****

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**OIL PIPELINE INSTRUMENTATION AND CONTROL**

**LEVEL 5**



TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the Oil and Gas sector’s growth.

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labor force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) in conjunction with Oil and Gas Sector Skills Advisory Committee (SSAC) have developed this curriculum.

This curriculum has been developed following the CBET framework policy; the CBETA Standards and guidelines provided by the TVET Authority and the Kenya National Qualification framework designed by the Kenya National Qualification Authority.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

I am grateful to the Council members, Council Secretariat, Oil and Gas Sector Skills Advisory Committee (SSAC), expert workers and all those who participated in the development of this curriculum.

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.**

**CHAIRMAN, TVET CDACC**

**ACKNOWLEDGEMENT**

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support was received from various organisations.

I recognize with appreciation the role of the Oil and Gas SSAC in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the oil and gas sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Oil and Gas sector acquire competencies that will enable them to perform their work more efficiently.

**DR. LAWRENCE GUANTAI M’ITONGA, PhD**

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

**ACRONYMS**

ANSI American National Standards Institute

BS British Standard

CDACC Curriculum Development, Assessment and Certification Council

CU Curriculum

DCP Dry Chemical Powder

ERP Emergency Response Plan/Procedure

ISO International Standards Organisation

JSA Job Safety Analysis

KNQF Kenya National Qualifications Framework

OG Oil and Gas

OHSAS Occupational Health and Safety Assessment Systems

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

PTW Permit to Work

SHE Safety, Health and Environment

KEY TO UNIT CODE

OG/CU /IC/CR /01/5 / A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

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**COURSE OVERVIEW**

The course takes 1580 hours, translating to 53 weeks of 30 hours each. It is designed for oil and gas sector personnel and those working in fire service departments and holds at least a fire engineering certificate or equivalent from recognized learning institutions. The course allows a trainee to work in a fire safety service in the oil and gas and other industries.

This course consists of the following basic, common and core units of learning:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| OG/CU/FO/BC/01/5/A | Communication skills | 25 | 2.5 |
| OG/CU/IC/BC/02/5/A | Numeracy skills | 40 | 4.0 |
| OG/CU/IC/BC/03/5/A | Digital literacy | 45 | 4.5 |
| OG/CU/IC/BC/04/5/A | Entrepreneurial skills | 70 | 7 |
| OG/CU/IC/BC/05/5/A | Employability skills | 50 | 5 |
| OG/CU/IC/BC/06/5/A | Environmental literacy | 25 | 2.5 |
| OG/CU/IC/BC/07/5/A | Occupational safety and health practices | 25 | 2.5 |
| **Total** | | **280** | **28.0** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours** | **Credit Factors** |
| OG/CU/IC/CR/01/5/A | Conducting fire safety training | 160 | 16 |
| OG/CU/IC/CR/02/5/A | Monitoring fire safety  management in the premises | 150 | 15 |
| OG/CU/IC/CR/03/5/A | Supervising fire-fighters and fire  wardens in the workplace | 140 | 14 |
| OG/CU/IC/CR/04/5/A | Containing workplace fire  emergencies(incidents/accidents) | 120 | 12 |
| OG/CU/IC/CR/05/5/A | Conducting workplace fire  incidents/accidents investigation | 140 | 14 |
| OG/CU/IC/CR/06/5/A | Conducting workplace fire risk  assessment | 120 | 12 |
| OG/CU/IC/CR/07/5/A | | Maintenance of fire-fighting  equipment and materials | 110 |
|  | | Industrial attachment | 360 |
| **Total** | | **1300** | **130** |
| **Grand total** | | **1580** | **158** |

The total duration of the course is 1580 hours including 360 hours’ industrial attachment.

**Entry Requirements**

A trainee entering this course should have any of the ICllowing minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) D (Plain)

**Or**

1. Equivalent qualification as determined by Kenya National Qualifications Authority (KNQA)

**Provision for industrial attachment**

It is envisaged that the trainee will have unfettered access to a fire safety service as a pre-requisite for admission into this training course.

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an internal verifier; while external assessment is the responsibility of TVET CDACC.

**Certification**

These units of learning can be done independently. On demonstration of competence in a unit of learning, a trainee will be awarded a Record of Achievement. Finally, on demonstration of competence in all the units of learning, the trainee will be awarded a Certificate in Oil Pipeline Fire Officer. The certificates will be awarded by TVET CDACC in conjunction with the training provider.

**BASIC UNITS OF LEARNING**

**COMMUNICATION SKILLS**

**UNIT CODE: OG/CU/IC/BC/01/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 25hours

**Unit Description**

This unit describes the competencies required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Contribute to the development of communication strategies
3. Conduct interviews
4. Facilitate group discussions
5. Represent the organization

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Organizational policies * Organization requirements for written and electronic communication methods * Report writing * Effective questioning techniques (clarifying and probing) * Workplace etiquette * Ethical work practices in handling communication * Active listening * Feedback * Interpretation * Flexibility in communication | * Observation * Oral |
| 1. Contribute to the development of communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Written * Observation |
| 1. Conduct interviews | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Written * Observation |
| 1. Facilitate group discussions | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Written * Observation |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Observation * Written |

**Suggested Delivery Methods**

* Interview
* Role playing
* Observation
* Viewing of related videos

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

# NUMERACY SKILLS

**UNIT CODE:** **OG/CU/IC/BC/02/5/A**

**Relationship to Occupational Standards:**

This unit addresses the unit of competency: Demonstrate numeracy skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to perform numerical functions. The person who is competent in this unit shall be able to: Calculate with whole numbers and familiar fractions, decimals and percentages for work; Estimate, measure, and calculate with routine metric measurements for work; Use routine maps and plans for work; Interpret, draw and construct 2D and 3D shapes for work; Interpret routine tables, graphs and charts for work; Collect data and construct routine tables and graphs for work; and Use basic functions of calculator

**Summary of Learning Outcomes**

1. Calculate with whole numbers and familiar fractions, decimals and percentages for work
2. Estimate, measure and calculate with routine metric measurements for work
3. Use routine maps and plans for work
4. Interpret, draw and construct 2D and 3D shapes for work
5. Interpret routine tables, graphs and charts for work
6. Collect data and construct routine tables and graphs for work
7. Use basic functions of calculator

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| Learning Outcome | Content | Suggested Assessment Methods |
| 1. Calculate with whole numbers and familiar fractions, decimals and percentages for work | * + Interpretation of whole numbers, fractions, decimals, percentages and rates   + Calculations involving several steps   + Calculation with whole numbers and routine or familiar fractions, decimals and percentages   + Conversion between equivalent forms of fractions, decimals and percentages   + Application of order of operations to solve multi-step calculations   + Application of problem solving strategies   + Making estimations to check reasonableness of problem solving process, outcome and its appropriateness to the context and task   + Use of formal and informal mathematical language and symbolism to communicate the result of a task | * Oral * Written * Practical test * Observation |
| 2. Estimate, measure and calculate with routine metric measurements for work | * Selection and interpretation of measurement information in workplace tasks and texts * Identification and selection of routine measuring equipment * Estimation and making measurements using correct units * Estimation and calculation using routine measurements * Performing conversions between routinely used metric units * Using problem solving processes to undertake tasks * Recording information using mathematical language and symbols | * Oral * Written * Practical test * Observation |
| 3. Use routine maps and plans for work | * Identification of features in routine maps and plans * Symbols and keys used in routine maps and plans * Identification and interpretation of orientation of map to North * Demonstrate understanding of direction and location * Apply simple scale to estimate length of objects, or distance to location or object * Give and receive directions using both formal and informal language | * Oral * Written * Practical test * Observation |
| 4. Interpret, draw and construct 2D and 3D shapes for work | * Identify two dimensional shapes and routine three dimensional shapes in everyday objects and in different orientations * Explain the use and application of shapes * Use formal and informal mathematical language and symbols to describe and compare the features of two dimensional shapes and routine three dimensional shapes * Identify common angles * Estimate common angles in everyday objects * Use formal and informal mathematical language to describe and compare common angles * Use common geometric instruments to draw two dimensional shapes * Construct routine three dimensional objects from given nets |  |
| 5. Interpret routine tables, graphs and charts for work | * Identify routine tables, graphs and charts in predominately familiar texts and contexts * Identify common types of graphs and their different uses * Identify features of tables, graphs and charts * Locate specific information * Perform calculations to interpret information * Explain how statistics can inform and persuade * Identify misleading statistical information * Discuss information relevant to the workplace | * Oral * Written * Practical test * Observation |
| 6. Collect data and construct routine tables and graphs for work | * Identify features of common tables and graphs * Identify uses of **different tables and graphs** * Determine data and variables to be collected * Determine audience * Select a method to collect data * Collect data * Collate information in a table * Determine suitable scale and axes * Draft and draw graph to present information * Check that data meets the expected results and context * Report or discuss information using formal and informal mathematical language | * Oral * Written * Practical test * Observation |
| 7. Use basic functions of calculator | * Identify and use keys for **basic functions on a calculator** * Calculate using whole numbers, money and routine decimals and percentages * Calculate with routine fractions and percentages * Apply order of operations to solve multi-step calculations * Interpret display and record result * Make estimations to check reasonableness of problem solving process, outcome and its appropriateness to the context and task * Use formal and informal mathematical language and appropriate symbolism and conventions to communicate the result of the task | * Oral * Written * Practical test * Observation |

