be able to critically review those elements of a nuclear safety case
- Apply selected assessment techniques (at a high level, rather than in detail)

After completing the course you should be able to:

1. Understand the key features and outputs of nuclear safety risk assessment
2. Be able to critically review those elements of a nuclear safety case
3. Apply selected assessment techniques (at a high level, rather than in detail)

Risk Reduction & ALARP

Purpose

ALARP (As Low As Reasonably Practicable) is a commonly used but often misunderstood concept. The purpose of this course is to enable students to understand the hierarchy of risk reduction measures and the options for risk reduction in the project lifecycle. Students will be introduced to the concept of ALARP, practise applying it and learn how to demonstrate that risk has been reduced to ALARP levels.

Outline

- Risk management summary
- Hierarchy of risk reduction measures
- Risk reduction through the project lifecycle
- The ALARP concept
- Demonstrating ALARP
- Qualitative and semi-quantitative approaches
- Cost Benefit Analysis (CBA)
- Societal risk

After completing the course you should be able to:

1. Risk management summary
2. Hierarchy of risk reduction measures
3. Risk reduction through the project lifecycle
4. The ALARP concept
5. Demonstrating ALARP
6. Qualitative and semi-quantitative approaches
7. Cost Benefit Analysis (CBA)
8. Societal risk

HSE Management Systems

Purpose

A formal management system or framework can help an organisation manage Health, Safety and the Environment (HSE). The aim of this course is to deliver an understanding of what constitutes an HSE Management System (HSE MS), and how these systems are applied in different hazardous industries. Legislative requirements and international standards for an HSE MS are also discussed. The course examines issues associated with the documentation and the human elements for the successful implementation of an HSE MS.

Outline

- Definition of an HSE MS
- Elements of an HSE MS
- Guidance and legislation
- Implementation aspects
- Documenting and implementing the HSE MS

At the end of the course you should be able to:

1. Discuss the key factors to be considered when developing an HSE MS
2. Assess the role of HSE MSs in reducing the probability and consequences of major accidents
3. Examine issues associated with the implementation of HSE MS

2 PgDip Modules

Bowtie Risk Management

Purpose

Bowtie analysis (also known as barrier diagrams) is an increasingly popular approach to help manage risk. This course introduces the bowtie methodology and examines in detail the various bowtie analysis components. The course also provides a critical review of the method's benefits, limitations and practical uses, with hands-on practice at applying the technique.

Outline

- Introduction to risk assessment and bowties
- The bowtie method
- Assuring barrier integrity
- Effectiveness and ALARP for bowties
- Benefits and practical uses of bowties
- Facilitating bowtie workshops
- Bowtie software tools

At the end of the course you should be able to:

1. Analyse hazard scenarios by applying the bowtie method and designing a bowtie diagram
2. Develop integrity assurance for bowtie barriers
3. Devise risk acceptance criteria for hazards in bowties

Emergency Response & Crisis Management

Purpose

The purpose of this course is to enable students to understand and apply the principles of emergency response planning and crisis management. It considers the need for emergency and crisis response planning and an integrated approach to emergency management. Emergency organisation and procedures are also studied.

Outline

- Emergency management basics
- Emergency anticipation and assessment
- Emergency prevention and mitigation
- Emergency preparations – planning, organisation, training, documentation, mutual aid, drills & exercises, etc.
- Emergency response and recovery
- Crisis management overview

After completing the course you should be able to:

1. Define the requirements and importance of Emergency and Crisis Response Management
2. Discuss aspects of integrated emergency management
3. Generate appropriate emergency and crisis response documentation

Human Factors in Design & Operations

Purpose

This course explains how an understanding of human abilities, limitations and needs can be applied to the design and assessment of tasks, equipment, systems and processes, in order to reduce human error, improve safety and increase efficiency. It also highlights how and why human errors occur, and describes the methods, tools and techniques that can be used to identify, analyse and reduce them. Key Human Factors tools and methodologies will be demonstrated through the use of real-world practical examples from high hazard industries.

Outline

- Introduction to Human Factors
- Human Factors integration (HFI)
- Human Factors support to the design lifecycle for high hazard industries
- Defining human error
- Human error and violations
- Human Reliability Analysis (HRA)

After completing the course you should be able to:

1. Analyse the role of HF in systems engineering in order to achieve safe and effective designs, systems and processes
2. Evaluate the human characteristics which influence a user's experience of the workplace environment to ensure it is comfortable, healthy, safe and effective (accounting for physical and psychological capabilities and limitations)
3. Evaluate human error types (including violation) and their potential causes
4. Appraise human reliability and performance using appropriate methods in order to develop measures to reduce the likelihood of human error

HAZOP Study

Purpose

To gain an understanding of the technique, application and limitations of the HAZOP study methodology, one of the most commonly used hazard identification methods. This course does not provide detailed HAZOP facilitator training but does cover the skills needed and the work that the facilitator must do as part of the HAZOP Study. Students will have the opportunity to practise the technique.

