

## CAPABILITIES OFFERED



At ASTEC Oil and Gas Limited we believe that the capabilities of our staff and consultants bring added value competencies and expertise to the global oil and gas industry within the areas of safety engineering and risk management.

ASTEC Oil and Gas Ltd is also committed to the provision of training and competency assurance of its own and client personnel, from new engineering and numerate science graduates, to cross safety critical industry awareness and best practice adoption, through to subject matter experts.

The consultancy services covered by the company are:

- Safety Engineering and Risk Management
- Safety Management Systems
- Integrity Management and Inspection
- Competency and Training

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### SAFETY ENGINEERING

#### Thorough Review of Safety Cases

The Offshore Installations (Safety Case) Regulations 2005, Regulation 13 requires a dutyholder to undertake a thorough review of a current safety case within 5 years of either the date on which the current safety case was accepted by the HSE, or the date of the previous thorough review.

The purpose of the thorough review is to confirm that the Safety Case as a whole continues to be fundamentally sound. It should be a systematic examination of all the basic assumptions made in the Safety Case, as well as of all its content.

ASTEC Consultants, with their many years experience in Nuclear, Oil and Gas and Defence industries can assist in the Thorough Review of Safety Cases by the provision of Independent Safety Consultants.

#### Safety Case Production

It is a legal requirement in many countries including the UK for operators of offshore installations to produce a Safety Case, which is a Health and Safety Document. The Safety Case should identify all relevant hazards to the workforce and any other critical groups and demonstrate that risks have been controlled by the application of safeguards to a level which is As Low As Reasonably Practicable (ALARP).

ASTEC Consultants have many years experience in the production and management of safety cases in the Nuclear, Oil & Gas and Defence industries.

#### Independent Assessment/Peer Review

The UK's Regulatory Authorities for high hazard industries have a clear requirement that the operator shall introduce arrangements where an assessment is carried out on a safety case by staff who are clearly independent from the preparation process.

The assessors must also be demonstrated to be competent in the safety case process, and the technical and scientific content of the safety case. The thoroughness of the assessment is related to the complexity and novelty of the case, and the magnitude of uncertainties and margins. If the case relies on judgements to a significant degree, the case is usually subject to Peer Review by a panel of external experts.

ASTEC have a long established reputation for providing expert and experienced resources for independent assessment and peer review.

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### HAZOP (HAZard and Operability) Studies

The acronym HAZOP stands for Hazard and Operability. It is defined to be a team-based method for hazard identification looking at either operating processes or engineering designs at each stage of the lifecycle from initial concept through to decommissioning.

A HAZOP study requires the application of GUIDEWARDS and DEVIATIONS to pre-determined NODES which represent sub-elements of the plant design eg PRESSURE, MORE THAN applied to RISER PIPEWORK. By a rigorous sub-division of the plant into nodes and application of the guidewords and deviations a hazard log can be generated to systematically identify the hazard potential across the facility.

Once the hazards have been identified the accident potential can be reviewed and control measures in the form of safeguards can be implemented to reduce risks down to a level which is judged to tolerable.

The HAZOP also enables the planning of any identified process or instrumentation improvements. The HAZOP process provides as an output the hazard log which can be fully audited in terms of the hazardous sequences, control measures and any actions relating to design issues.

ASTEC consultants are experienced in serving on HAZOP teams as key members such as Chairman and Secretary / Scribe.

### HAZID (HAZard Identification) Studies

The acronym HAZID stands for Hazard Identification. The HAZID technique allows the identification of hazards in a less formal way than a HAZOP. It is usually carried out at a high level at the Conceptual / FEED stage where a more detailed HAZOP may not be appropriate due to lack of detailed drawings.

HAZID assists the delivery of HSE compliance, and forms part of the Risk Register required by many licensing authorities. Pre-identified guidewords can be used to identify hazards and make high level comparative assessment of design options. The HAZID report then documents the hazard potential associated with each design option and thereby highlight designs with lower inherent hazard potential.

ASTEC Consultants are experienced in conducting HAZID studies within the Nuclear, Oil & Gas and Defence industries.

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### Hazardous Area Classification

Hazardous Area Classification is a rule based classification scheme for the avoidance or minimumisation of hydro carbon explosions as a result of ignition sources in combination with explosive inventory.

Typically exclusion zones (Zone 0, 1 and 2) are drawn around equipment which may contain or have the potential to contain hydro carbon inventory. NPFA 497, BS 60079 - 10 or IP 15 provide guidance on the extent of said exclusion zones.

The zoning of a facility normally influences the eventual design and highlights any areas where intrinsically safe electrical equipment and/or positive ventilation may be required.

ASTEC Consultants are experienced in conducting Hazardous Area Classification within the Nuclear, Oil & Gas and Defence industries.

### FMECA (Failure Modes and Effects Criticality Analysis)

Failure Modes and Effects Criticality Analysis (FMECA) is usually undertaken to identify single failure points in a design and their criticality to system performance. The method of failure detection is also identified and provides useful feedback when assigning the level of Built In Test Equipment (BITE) to any given system.

The FMECA is a systematic process of assessing all equipment associated with a given design and individual failure modes of equipment usually at the Line Replaceable Unit (LRU) level.

ASTEC Consultants are experienced in the wider FMECA within the Nuclear, Oil & Gas and Defence industries.

### Risk Ranking

The risk ranking process is a coarse assessment of frequency and consequence associated with any given hazardous sequence. The risk ranking uses a risk matrix to allow the ranking of frequency and consequence to arrive at a level of risk. The identified level of risk will then normally be assessed for its tolerability.

ASTEC Consultants are experienced in carrying out Risk Ranking within the Nuclear, Oil & Gas and Defence industries.