**DIGITAL LITERACY**

**UNIT CODE: OG/CU/IC/BC/03/5/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate digital literacy

**Duration of Unit:** 45 hours

**Unit Description**

This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation * Observation |
| 1. Apply security measures to data, hardware and software | * Data security and control * Security threats and control measures * Types of computer crimes * Detection and protection against computer crimes * Laws governing protection of ICT | * Written tests * Oral presentation * Observation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Observation * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Observation * Oral presentation * Written report |
| 1. Apply desktop publishing in official assignments | * Concept of desktop publishing * Opening publication window * Identifying different tools and tool bars * Determining page layout * Opening, saving and closing files * Drawing various shapes using DTP * Using colour pellets to enhance a document * Inserting text frames * Importing and exporting text * Object linking and embedding * Designing of various publications * Printing of various publications | * Oral questioning * Observation * Oral presentation * Written report * Project |
| 1. Prepare presentation packages | * Types of presentation packages * Procedure of creating slides * Formatting slides * Presentation of slides * Procedure for editing objects | * Oral questioning * Observation * Oral presentation * Written report * Project |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Desk top computers
* Laptop computers
* Other digital devices
* Printers
* Storage devices
* Internet access
* Computer software

**ENTREPRENEURIAL SKILLS**

**UNIT CODE: OG/CU/IC/BC/04/5/A**

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

**Duration of unit:** 70 hours

**Unit description**

This unit describes the competencies critical to demonstration of entrepreneurial capabilities. It involves, enhancing the entrepreneur’s business skills, fostering a culture of continuous improvement at individual and organization level, implementing appropriate internal controls for profitability, improving employed capital base and undertaking regional/county business expansion.

**Summary of Learning Outcomes**

1. Develop one’s business skill
2. Develop individual workers and teams
3. Expand markets and customers
4. Expand employed capital
5. Undertake regional/county business expansion
6. Develop business Innovative strategies
7. Develop new products/ markets

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop one’s business skill | * Entrepreneurial skills development * Market trends * Monitoring and anticipating market trends * New technologies in entrepreneurship * Products and processes in entrepreneurship * Linkages with other entrepreneurs * Business conventions ad exhibitions * Personal improvement and growth | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |
| 1. Develop individual workers and teams | * Good staff/workers * Team building and team work * Staff development and enhancement * Culture of continuous improvement * Increasing products and services * Marketing improvement * Intrapreneurship | * Observation * Case studies * Individual/group assignments * projects * Written * Oral |
| 1. Expand markets and customers base | * Maintaining appropriate cash flow in the organization * Internal controls * Business break-even point * Business profitability determinants * Prudent purchases in an enterprise * Reducing business expenses * Good staff/workers and customer relations * Identifying and maintain new customers and markets * Product/ service promotions * Products / services diversification * SWOT / PESTEL analysis * Conducting a business survey * Market expansion * Small business records management * Book keeping and auditing for small businesses * Business support services * Small business resources mobilization and utilization * Basic business social responsibility * Management of small business * Word processing concepts in small business management * Computer application software * Monitoring and controlling business operations | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Expand employed capital | * Employed capital in small businesses * Share holdings * Business expansion and diversification * Resources for growing small business * Small business Strategic Plan * Cooperate Social responsibility * Computer software in business development * ICT and business growth | * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Undertake county/regional business expansion | * Region identification process * Regional laws and regulation * Business regional expansion requirements | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practice by trainee
* Role play
* Case study

**Recommended Resources**

* Case studies for small businesses
* Business plan templates
* Lap top/ desk top computer
* Internet

**EMPLOYABILITY SKILLS**

**UNIT CODE:** **OG/CU/IC/BC/05/5/A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:** 50 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management

2. Demonstrate interpersonal communication

3. Demonstrate critical safe work habits

4. Lead small teams

5. Plan and organize work

6. Maintain professional growth and development

7. Demonstrate workplace learning

8. Demonstrate problem solving skills

9. Demonstrate workplace ethics

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Self-development * Financial literacy * Healthy lifestyle practices | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Writing skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Sharing information | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate critical safe work habits | * Stress and stress management * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources utilization * Setting work priorities * HIV and AIDS * Drug and substance abuse * Handling emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Lead a small team | * Leadership qualities * Team building * Determination of team roles and objectives * Team performance indicators * Responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Maintaining relationships * Conflicts and conflict resolution | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making process * Task allocation * Evaluating work activities * Resource utilization * Problem solving * Collecting and organising information | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development | * Opportunities for professional growth * Assessing training needs * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Identifying work priorities * Recognizing career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Contributing to the learning community at the workplace * Cultural aspects of work * Variety of learning context * Application of learning * Safe use of technology * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Handling emerging issues * Future trends and concerns in learning | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate problem solving skills | * Problem identification * Problem solving * Application of problem-solving strategies * Resolving customer concerns | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace ethics | * Meaning of ethics * Ethical perspectives * Principles of ethics * Values and beliefs * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Observation * Oral interview * Written * Third party report |

**Suggested Methods of Delivery**

* Instructor lead facilitation of theory
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE:**  **OG/CU/IC/BC/06/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate environmental literacy

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs and monitor activities on environmental protection/programs.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard | * Purposes and content of Environmental Management and Coordination Act 1999 * Purposes and content of Solid Waste Act * Storage methods for environmentally hazardous materials * Disposal methods of hazardous wastes * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) | * Written questions * Oral questions * Observation of work procedures |
| 1. Control environmental Pollution control | * Types of pollution * Environmental pollution control measures * Types of solid wastes * Procedures for solid waste management * Different types of noise pollution * Methods for minimizing noise pollution | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Demonstrate sustainable resource use | * Types of resources * Techniques in measuring current usage of resources * Calculating current usage of resources * Methods for minimizing wastage * Waste management procedures * Principles of 3Rs (Reduce, Reuse, Recycle) * Methods for economizing or reducing resource consumption | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Evaluate current practices in relation to resource usage | * Collection of information on environmental and resource efficiency systems and procedures, * Measurement and recording of current resource usage * Analysis and recording of current purchasing strategies. * Analysis of current work processes to access information and data * Identification of areas for improvement | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Identify Environmental legislations/conventions for environmental concerns | * Environmental issues/concerns * Environmental legislations /conventions and local ordinances * Industrial standard /environmental practices * International Environmental Protocols (Montreal, Kyoto) * Features of an environmental strategy | * Written questions * Oral questions * Observation of work procedures |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5 s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analysing data gathered * Documentation of recommendations and submission * Setting of management support systems to sustain and enhance the program * Monitoring and reporting of environmental incidents to concerned /proper authorities | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Ccompany environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:**  **OG/CU/IC/BC/07/5/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSH programs, procedures and policies/guidelines

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace is conducted by * Authorized personnel or agency * Gathering of OHS issues and/or concerns raised | * Oral questions * Written tests * Observation of trainees identify hazards and risks |
| 1. Identify and implement appropriate control measure to hazards and risks | * Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented * Appropriate risk controls based on result of OSH hazard evaluation is recommended * Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures | * Oral questions * Written tests * Practical test * Observation of implementation of control measures |
| 1. Implement OSH   programs, procedures  and policies/guidelines | * Providing information to work team about company OHS program, procedures and policies/guidelines * Participating in implementation of OSH procedures and policies/ guidelines * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

**CORE UNITS OF LEARNING**

**MAINTENANCE OF MAINLINE AND PUMP-SET PIPELINE INSTRUMENTS**

**Unit Code: OG/CU/IC/CR/01/5/A**

**Relationship to Occupational Standards**

The unit addresses the unit standard: Maintain mainline and pump-set instruments.