Outline

- Introduction to risk assessment
- Basic engineering terminology
- Process safety incidents – lessons learned
- HAZOP: what, when, how, guidewords and parameters, nodding, teams, roles and responsibilities
- Recording methods, software, reporting and close-out
- Overview of the LOPA technique
- Major HAZOP studies, minor modification studies
- Common failings in HAZOPs, Limitations of HAZOPs
- Leading HAZOP teams
- Other forms of HAZOP: procedures, batch operations

After completing the course you should be able to:

1. Critically review the HAZOP technique and examples of output
2. Analyse how the HAZOP technique can be applied at the different stages of a project's lifecycle such as FEED, detailed design, revalidation and decommissioning
3. Prepare for a HAZOP workshop, determine the skills and actions necessary to lead a HAZOP and how to generate a HAZOP report

Incident Investigation & Analysis

Purpose

This course provides an awareness and understanding of incident investigation and analysis, including why we need to investigate incidents. The stages of incident investigation are discussed: immediate actions in the event of an incident; initiating the investigation; collecting, organising and analysing data; identifying corrective and preventive actions; reporting the incident and learning from it.

Outline

- Introduction
- Immediate actions in the event of an accident
- Planning the investigation
- Collecting data
- Data organisation/analysis
- Corrective actions
- Concluding the analysis

After completing the course you should be able to:

1. Demonstrate a thorough grounding in the underlying theories behind accident cause analysis
2. Apply the investigation and analysis process to determine the sequence of events and the causes of an incident
3. Critically analyse published incident and accident reports including the recommendations

Safety/HSE Cases (Cross-sector)

Purpose

The aim of this course is to explain the purpose, content and uses of a Safety/HSE Case. Particular attention is focused on the best practical approaches to address legal, industry and company requirements. The differing types of Safety/HSE Case during the project lifecycle are discussed, as well as differences in approaches between industries. Links between the case, supporting studies and the management system are studied. Best practices for implementing and maintaining the case are also reviewed.

Outline

- Historical drivers
- Legal requirements: UK, Europe, worldwide
- Company and industry body requirements
- Differing types of case by project phase (e.g. PSR, PCSR, design, operational, decommissioning)
- Safety Case structure and approach by industry
- Bridging documents
- Links between the case and supporting studies and the case and the management system
- Documentation, management and maintenance of the Safety Case
- Roll-out and implementation
- Features of a fit-for-purpose Safety Case

After completing the course you should be able to:

1. Critically review the reasons for having Safety Cases and the role of the Safety Case
2. Justify the contents of a Safety Case
3. Discuss the key factors to be considered when planning a Safety Case

Safety/HSE Cases (Nuclear)

Purpose

The aim of this course is to illustrate the purpose of a safety case and to develop an understanding of typical nuclear safety case contents and structure. This includes historical drivers, legal and regulatory requirements and different approaches in the nuclear industry and internationally. Links between the safety case and supporting studies and between the safety case and the safety management system are explored. Safety case documentation and outputs and their roll-out, upkeep and implementation are also reviewed.

Outline

- Historical drivers
- Legal Requirements - UK, Europe, worldwide
- Company and industry body requirements
- Differing types of case by project phase (e.g. PSR, PCSR, design, operational, decommissioning)
- Safety case structure and approach and differences between countries and types of nuclear safety cases (e.g. reactor safety case vs process safety case)Links between the safety case and supporting studies
- Safety case outputs and links to the safety management system
- Documentation and management / maintenance of the safety case
- Roll-out and implementation - keeping the case as a working document (including periodic safety review)
- Features of a fit-for-purpose safety case
- Module conclusions, close out and sources for further study

After completing the course you should be able to:

1. Critically review the reasons for having safety cases and their role in assuring safety
2. Justify the contents of a nuclear safety case
3. Discuss the key factors to be considered when planning a nuclear safety case.

Safety/HSE Cases (Clean Energy)

Purpose

The aim of this module is to explain the purpose of a Safety / HSE Case in general and provide an understanding of the potential contents and structure of a clean energy safety case. This includes historical drivers, legal requirements and company and industry body requirements. The differing types of safety / HSE case and different industry approaches are discussed. Links between the case and supporting studies and between the case and the management system are studied. Documentation, maintenance, roll-out and implementation are also reviewed.

Outline

- Historical drivers
- Legal Requirements - UK, Europe, worldwide
- Company and industry body requirements
- Differing types of case by project phase (e.g. design, operational, decommissioning)
- Safety/HSE Case structure and approach by industry
- Bridging documents
- Links between the case and supporting studies
- Safety case outputs and links to the management system
- Documentation and management and maintenance of the Safety/HSE Case
- Roll-out and implementation - keeping the case as a working document
- Features of a fit-for-purpose safety case bibliography, sources of further study and common abbreviations
- Module conclusions and close out

After completing the course you should be able to:

1. Critically review the reasons for having Safety/HSE Cases and their role in ensuring safety
2. Justify the contents of a clean energy safety case
3. Discuss the key factors to be considered when planning a clean energy safety case.

3 MSc Project

The MSc project comprises a dissertation of approximately 15,000 words. The project is selected in consultation with Risktec and LJMU and requires the student to justify the project's objectives and development plan. Risktec guides the student in selecting a state-of-the-art topic in risk and safety management that is of real interest to current and prospective employers. The student liaises with an academic (LJMU) and industrial (Risktec) supervisor throughout the project.

Completing the MSc enables the student to demonstrate an in-depth knowledge of specific issues related to their dissertation topic, present systematic and relevant written arguments and apply analytical skills in a rigorous and comprehensive manner.

After completing the course you should be able to:

1. Demonstrate an in-depth knowledge of specific issues related to your dissertation topic.
2. Present systematic written arguments relevant to a specific topic.
3. Apply analytical skills in a rigorous and in-depth manner.

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