**Duration of Unit:** 136 hours

**Unit Description**

This unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain mainline and pump-set instruments.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to mainline and pump-set instrument maintenance
3. Prepare for mainline and pump-set instrument maintenance
4. Carry out maintenance of the mainline and pump-set instruments
5. Commission and handover the mainline and pump-set instrument

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment** **Methods**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | | | | | | |
| **Specific**  **Learning Outcomes** | | **Content** | | | | | | | **Suggested**  **Assessment Methods** |
| 1. Develop safety plan for instrument maintenance work | | Elements of safety plan  How to develop the safety plan | | | | | | | Written  Observation |
| 1. Carry out job safety analysis | | Job safety analysis  Workplace safety procedures | | | | | | | Written  Practical |
| 1. Present toolbox talk | | Meaning of toolbox talk  Safe working practices in instrument maintenance  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | | | | | | | Observation  Written |
| 1. Identify correct personal protective equipment (PPE) for the job | | Types of PPEs for instrument maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | | | | | | | Observation  Written |
| 1. Process   required permits | | Types of work permits for instrument maintenance  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | | | | | | | Written  Inspection of records |
| 1. Report   incident/accide nts | | Description of incident/ accident  Accident/incident reporting process | | | | | | | Written |
| **Learning Outcome 2:** Apply housekeeping principles to  mainline and pump-set instrument maintenance | | | | | | |
| **Specific Learning**  **Outcomes** | | **Content** | | | | | | | **Suggested Assessment**  **Methods** |
| 2.1 Clean  workplace before, during and after instrument maintenance | | Purpose of cleaning and storage  Regulations governing good housekeeping in maintenance | | | | | | | Written  Observation |
| 2.2. Store tools, equipment and materials | | Manufacturers guidelines for Care of tools, equipment and materials  Proper storage of tools, equipment and materials | | | | | | | Written  Observation |
| **Learning Outcome 3:** Prepare for the mainline and pump-set  instrument maintenance | | | | | | | | |
| **Specific**  **Learning Outcomes** | | | **Content** | | **Suggested**  **Assessment Methods** | | | |
| 3.1. Identify the instrument to maintain | | | Types of mainline and pump-set instruments  Principle of instrument operation  Interpretation of maintenance chart  Interpretation of defect notification  Importance of instrument inventory  Instrument defect troubleshooting methods | | Observation | | | |
| 3.2. Interpret  instrument wiring diagrams and PIDs | | | Meaning of wiring diagrams and PIDs  How to use mainline and pump-set instrument wiring diagrams and PIDs | | Observation  Written | | | |
| 3.3. Identify and assemble tools and materials to use | | | Types of tools and materials for instrument maintenance  Methods of handling tools and materials | | Observation  Written | | | |
| **Learning Outcome 4:**Carry out maintenance of the mainline and  pump-set instruments | | | | | |
| **Specific**  **Learning Outcomes** | **Content** | | | **Suggested**  **Assessment Methods** | |
| 4.1 Process Job card | Types of job card  Purpose of job card  Job card structure  Job card data entry | | | Practical  Written | |
| 4.2 Clean and repair the instruments | Tools and materials for cleaning instruments  Reasons for cleaning  Spares management (procurement, storage, requisition, handling and disposal)  Replacement of defective parts procedure | | | Practical  Observation  Written | |
| 4.3 Check the physical condition of the instruments | Types of checks on instruments  Methods of instrument checks  Instrument status indications interpretations  Instrument alarm conditions interpretations | | | Observation  Written | |
| 4.4 Calibrate the instruments | Instrument calibration requirements  Statutory requirements  Instrument calibration schedule  Instrument calibration span  Instrument calibration equipment and tools setup | | | Written  Observation | |
|  | Instrument calibration procedure  Identifying the correct calibration Standard (e.g. 4 – 20 mA current, 0 – 5 V voltage)  Instrument calibration methods | | |  | |
| **Learning Outcome 5:** Commission and handover the mainline  and pump-set instruments after maintenance | | | | | |
| **Specific Learning Outcomes** | **Content** | | | **Suggested Assessment Methods** | |
| 5.1 Normalise the instruments | Instrument normalisation procedures  Work permit closure procedure | | | Written  Observation | |
| 5.2 Prepare  maintenance report | Structure and content of report | | | Written  Inspect  completed records | |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Demonstration of task by trainer
3. Practice by trainee

**List of Recommended Resources**

|  |
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| **References** |
| [www.instrumentationtoolbox.com](http://www.instrumentationtoolbox.com/)  [www.us.endress.com/en](http://www.us.endress.com/en)  **Instrumentation Reference Book**, by Horn, Delton, Darer, Jack  KPC work procedure manual |
| **Tools:** |
| 1. Device under test (DUT) 2. Reference device 3. Digital multi-meter 4. Closed end pipe with known parameters 5. Computer 6. Technician toolkit (spanners, screw drivers,) 7. Wrenches 8. Wire strippers |
| **Consumables:** |
| 1. Reference hydrocarbon 2. Mutton cloth 3. Contact cleaner 4. Grease |
| **PPEs:** |
| Safety shoes, oil resistant gloves, dust coat, helmet |

**MAINTENANCE OF PRODUCT VOLUME MEASURING SYSTEMS**

**Unit Code: OG/CU/IC/CR/02/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain product volume measuring systems

**Duration of Unit:** 112 hours

**Unit Description**

The unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain product volume measuring systems.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to product volume measuring systems maintenance
3. Prepare for the product volume measuring systems maintenance
4. Configure product volume measuring systems
5. Calibrate product volume measuring systems
6. Clean, service and repair product volume measuring systems
7. Commission and handover product volume measuring systems

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | | | | | | | | | | | |
| **Specific Learning Outcomes** | | | | **Content** | | | | **Suggested**  **Assessment Methods** | | | | |
| 1.1. Develop safety plan for instrument maintenance  work | | | | Elements of safety plan  How to develop the safety plan | | | | Written  Observation | | | | |
| 1.2. Carry out job safety analysis | | | | Job safety analysis  Workplace safety procedures | | | | Written  Observation | | | | |
| 1.3. Present toolbox talk | | | | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | | | | Observation  Written | | | | |
| 1.4. Identify correct PPEs for the job | | | | Types of PPEs for product volume measuring system maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | | | | Observation  Written | | | | |
| 1.5. Process required permits | | | | Types of work permits for product measuring systems maintenance  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | | | | Written  Inspection of records | | | | |
| 1.6. Report incidents/ accidents | | | | Description of incident/accident,  Accident/incident reporting process | | | | Written  Inspection of records | | | | |
| **Learning Outcome 2:** Apply housekeeping principles to product  volume measuring systems maintenance activities | | | | | | | | | | | | |
| **Specific Learning Outcomes** | | | | **Content** | | | | **Suggested**  **Assessment Methods** | | | | |
| 2.1. Clean workplace before, during and after the maintenance | | | | Regulatory requirements for good housekeeping  Methods of cleaning in product measuring systems | | | | Written  Observation | | | | |
| 2.2. Store tools, equipment and materials for product volume measuring systems | | | | Manufacturers guidelines for Care of tools, equipment and materials  Proper storage of tools, equipment and materials | | | | Written  Observation | | | | |
| **Learning Outcome 3:** Prepare for the product volume measuring  systems maintenance | | | | | | | | | | | | |
| **Specific Learning Outcomes** | | | | **Content** | | | | **Suggested Assessment Methods** | | | | |
| 3.1. Process job card | | | | Purpose of job card  Job card structure  Job card data entry | | | | Practical  Written | | | | |
| 3.2. Identify the product volume measuring systems for maintenance | | | | Types of product metering, tank gauging and fuel accounting systems  Operation principles of product metering, tank gauging and fuel accounting systems  Maintenance chart interpretation  Defect notification interpretation  Product metering, tank gauging and fuel accounting systems defect troubleshooting methods | | | | Practical  Observation | | | | |
| 3.3. Interpret product volume measuring systems wiring  diagrams and PIDs | | | | Meaning of wiring diagrams and PIDs  How to use product volume measuring systems wiring diagrams and PIDs | | | | Observation | | | | |
| 3.4. Identify and assemble tools and materials to use | | | | Types of tools and materials for instrument maintenance  Methods of handling tools and materials | | | | Observation  Written | | | | |
| **Learning Outcome 4:** Configure product volume measuring  systems | | | | | | | | | | | | |
| **Specific Learning Outcomes** | | | | **Content** | | | | **Suggested Assessment**  **Methods** | | | | |
| 4.1 Configure truck loading system | | | | * Truck loading pre-set units (accuload) configurations and error log management * Truck loading pre-set units (accuload) database management * Digital flow control valve solenoid setting * Purpose of earth monitoring relay (EMR) * Product meter’s meter factor (MF) management * Loading arm switches maintenance | | | | Written  Observation | | | | |
| 4.2 Configure product metering systems | | | * Components of product metering systems * Turbine meter and PDM principle of operation * Turbine and positive displacement meter (PDM) compartment and blades assembly * Pulse pickup principle of operation and design * Pulse pickup position adjustment * Ultrasonic flow meter (UFM) transceiver (beams) operation principle * UFM transceiver assembly * UFM transceiver (beams) adjustment * UFM flow computer configuration and data management * Flow computer configuration * Pulse transmitter assembly and connection to meter | | | | * Written * Observation | | |
|  | | | | Air gap between pulse pickup head  and to gear and adjustments | | | |  | | | | |
| 4.3 Perform terminal automation fuel accounting system software administration | | | | * Configuration of terminal automation fuel accounting system (Fuel FACS) databases * Terminal automation fuel accounting system (Fuel FACS) fuel advice note (FAN) printer operation and configuration * Terminal automation fuel accounting system (Fuel FACS) bill of loading (BOL) printer operation and configuration * Configuration of terminal automation fuel accounting system (Fuel FACS) trucks, shippers and drivers’ database * Terminal automation fuel accounting system (Fuel FACS) administration activities | | | | * Written * Observation | | | | |
| 4.4 Configure tank gauging system | | | | Types of tank gauges  Tank side level indicator status interpretations  FCU (field control unit) status indication interpretations  Tank gauging computer error logs interpretations  Product level measurement principles  Temperature measurement methods  Application of API table  Density measurement methods | | | | Written  Observation | | | | |
| **Learning Outcome 5:** Calibrate product volume measuring  systems | | | | | | | | | | | | |
| **Specific Learning Outcomes** | | | | **Content** | | | | **Suggested Assessment Methods** | | | | |
| 5.1 Calibrate Truck loading system | | | | Digital flow control valve solenoid settings  Product meter’s meter factor (MF) management | | | | Written  Observation | | | | |
|  | | | | Truck loading  system (accuload) MF configuration | | | |  | | | | |
| 5.2 Calibrate Product metering system | | | | Components of product metering system  Flow computer configuration  Meter calibration procedures  Prover system operation  Prover computer configuration  Meter factor management  Prover start-stop contact switches and their operation  Meter flow computer meter factor configuration  Comparison of manual dips to meter measurements | | | | Written  Observation | | | | |
| 5.3 Calibrate tank gauging system | | | | Components of tank gauging system  Comparison of manual dips to automatic tank gauging measurements | | | | Written  Observation | | | | |
|  | | | | Tank gauging computer strap table configuration  Configuration of density calculation data using pressure transmitter in automatic tank gauging computer  Comparison of manual dips to automatic tank  gauging measurements | | | |  | | | |
| **Learning Outcome 6:** Clean, service and repair product volume measuring systems | | | | | | | | | | | |
| **Specific Learning**  **Outcomes** | | **Content** | | | | **Suggested Assessment**  **Methods** | | | | | |
| 6.1 Clean  product volume measuring systems | | Methods of cleaning product measuring systems  Reasons for cleaning  Product volume measuring systems cleaning tools and materials | | | | Observation | | | | | |
| 6.2 Repair  product volume measuring systems | | Methods of repairing product measuring systems | | | | Observation | | | | | |
| **Learning Outcome 7:** Commission and handover product  volume measuring systems | | | | | | | | | | |
| **Specific**  **Learning Outcomes** | | **Content** | | | | **Suggested**  **Assessment Methods** | | | | |
| 7.1Normalise product volume measuring systems after maintenance | | Product volume measuring systems normalisation procedures  Work permit closure procedure | | | | Written  Observation | | | | |
| 7.2Prepare  maintenance report | | Maintenance  report structure and content | | | | Inspect  completed records | | | | |

**Suggested Delivery Methods**

Instructor-led facilitation of theory

Demonstration of task by trainer

Practice by trainee

List of Recommended Resources

|  |
| --- |
| **References** |
| [http://www.emersonprocess.com.a](http://www.emersonprocess.com.a/)  [www.us.endress.com/en](http://www.us.endress.com/en)  **Instrumentation and Control Documentation – Second Edition,** by Frank Meir |
| **Tools:** |
| 1. Multi-meter 2. Maintenance laptop/software 3. Network management system 4. Manufacturers’ manual 5. Standard toolkit 6. Wrenches 7. Spanners |
| **Consumables:** |
| 1. Contact cleaner 2. Masking tape 3. Insulating tape 4. Cleaning rug |
| **PPE:** |
| Safety shoes, oil resistant gloves, dust coat, helmet, |

**MAINTENANCE OF SUPERVISORY, CONTROL AND DATA ACQUISITION (SCADA) SYSTEM**

**Unit Code: OG/CU/IC/CR/03/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain supervisory, control and data acquisition (SCADA) system.

**Duration of Unit:** 32 hours

Unit Description

The unit describes the knowledge, skills and attitudes required by Oil Pipeline Instrumentation and Control Technician to competently maintain supervisory, control and data acquisition (SCADA) system.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to SCADA system maintenance
3. Prepare for the SCADA system maintenance
4. Perform SCADA system administration
5. Clean, service and repair SCADA system
6. Commission and handover the SCADA system after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop safety plan for instrument maintenance  work | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out job safety analysis | Job safety analysis  Workplace safety procedures for SCADA maintenance | written  Practical |
| 1.3. Present  toolbox talk | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | Observation |
| 1.4. Identify correct PPEs for the job | Types of PPEs for SCADA system maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | Observation |
| 1.5. Process  required permits | Types of work permits  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | Written  Inspection of records |
| 1.6. Report  incidents/ accidents | Description of incident/accident  Accident/incident reporting process | Written |
| **Learning Outcome 2:** Apply housekeeping principles to SCADA  System maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 2.1. Clean  workplace before and after the maintenance | Regulatory requirements for good housekeeping  Methods of cleaning in SCADA system maintenance   | Written  Observation |
| 2.2. Store tools, equipment and materials | Manufacturers’ guidelines for care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |
| **Learning Outcome 3:** Prepare for SCADA System maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 3.1 Process Job card | Purpose of job card  Job card structure  Job card data entry | Practical  Written |
| 3.2 Identify the SCADA system to maintain | Definition of SCADA systems  Architecture of SCADA systems  Maintenance chart interpretation  Defect notification interpretation  Importance of SCADA systems inventory  SCADA systems defect troubleshooting methods | Observation  Written |
| 3.3 Interpret  SCADA  system wiring diagrams and PIDs | Meaning of wiring diagrams and PIDs  How to use SCADA system wiring diagrams and PIDs | Observation  Written |
| 3.4 Identify and assemble tools and materials | Types of tools and materials for instrument maintenance  Methods of handling tools and materials | Observation  Written |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 4:** Perform SCADA System administration | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 4.1Check physical conditions of SCADA  system | Real time, historical, time, engineering, terminal servers status indications and interpretations  RAID disks mass storage status indication and interpretations  Operator workstations status indications and interpretations  Network switch, fire wall, and routers status  indications and interpretations | Written  Observation |
| 4.2Carry out administration of SCADA  system | How to carry out antivirus administration  How to carry out user’s profile and login administration  Schedule of antivirus update and administration  Prevailing system and network security threats  How to carry out system start-up and shutdown  How to carry out system backup and restoration  How to carry out system data archiving | Written  Observation |
|  | How to carry out display creation and adding new devices  How to carry out log files analysis  How to carry out system failover  How to carry out report generation  How to carry out system memory disk space monitoring  How to carry out starting and stopping system processes  How to carry out distributing files and sub systems  How to carry out  installing software licences |  |
| **Learning Outcome 5:** Clean, service and repair SCADA  System | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Clean the SCADA system | Reasons for cleaning  SCADA system  cleaning tools and materials | Observation |
| 5.2 Repair the SCADA system | Defective parts replacement procedure  SCADA system shutdown and start-up procedure | Observation  Written |
| **Learning Outcome 6:** Commission and handover the SCADA  system | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 6.1 Normalise the SCADA system | SCADA system normalisation procedure  Work permit closure procedure | Written  Observatio n |
| 6.2 Prepare maintenance  report | Report structure and  content | Written  Inspection of records |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Demonstration of task by trainer
3. Practice by trainee

List of Recommended Resources

|  |
| --- |
| **References** |
| 1. Pipeline work procedure manual on ISO documents site 2. [http://www.schneider-electric.com](http://www.schneider-electric.com/) 3. **SCADA, Supervisory Control and Data Acquisition - 4th Edition,** by Stuart Boyer |
| **Tools:** |
| 1. Blower 2. Laptop 3. Multi-meter 4. Maintenance Software |
| **Consumables:** |
| 1. Contact cleaner 2. Masking tape 3. Insulating tape 4. Cleaning rug 5. Mutton cloth 6. Backup media |
| **PPE:** |
| Safety shoes, oil resistant gloves, dust coat, helmet, |

**MAINTENANCE OF LEAK DETECTION SYSTEM (LDS)**

**Unit Code: OG/CU/IC/CR/04/5/A**

Relationship to Occupational Standards

This unit addresses the unit standard: Maintain leak detection system (LDS)

**Duration of Unit:** 32 hours

Unit Description

This unit describes the skills, knowledge and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain leak detection system (LDS).

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to LDS maintenance
3. Prepare for the LDS maintenance
4. Perform LDS administration
5. Clean, service and repair LDS
6. Commission and handover the LDS after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 1.1. Develop safety plan for LDS maintenance | * Elements of safety plan * How to develop the safety plan | * Written |
| 1.2. Carry out job safety analysis | * Job safety analysis * Workplace safety procedures for LDS maintenance | * Written |
| 1.3. Present toolbox talk | * Meaning of toolbox talk * Safe working practices * How to conduct toolbox talk * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.4. Identify correct PPEs for the job | Types of PPEs for LDS maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | Observation |

|  |  |  |
| --- | --- | --- |
| 1.5. Process required permits | * Types of work permits for LDS maintenance * Requirements of a permit to work (PTW) system * Design of PTW forms * Procedure of raising work permit * Tracking of permit approvals | * Written * Inspection of records |
| 1.6. Report  incidents/ accidents | Description of incident/accident  Accident/incident reporting process | Written assessment  Inspection of records |
| **Learning Outcome 2:** Apply housekeeping principles to LDS  maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 2.1. Clean  workplace before, during and after the maintenance | Regulatory requirements for good housekeeping  Methods of cleaning in LDS maintenance | Written  Observation |
| 2.2. Store tools, equipment and materials | Manufacturers guidelines for care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 3:** Prepare for LDS maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 3.1 Process job card | * Purpose of job card * Job card structure * Job card data entry | Written  Observation |
| 3.2 Identify the LDS to maintain | * Maintenance chart interpretation * Defect notification interpretation * Importance of keeping LDS inventory * LDS defect troubleshooting methods | Observation |
| 3.3 Identify LDS wiring diagrams and PIDs | * Meaning of wiring diagrams and PIDs * How to use LDS wiring diagrams and PIDs | Observation |
| 3.4 Identify and assemble tools and materials to use | * Types of tools and materials for LDS maintenance * Methods of handling tools and materials | Observation |
| **Learning Outcome 4:** Perform LDS administration | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| * + Check physical * condition of | * LDS leak detection technologies | * written * Observation |
| * LDS | * Operation principle of the LDS * Real time, historical, time, engineering, terminal servers status indications interpretations * RAID disks mass storage status indication interpretations * Operator workstations status indications interpretations * Network switch, fire wall, and routers status indications interpretations |  |
| * + Carry out * system | * How to carry out antivirus administration * How to carry out user’s profile and login administration * How to keep schedule of antivirus update and administration * How to carry out system start-up and shutdown * How to carry out system backup and restoration | * Written * Observation |
| * administration |  |
| * maintenance of |  |
| * LDS |  |

|  |  |  |
| --- | --- | --- |
|  | How to carry out system data archiving  How to carry out display creation and adding new devices  How to carry out log files analysis  How to carry out system failover  How to carry out report generation  How to carry out system memory disk space monitoring  How to carry out starting and stopping system processes  How to install software licenses |  |
| **Learning Outcome 5:** Clean, service and repair LDS | | |
| **Specific Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 5.1 Clean the LDS | Methods of cleaning LDS  Reasons for cleaning  LDS cleaning tools and materials | Observation |
| 5.2 Repair the LDS | Defective parts replacement procedure  LDS shutdown and start-up procedure | Observation |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 6:** Commission and handover the LDS | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 6.1 Normalize the LDS | LDS normalization procedure  Work permit closure procedure | Written  Observation |
| 6.2 Prepare  maintenance report | Report structure and content | Written |

**Suggested Delivery Methods**

Instructor-led facilitation of theory

Practical demonstration of task by trainer

Practice by trainee

List of Recommended Resources

|  |
| --- |
| **References** |
| Pipeline work procedure manual on ISO documents site  [http://www.schneider-electric.com](http://www.schneider-electric.com/)  **Standard Test Procedure for Evaluating Leak Detection Methods: Pipeline Leak Detection Systems**,  by US Energy Protection agency |
| **Tools:** |
| Blower  Laptop  Multi-meter  Maintenance software |
| **Consumables:** |
| Contact cleaner  Mutton cloth  Backup media |
| **PPE:** |
| Safety shoes, oil resistant gloves, dust coat, helmet, |

**MAINTENANCE OF PROGRAMMABLE LOGIC CONTROLLER (PLC)**

**Unit Code: OG/CU/IC/CR/05/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain programmable logic controller (PLC).

**Duration of Unit:** 32 hours

Unit Description

This unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain programmable logic controller (PLC).

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to PLC maintenance
3. Prepare for the PLC maintenance
4. Configure and program PLC
5. Clean, service and repair PLC
6. Commission and handover the PLC after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | * **Content** | * **Suggested** * **Assessment Methods** |
| 1.1. Develop  safety plan for instrument maintenanc  e work | * Elements of safety plan * How to develop the safety plan | * Written * Observation |
| 1.2. Carry out  job safety analysis | * Job safety analysis * Workplace safety procedures for PLC maintenance | * Written * Practical |
| 1.3. Present  toolbox talk | * Meaning of toolbox talk * Safe working practices * How to conduct toolbox talks * Who conducts toolbox talk * Benefits of toolbox talk | * Observation |
| 1.4. Identify  correct PPEs for the job | * Types of PPEs for PLC maintenance * Purpose of PPEs * Safe and correct handling, use, maintenance and storage of different types of * PPEs | * Observation |
| 1.5. Process  required permits | * Types of work permits for PLC maintenance * Requirements of a permit to work (PTW) system | * Written * Inspection records |
|  | * Design of PTW forms * Procedure of raising work permit * Tracking of permit approvals |  |
| 1.6. Report  incidents/ accidents | * Description of incident/accident * Accident/incident reporting process | * Written * Inspection of records |
| * **Learning Outcome 2:** Apply housekeeping principles to PLC * maintenance | | |
| **Specific Learning Outcomes** | * **Content** | * **Suggested Assessment Methods** |
| 2.1. Clean  workplace before, during and after the maintenanc  e | * Regulatory requirements for good housekeeping * Methods of cleaning in PLC maintenance | * Written * Observation |
| 2.2. Store tools, equipment and materials | * Manufacturers’ guidelines for care of tools, equipment and materials * Proper storage of tools, equipment and materials | * Written * Observation |
| **Learning Outcome 3:** Prepare for the PLC maintenance | | |
| **Specific Learning Outcomes** | **Content** | Assessment Tasks |
| 3.1 Process job card | Purpose of job card  Job card structure  Job card data entry | Written |

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| 3.2 Identify the PLC to maintain | Maintenance chart interpretation  Defect notification interpretation  Importance of keeping PLC inventory  PLC defect troubleshooting methods | Observation  Written |
| 3.3 Identify PLC wiring diagrams and  PIDs to use | Meaning of wiring diagrams and PIDs  How to use PLC wiring diagrams and PIDs | Observation |
| 3.4 Identify and assemble tools and materials | Types of tools and materials for PLC maintenance  Methods of handling tools and materials | Observation  Written test |
| **Learning Outcome 4:** Configure and program PLC | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 4.1Check  physical condition of PLC | Definition of PLC  Types of PLCs  PLC operation principle  PLC basic programming  PLC status LED indications interpretations  PLC alarm status indications interpretations  PLC audible alarms interpretations | Written  Observation |
|  | PLC operator workstation fault/alarm reports  PLC controller LED status indications interpretations  PLC input/output (I/O) modules LED status indications interpretations  PLC cabinet environment temperature settings  Power supply values and quality (voltage, current and frequency) |  |
| 4.2Wire and install PLC modules | PLC network wiring connection types (BNC, fibre, wireless)  Types of PLC modules (processor, power supply, network, communication, input/output (I/O), and backplane)  Hot swapping of PLC modules  PLC cabinet and rack sizing | Written  Observation |
| 4.3Program and configure PLC | Types of PLC programmes (relay ladder logic, relay building blocks, etc.)  How to programme PLC | Written  Observation |
|  | PLC programme upload/download operation  PLC logic programme backup/restoration operation  PLC communication configuration and input/output (I/O) mapping configuration  PLC programming and running modes of operation  PLC engineering and raw field value scaling methods |  |
| 4.4Maintain PLC operator workstation display and  database | PLC display creation and display creation tools  PLC database management  Operator workstation communication configuration and database mapping to other databases  PLC operator workstation operating system administration  How to carry out antivirus administration on operator workstation | Written  Observation |
| **Learning Outcome 5:** Clean, service and repair PLC | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 5.1 Clean the PLC | Methods of cleaning PLC  Reasons for cleaning  PLC cleaning tools and materials | Observation  Written |
| 5.2 Repair the PLC | Defective parts replacement procedure  PLC shutdown and start- up procedure | Written  Observation |
| **Learning Outcome 6:** Commission and handover the PLC | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 6.1 Normalise the PLC | * PLC normalization procedure * Work permit closure procedure | Written  Observation |
| 6.2 Prepare  maintenance report | * Report structure and content | Written |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Practical demonstration of task by trainer
3. Practice by trainee
4. List of Recommended Resources

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| --- |
| **References** |
| [*http://www.schneider-electric.com*](http://www.schneider-electric.com/)  [http://www.rockwellautomation.com/global/services/onsit e/programmable-logic-controllers.page](http://www.rockwellautomation.com/global/services/onsite/programmable-logic-controllers.page)  **Programmable Logic Controllers,** by Frank Petruzella |
| **Tools:** |
| Maintenance laptop  Network management system  Standard toolkit  Multi-meter  Wire strippers  Manufacturers’ manual  Blower |
| **Consumables:** |
| Contact cleaner  Mutton cloth  Backup media  Contact cleaner |
| **PPE:** |
| Safety shoes, oil-resistant gloves, dust coat, helmet, |

**MAINTENANCE OF TELECOMMUNICATION SYSTEMS**

**Unit Code: OG/CU/IC/CR/06/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain Telecommunication Systems.

**Duration of Unit:** 56 hours

Unit Description

This unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain telecommunication systems.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to telecommunication maintenance
3. Prepare for telecommunication systems maintenance
4. Configure telecommunication systems
5. Clean, service and repair telecommunication systems
6. Commission and handover the telecommunication systems after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop  safety plan for telecommuni cation systems maintenance  work | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out job safety analysis | Job safety analysis  Workplace safety procedures in telecommunication systems maintenance | Written  Observation |
| 1.3. Present  toolbox talk | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talks  Who conducts toolbox talk  Benefits of toolbox talk | Observation |
| 1.4. Identify  correct PPEs for the job | Types of PPEs for telecommunication systems maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | Observation |

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| --- | --- | --- |
| 1.5. Process  required permits | Types of work permits for telecommunication systems maintenance  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | Inspection of records  Written test |
| 1.6. Report  incidents/acci dents | Description of incident/accident  Accident/incident reporting process | Written assessment  Inspection of records |
| **Learning Outcome 2:** Apply housekeeping principles to  telecommunication systems maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1. Clean  workplace before, during and after the maintenance | Regulatory requirements for good housekeeping  Methods of cleaning in PLC maintenance | Written  Observation |
| 2.2. Store tools, equipment and materials. | Manufacturers’ guidelines for care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |

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| **Learning Outcome 3**: Prepare for the telecommunication system  maintenance | | |
| **Specific Learning Outcomes** | * **Content** | **Suggested Assessment Methods** |
| 3.1 Process job card | * Purpose of job card * Job card structure * Job card data entry | Practical  Written |
| 3.2 Identify the telecom systems to maintain | * Types of telecommunication systems * Various telecommunication technologies * Telecommunication systems operation principles * Maintenance chart interpretation * Defect notification interpretation * Keeping telecommunication system inventory * Telecommunication system defect troubleshooting methods | Observation  Written |
| 3.3 Identify  telecom systems wiring diagrams and PIDs to  use | * Meaning of wiring diagrams and PIDs * How to use telecommunication systems wiring diagrams and PIDs | Observation  Written test |

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| --- | --- | --- | --- | --- |
| 3.4 Identify and assemble tools and materials to  use | Types of tools and materials for telecommunication systems maintenance  Methods of handling tools and materials | | Observation | |
| **Learning Outcome 4:** Configure telecommunication systems | | | | |
| **Specific Learning**  **Outcomes** | **Content** | | **Suggested Assessment**  **Methods** | |
| 4.1 Check  physical condition of microwave telecom system | Microwave radio telecom system operation principle  Microwave RF frequency band  Microwave radio components  Microwave radio status LED indications interpretations  Microwave radio alarm status indications interpretations  Microwave radio audible alarms intepretation  NMS fault/alarm reports navigation  Microwave radio power supply LED status indications  Microwave radio transmitter/receiver LED status indications  Microwave radio cabinet environment temperature settings | | Written  Observation | |
|  | Power supply values and  quality (voltage, current and frequency) | |  | |
| 4.2 Check  physical condition of VHF  telecom system | * VHF radio telecom system operation principle * Trunked VHF, portable, base and mobile VHF radio networks * VHF RF frequency band * VHF radio components * VHF radio status LED indications interpretations * VHF radio alarm status indications interpretations * VHF radio audible alarms interpretations * VHF radio NMS fault/alarm reports * VHF radio power supply LED status indications * VHF radio transmitter/receiver LED status indications * VHF radio cabinet environment temperature settings * Power supply values and quality (voltage, current, frequency) | | Written  Observation | |
| 4.3 Check  physical condition of fibre optic cable telecom system | * FOC technology * FOC components * FOC transreceiver status LED indications interpretations * FOC transreceiver alarm status indications interpretations * FOC transreceiver audible alarms interpretations * FOC transreceiver NMS fault/alarm reports interpretations * FOC transreceiver power supply LED status indications interpretations * FOC transreceiver LED status indications * FOC transreceiver cabinet environment temperature settings * Power supply values and quality (voltage, current and frequency) | | Written  Observation | |
| 4.4 Configure microwave telecom systems | * Microwave frequency spectrum * Microwave radio system components * Microwave radio expected readings (signal strength, attenuation, frequency) * Microwave radio operating RF (radio frequency) power range | | Written  Observation | |
|  | Microwave radio operating frequency band and spot frequency  Operation of radio power tester and frequency analyser  Safety precautions against frequency radiation to take while carrying out power test  Microwave radio antenna design, installation and operation  Frequency line of sight principle | |  | |
| 4.5 Configure VHF telecom system | VHF radio trunking technology  VHF portable, mobile, fixed, base, dispatcher radios and their operation  VHF radio antenna operation principle  VHF system components (VHF transceiver, antenna)  VHF radio expected readings (signal strength, attenuation, frequency etc.)  Physical condition of VHF radios (casing, harness, antenna, keypad buttons, charger).  VHF radios operating RF (radio frequency) power range  VHF radios operating frequency band and spot frequency | | Written  Observation | |
|  | VHF radio frequency configuration  VHF radios operation modes (simplex, duplex)  Operation of VHF radio power meter | |  | |
| 4.6 Configure and repair fibre optic cable (FOC) telecommun ication systems | Principle of operation of optical fibre optic technology  Operating optical signal generator and receiver meters  Operating optical time division reflectometer (OTDR)  Light characteristics  Equipment optical power adjustment  Optical fibre splicing  Operating fibre splicing machine  Environment cleanliness precaution to take while splicing fibre  Expected fibre splice quality | | Written  Observation | |
| 4.7 Manage  microwave telecom network management system (NMS) | Microwave radio network equipment display creation and display creation tools  Microwave radio network management system (NMS) database management  NMS report generation and reporting tools  NMS communication protocols | | Written  Observation | |
|  | NMS operating system administration  NMS system administration | |  | |
| 4.8 Manage VHF telecom system NMS | VHF radio network equipment display creation and display creation tools  VHF radio NMS database management  NMS report generation and reporting tools  NMS communication protocols | | Written  Observation | |
|  | NMS operating system administration  NMS system antivirus administration | |  | |
| 4.9 Manage | FOC network equipment display creation and display creation tools  FOC NMS database management  NMS report generation and reporting tools  NMS communication protocols  NMS operating system administration  NMS system antivirus administration | | Written | |
| fibre optic | Observation | |
| cable (FOC) |  | |
| telecom |  | |
| system |  | |
| NMS |  | |
| **Learning Outcome 5:** Clean, service and repair  telecommunication systems | | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** | |
| 5.1 Clean the microwave telecommunica tion systems | Methods of cleaning telecommunication systems  Reasons for cleaning | Observation  Written | |
|  | Telecommunication systems cleaning tools and materials |  | |
| 5.2 Repair the | Defective parts replacement procedure | Written | |
| microwave | Observation | |
| telecommunica |  | |
| tion system |  | |
| **Learning Outcome 6:** Commission and handover the  telecommunication systems | | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** | |
| 6.1 Normalise the telecommunica tion system | Telecommunication  systems normalisation procedure  Telecommunication  system shutdown and start-up procedure  Work permit closure procedure | Written  Observation | |
| 6.2 Prepare  maintenance report | Report structure and content | Written | |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Group and individual learning activities
3. Demonstration of task by trainer
4. Practice by trainee

**List of Recommended Resources**

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| **References** |
| [www.GEmds.com](http://www.gemds.com/)  <https://en.wikipedia.org/wiki/Optical_fiber>  [https://www.gedigitalenergy.com](https://www.gedigitalenergy.com/)  **Digital Microwave Radio**, by George Kizer |
| **Tools:** |
| 1. Frequency counter 2. Power source 3. Connectors/adapters 4. Spectrum analyser 5. Standard toolkit 6. OTDR 7. Optical power generator/receiver 8. Fiber splicing kit 9. Maintenance laptop 10. Network management system (NMS) 11. Power meter 12. Oscilloscope 13. Multi-meter 14. Blower 15. Recording pen |
| **Consumables:** |
| 1. Contact cleaner 2. Mutton cloth 3. Backup media 4. Contact cleaner 5. Masking tape 6. Insulation tape 7. Spares 8. Cotton wool 9. Fiber cleaning spirit |
| **PPE:** |
| 1. Safety shoes, dust coat, helmet, |

**MAINTENANCE OF FIRE DETECTION AND ALARM (FDA) SYSTEMS**

**Unit Code: OG/CU/IC/CR/07/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain fire detection and alarm (FDA) systems

**Duration of Unit**: 32 hours

Unit Description

This unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain fire detection and alarm (FDA) systems.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to FDA system maintenance
3. Prepare for the FDA system maintenance
4. Configure and test FDA system
5. Clean, service and repair FDAsystem
6. Commission and handover the FDA system after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop  safety plan for FDA  maintenan ce work | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out  job safety analysis | Job safety analysis  Workplace safety procedures in FDA system maintenance | Written  Practical |
| 1.3. Present  toolbox talk | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | Observation  Written |
| 1.4. Identify  correct PPEs for the job | Types of PPEs for FDA systems maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of  PPEs | Observation  Written |

|  |  |  |
| --- | --- | --- |
| 1.5. Process  required permits | Types of work permits  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | Written assessment  Inspection of records |
| 1.6. Report  incidents/ accidents | Description of incident/accident  Accident/incident reporting process | Written  Observation |
| **Learning Outcome 2:** Apply housekeeping principles to FDA  systems maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 2.1 Clean  workplace before, during and after the maintenanc e | Regulatory requirements for good housekeeping  Methods of cleaning in FDA systems maintenance | Written  Observation |
| 2.2 Store tools, equipment and materials | Manufacturers guidelines for Care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |

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| **Learning Outcome 3:** Prepare for the FDA systems maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 3.1 Process job card | Purpose of job card  Job card structure  Job card data entry | Practical  Written |
| 3.2 Identify the FDA systems to maintain | Maintenance chart interpretation  Defect notification interpretation  Importance of keeping FDA system inventory  FDA system defect troubleshooting methods | Observation  Written |
| 3.3 Identify  FDA system wiring diagrams and PIDs to use | Meaning of wiring diagrams and PIDs  How to use FDA systems wiring diagrams and PIDs | Observation  Written |
| 3.4 Identify and assemble tools and materials to  use | Types of tools and materials for FDA systems maintenance  Methods of handling tools and materials | Observation  Written test |
| **Learning Outcome 4:** Configure and test FDA system | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 4.1 Check the physical condition of FDA systems | FDA system components  FDA system operation principle  Types of detectors (smoke, fire, heat, flame)  FDA system fire control panel (FCP) status LED indications and interpretations  FDA system FCP alarm status indications and interpretations  FDA system FCP audible alarms interpretations  Controller LED status indications  Detector LED status indications interpretation  Power supply values and quality (voltage, current and frequency) | Written  Observation |
| 4.2 Configure and test the FDA system | Types of FDA system fault diagnostic equipment and tools  Types of detectors  Fire suppression systems  Fire alarm control panel operation  FDA system isolation procedure  System device address  identification  System detector locations  FDA system circuit diagram reading and interpretation  FDA system fault location methods | Written  Observation |
| 4.3 Maintain FDA system fire control panel (FCP) | FDA system detector control loops configuration  Configuration and setting up of the FCP  FDA system configuration of detector locations  FCP display indications and buttons interpretations | Written test  Observation |
| **Learning Outcome 5:** Clean, service and repair FDA systems | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 5.1 Clean the FDA system | Methods of cleaning FDA systems  Reasons for cleaning  FDA systems cleaning tools and materials | Observation |
| 5.2 Repair the FDA  system | Defective parts replacement procedure | Written  Observation |
| **Learning Outcome 6:** Commission and handover the FDA  systems | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 6.1 Normalize the FDA  system | FDA system normalisation procedure  Work permit closure procedure | Written  Observation |
| 6.2 Prepare  maintenan ce report | Report structure and content | Written |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Practical demonstration of task by trainer
3. Practice by trainee

List of Recommended Resources

|  |
| --- |
| **References** |
| [http://www.slideshare.net](http://www.slideshare.net/)  <https://en.wikipedia.org/wiki/Fire_alarm_system>  **Fire Detection and Suppression Systems** - Fourth edition by International Fire Training Association |
| **Tools:** |
| Smoke /heat detector test kit  Flame simulator  Maintenance laptop  Standard tool kit (spanners, screw drivers, Allen keys) |
| **Consumables:** |
| Cleaning solvent  Mutton cloth |
| **PPE:** |
| Safety Shoes, oil resistant gloves, dust coat, helmet, |

**MAINTENANCE OF EMERGENCY SHUTDOWN (ESD) SYSTEMS**

**Unit Code: OG/CU/IC/CR/08/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain emergency shutdown (ESD) systems

**Duration of Unit:** 32 hours

**Unit Description**

This unit describes the knowledge, skills and attitudes required by an oil pipeline instrumentation and control technician to competently maintain emergency shutdown (ESD) systems.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to ESD systems maintenance
3. Prepare for the ESD systems maintenance
4. Configure and test ESD systems
5. Clean, service and repair ESD systems
6. Commission and handover the ESD systems after maintenance

**Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop  safety plan for ESD maintenan  ce work | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out  job safety analysis | Job safety analysis  Workplace safety procedures for ESD systems maintenance | Written  Observation |
| 1.3. Present  toolbox talk | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | Observation |
| 1.4. Identify  correct PPEs for the job | Types of PPEs for ESD systems maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | Observation |
| 1.5. Process  required permits | Types of work permits  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | Inspection of records  Written |

|  |  |  |
| --- | --- | --- |
| 1.6. Report  incidents/ accidents | Description of incident/accident  Accident/incident reporting process | Written  Observation |
| **Learning Outcome 2:** Apply housekeeping principles to ESD  systems maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 2.1Clean  workplace before, during and after the maintenanc e | Regulatory requirements for good housekeeping  Methods of cleaning in ESD systems maintenance | Written  Observation |
| 2.2Store tools, equipment and materials | Manufacturers’ guidelines for Care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |

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| --- | --- | --- |
| **Learning Outcome 3:** Prepare for the ESD systems  maintenance | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 3.1 Process  Job card | Purpose of job card  Job card structure  Job card data entry | Written |
| 3.2 Identify  the ESD systems to maintain | Maintenance chart interpretations  Defect notification interpretations  Importance of keeping ESD system inventory  ESD system defect troubleshooting methods | Observation  Written |
| 3.3 Identify ESD systems wiring diagrams  and PIDs to use | Meaning of wiring diagrams and PIDs  How to use ESD systems wiring diagrams and PIDs | Observation |
| 3.4 Identify and assemble tools and  materials to use | Types of tools and materials for ESD systems maintenance  Methods of handling tools and materials | Observation  Written |

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| --- | --- | --- |
| **Learning Outcome 4:** Configure and test ESD systems | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1Check the physical condition of ESD systems | Definition of ESD systems  Operation principle of ESD systems  Principle of operation of ESD systems  Status of ESD valve status indications and interpretations  Importance of cleanliness of ESD PLC panel  Fire alarm system status indications and interpretations  Leak alarm status indications and interpretations  Operation principle of ESD System  Types of gas detection sensors  Basic operation principle of gas detection instruments | Written  Observation |
| 4.2Configure and test the ESD  systems | ESD annunciator panels interpretations  ESD PLC programming  ESD resetting procedure  Calibration of gas detection instruments step by step procedure | Written  Observation |
|  | Setting ESD valve close and open positions  Testing components of ESD systems e.g. product high- level switches, ESD button, valve leak switches, pressure switches etc.  Equipment and operations precautions to take before carrying out ESD tests  Testing procedure of ESD system  Power supply values and quality (voltage, current and frequency) |  |
| **Learning Outcome 5:** Clean, service and repair ESD system | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 5.1 Clean the ESD system | Methods of cleaning ESD systems  Reasons for cleaning  ESD systems cleaning tools and materials | Practical  Observation |
| 5.2 Repair the ESD  systems | Defective parts replacement procedure | Written  Observation |

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| --- | --- | --- |
| **Learning Outcome 6:** Commission and handover the ESD  systems | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 6.1 Normalize the ESD systems | ESD systems normalisation procedure  ESD resetting procedures  Work permit closure procedure | Written  Observation |
| 6.2 Prepare  maintenance report | Report structure and content | Written |

**Suggested Delivery Methods**

1. Instructor-led facilitation of theory
2. Demonstration of task by trainer
3. Practice by trainee

**List of Recommended Resources**

|  |
| --- |
| **References** |
| [http://www.instreng.com/community/threads/difference- between-esd-emergency-shut-down-and--psd-process- shut-down.3341](http://www.instreng.com/community/threads/difference-between-esd-emergency-shut-down-and-the-psd-process-shut-down.3341)  [http://www.km.kongsberg.com/ks/web/nokbg0240.nsf/All Web/27440FE5DAB88FC6C1256A6C0043EBC3?OpenD ocument](http://www.km.kongsberg.com/ks/web/nokbg0240.nsf/AllWeb/27440FE5DAB88FC6C1256A6C0043EBC3?OpenDocument) |
| **Tools:** |
| Digital multi-meter  Temperature calibrator  Pressure calibrator  Flame tester  Computer  Standard toolkit |
| **Consumables:** |
| Cleaning solvent  Mutton cloth  Masking tape  Insulating tape |
| **PPE:** |
| Safety shoes, oil resistant gloves, dust coat, helmet, |

**MAINTENANCE OF UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM**

**Unit Code: OG/CU/IC/CR/09/5/A**

Relationship to Occupational Standards

The unit addresses the unit standard: Maintain uninterruptible power supply (UPS) system.

**Duration of Unit:** 16 hours

Unit Description

This unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain an uninterruptible power supply (UPS) system.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to UPS system maintenance
3. Prepare for the UPS system maintenance
4. Configure and test UPS system
5. Clean, service and repair UPS system
6. Commission and handover the UPS system after maintenance

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

|  |  |  |
| --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | |
| **Specific**  **Learning Outcomes** | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop  safety plan for UPS maintenan  ce work | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out  job safety analysis | Job safety analysis  Workplace safety procedures for UPS system maintenance | Written  Observation |
| 1.3. Present  toolbox talk | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | Observation |
| 1.4. Identify  correct PPEs for the job | Types of PPEs for UPS systems maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types of PPEs | Observation |
| 1.5. Process  required permits | Types of work permits  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit  Tracking of permit approvals | Inspection of records  Written test |
| 1.6. Report  incidents/ accidents | Description of incident/accident  Accident/incident reporting process | Written  Observation |
| **Learning Outcome 2:** Apply housekeeping principles to UPS  system maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 2.1. Clean  workplac e before, during and after the maintena nce | Regulatory requirements for good housekeeping  Methods of cleaning in UPS systems maintenance | Written  Observation |
| 2.2. Store  tools, equipmen  t and materials. | Manufacturers’ guidelines for care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |
| **Learning Outcome 3:** Prepare for the UPS system maintenance | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 3.1 Process  job card | Purpose of job card  Job card structure  Job card data entry | Practical test  Written test |
| 3.2 Identify  the UPS system to maintain | Maintenance chart interpretation  Defect notification interpretations  Importance of keeping UPS system inventory | Practical  Observation |
|  | UPS system defect  troubleshooting methods |  |
| 3.3 Identify UPS system wiring  diagrams and PIDs | Meaning of wiring diagrams and PIDs  How to use UPS wiring diagrams and PIDs | Observation |
| 3.4 Identify and assemble  tools and materials | Types of tools and materials for UPS system maintenance  Methods of handling tools and materials | Observation  Written test |
| **Learning Outcome 4:** Configure and test UPS system | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 4.1 Check the physical conditions of UPS system | Components of UPS  Status of UPS system indications and interpretations  Importance of cleanliness UPS system panel  UPS system alarm status indications and interpretations  Operation principle of UPS system  Confirm and record individual Battery cell voltage on load and Total battery output voltage. | Written  Observation |

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| 4.2 Service  and test the UPS system | Importance of cleaning batteries terminals  Toping up cell electrolyte level to cover cell plates using de-ionized water  Shutting down UPS AC power supply to confirm UPS inverter supply remains and UPS various outputs  Electrolyte level interpretations  UPS shutdown and start-up procedure  UPS wiring circuit  Types UPS loads  Equipment and operations  precautions to take before carrying out UPS tests | Written  Observation |
| **Learning Outcome 5:** Clean, service and repair UPS system | | |
| **Specific Learning**  **Outcomes** | **Content** | **Suggested Assessment**  **Methods** |
| 5.1 Clean the UPS system | Methods of cleaning UPS systems  Reasons for cleaning  UPS systems cleaning tools and materials | Observation |
| 5.2 Repair the  UPS  system | Defective parts replacement procedure | Written  Observation |

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| **Learning Outcome 6:** Commission and handover the UPS  system | | |
| **Specific Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 6.1 Normalize the UPS system | UPS system normalization procedure  Work permit closure procedure | Written  Observation |
| 6.2 Prepare  maintenance report | Report structure and content | Written |

**Suggested Delivery Methods**

Instructor-led facilitation of theory

Demonstration of task by trainer

Practice by trainee

List of Recommended Resources

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| **References** |
| <http://idc-online.com/slideshare>  IEEE STANDARD 1100-2005: Recommended practice for powering and grounding sensitive electronic equipment  IEEE STANDARD 1159-1995: Recommended practice for monitoring electrical power quality  **Uninterruptible Power Supplies and Standby Power Systems**, by Alexander King |

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| **Tools:** |
| Digital multi-meter  Hydrometer  Technician toolkit  Computer  Blower |
| **Consumables:** |
| Cleaning solvent  Mutton cloth  Distilled water  Baking powder  Grease |
| **PPE:** |
| Safety shoes, helmet, protective clothing, gloves, goggles |

**MAINTENANCE OF INTRINSIC SAFETY (IS) DEVICES**

**Unit Code: OG/CU/IC/CR/10/5/A**

Relationship to Occupational Standards

This unit addresses the unit standard: Maintain intrinsic safety (IS) devices

**Duration of Unit:** 136 hours

Unit Description

The unit describes the knowledge, skills and attitudes required by an Oil Pipeline Instrumentation and Control Technician to competently maintain intrinsic safety (IS) devices.

**Summary of Learning Outcomes**

1. Apply workplace safety
2. Apply housekeeping principles to intrinsic safety devices maintenance
3. Prepare for the intrinsic safety devices maintenance
4. Carry out maintenance of the intrinsic safety devices
5. Commission and handover the intrinsic safety devices after maintenance

Learning Outcomes, Specific Learning Outcomes, Content and Suggested Assessment Methods

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| --- | --- | --- | --- |
| **Learning Outcome 1:** Apply workplace safety | | | |
| **Specific**  **Learning Outcomes** | | **Content** | **Suggested**  **Assessment Methods** |
| 1.1. Develop  instrument maintenance work safety  plan | | Elements of safety plan  How to develop the safety plan | Written  Observation |
| 1.2. Carry out  job safety analysis | | Job safety analysis  Workplace safety procedures for IS devices maintenance | Written Practical |
| 1.3. Present  toolbox talk | | Meaning of toolbox talk  Safe working practices  How to conduct toolbox talk  Who conducts toolbox talk  Benefits of toolbox talk | Observation |
| 1.4. Identify  correct PPEs for the job | | Types of PPEs for IS devices maintenance  Purpose of PPEs  Safe and correct handling, use, maintenance and storage of different types  of PPEs | Observation |
| 1.5. Process  required permits | | Types of work permits  Requirements of a permit to work (PTW) system  Design of PTW forms  Procedure of raising work permit | Written  Inspection of records |
|  | | Tracking of permit  approvals |  |
| 1.6. Report  incidents/ accidents | | Description incident/accident,  Accident/incident reporting process | Written  Observation |
| **Learning Outcome 2:** Apply housekeeping principles to  intrinsic safety devices maintenance | | | |
| **Specific Learning**  **Outcomes** | | **Content** | **Suggested Assessment**  **Methods** |
| 2.1. Clean  workplace before, after instrument maintenance | | Regulatory requirements for good housekeeping  Methods of cleaning IS devices maintenance | Written  Observation |
| 2.2. Store tools, equipment and materials. | | Manufacturers’ guidelines for care of tools, equipment and materials  Proper storage of tools, equipment and materials | Written  Observation |
| **Learning Outcome 3:** Prepare for the IS devices maintenance | | | |
| **Specific Learning Outcomes** | **Content** | | **Suggested Assessment Methods** |
| 3.1 Process Job card | Purpose of job card  Job card structure  Job card data entry | |   Written |
| 3.2 Identify the IS devices to maintain | Maintenance chart interpretation  Defect notification interpretation  IS devices inventory | | Observation  Written |
|  | IS devices defect  troubleshooting methods | |  |
| 3.3 Identify IS deviceswirin g diagramsand  PIDs | Meaning of wiring diagrams and PIDs  How to use IS devices wiring diagrams and PIDs | | Observation  Written |
| 3.4 Identify and assemble tools and materials to use | Importance of tools inventory  Identification of materials, consumables, and tools for the task | | Observation  Written |
| **Learning Outcome 4:** Carry out maintenance of the IS devices | | | |
| **Specific Learning Outcomes** | **Content** | | **Suggested Assessment Methods** |
| 4.1 Clean and repair the IS devices | Regulatory requirements for good housekeeping  Methods of cleaning in IS devices maintenance | | Observation  Written |
| 4.2 Check the physical condition of the IS  devices | IS devices status indications interpretations  IS devices alarm conditions  Expected normal physical conditions of the IS devices | | Observation  Written |
| 4.3 Calibrate the IS devices | IS devices calibration requirements  Statutory requirements  IS calibration schedule  IS calibration span  IS calibration equipment and tools setup  IS calibration procedure | | Observation  Written |
|  | Identifying the correct calibration standard (e.g. 4 – 20 mA current, 0 – 5  V voltage) | |  |
| **Learning Outcome 5:** Commission and handover the IS  devices after maintenance | | | |
| **Specific Learning Outcomes** | **Content** | | **Suggested Assessment Methods** |
| 5.1 Normalize the IS  devices after maintenance | IS systems normalisation procedure  Work permit closure procedure | | Written  Observation |
| 5.2 Prepare  maintenance report | Report structure and content | | Written |

**Suggested Delivery Methods**

Instructor-led facilitation of theory

Practical demonstration of task by trainer

Practice by trainee

List of Recommended Resources

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| **References:** |
| Pipeline work procedure manual on ISO documents site  [www.instrumentationtoolbox.com](http://www.instrumentationtoolbox.com/)  [www.us.endress.com/en](http://www.us.endress.com/en)  **Instrumentation Reference Book**, by Horn, Delton, Darer, Jack |
| **Tools:** |
| Device under test (DUT)  Reference device  Digital multi-meter  Closed end pipe with known parameters  Computer  Technician tool kit (spanners, screw drivers,)  Wrenches  Wire strippers |
| **Consumables:** |
| Reference hydrocarbon product  Mutton cloth  Contact cleaning agent  Grease |
| **PPE:** |
| Safety shoes, oil resistant gloves, dust coat, helmet |