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### Bow Tie Assessment

The Bow Tie Assessment operates by assessing threats to a system and any barriers or defences within the system. This allows the development of top event accidents which are then reviewed for recovery preparedness measures. The outcome of the process is a set of consequences arising from potential accident top events.

ASTEC Consultants are experienced in carrying out various Bow Tie Type Assessments within the Nuclear, Oil & Gas and Defence industries.

### SCE (Safety Critical Elements) Identification

Safety Critical Elements are usually identified from the HAZOP or HAZID process and are the items of equipment critical for the safety of the facility eg in a hazardous sequences identified as high risk, a given control measure may be regarded as critical to prevent an accident.

ASTEC Consultants are experienced in carrying out SCE identification within the Nuclear, Oil & Gas and Defence industries.

### SIL (Safety Integrity Level) Assessments

A Safety Integrity Level (SIL) Assessment is normally performed on the control loops on any given facility. The control loop is identified from initial parameter measurement eg high pressure to physical realignment of the facility eg close ESD valve.

A SIL shall be one of 4 levels, each corresponding to a range of target likelihood of failures of a safety function. SIL 1 corresponds to the highest Probability of Failure on Demand (PFD), and SIL 4 the lowest PFD. Use of a SIL Matrix is carried out which is based on frequency and consequence to derive a final SIL value.

ASTEC Consultants have extensive experience in conducting SIL Assessments for its clients in the Nuclear, Defence and Oil & Gas industries.

### Software Assurance

Software Assurance is normally a qualitative process which is used to assure a given software design meets the required SIL level. Extensive guidance on software assurance processes is provided in IEC61511 where techniques for the management of software design are assigned as either Highly Recommended (HR), Recommended (R) or Not Recommended (NR) for SIL Levels 1 - 4. It is normal for any software assurance process to begin with the development of a Software Development Assurance Plan (SDAP). This plan will document the techniques which have been selected based on the required SIL level.

An independent Software Assessor will normally use the SDAP to audit the software design development process.

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ASTEC Consultants have extensive experience in conducting Software Assurance studies for its clients in the Nuclear, Oil & Gas and Defence industries.

### QRA (Quantified Risk Assessments)

Quantified Risk Assessment (QRA) is a probabilistic approach to identifying and quantifying the risks associated with the major accident hazards identified during the HAZOP. The technique allows the calculation of individual risk of premature fatality as a result of exposure to occupational exposure to hazards.

The technique uses consequence modelling software in combination with fault event tree software to evaluate the risks associated with each sequence of events which may lead to an accident situation and thus expose workers to risk.

ASTEC Consultants are experienced in conducting QRA within the Nuclear, Oil and Gas and Defence industries.

### FTA and ETA (Fault and Event Tree Analysis)

Fault Tree Analysis (FTA) and Event Tree Analysis (ETA) are generally used when carrying out quantified safety assessments.

Fault Trees may also be used for availability modelling and provide a logical assessment of the failure potential of a system. Event Trees are generally used to model the development of an initiating events through to accident end points based on the various combinations of safeguards success or failure. The results from FTA and ETA provide important feedback on the strengths and weaknesses of proposed designs and can therefore be used to evaluate design options.

ASTEC consultants are experienced in conducting both FTA and ETA within the Nuclear, Oil & Gas and Defence industries.

### CCF (Common Cause Failure) Assessments

Common Cause Failure models the typical failures which can render whole systems ineffective. There are several beta factor methodologies available to facilitate this analysis. The beta factor is applied to the random component failure rates to predict or estimate the common cause failure rates.

One such beta factor method is the Partial Beta Factor method which estimates the beta factor by ranking various attributes of the system such as provision of redundancy and provision of equipment diversity.

### Human Factors

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### Consequence Modelling

The Consequence Modelling is usually undertaken as part of the QRA or FERA. The modelling essentially converts the accident sequences into thermal radiation contours which are super-imposed over the facility layout. By consideration of the demographics of the facility in combination with thermal radiation contours, the individual risk to workers and TR impairment can be derived.

ASTEC consultants have extensive experience of modelling most major accident consequences such as fire, explosion, toxic gas release and hazardous spillage.

A wide range of consequence modelling software modelling tools are used to assess the effects of such hazards on people, the environment and the asset.

### Safety Support Studies

- Escape, Evacuation and Rescue Analysis (EERA)
- Emergency Systems Availability and Survivability Analysis (ESASA)
- Temporary Refuge Impairment Studies (TRI)
- As Low As Reasonably Practicable Assessments (ALARP)
- Marine and Mechanical Hazards Analysis (MMHA)
- Fire, Explosion and Blowout Risk Analysis (FEBRA).

ASTEC Consultants are experienced in the provision of the above Safety Support Studies to its clients in the Nuclear, Oil and Gas and Defence Industries.

### Provision of Safety Engineering Specialists

ASTEC has through years experience in the provision of safety engineering specialists through consultancy, short term problem solving, projects and client secondments. Typical examples would be expert witness provision, peer reviews, independent persons on Thorough Reviews of Safety Case teams, HAZOP chairpersons, or provision of cover for key personnel.

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## SAFETY MANAGEMENT SYSTEMS

### Safety Culture Review and Gap Analysis

#### Accreditation Assistance

Through the provision of Accreditation Assistance, ASTEC consultants can support companies to achieve internationally accepted and verified British Standard to Safety Management. (BS 8800; OHSAS 18000). Such accreditation allows clients to demonstrate that their systems of safety management are externally verified. It can also prove to be a cost effective means of minimising loss.

#### Process Mapping

Process Mapping removes the jungle of words out of procedures and gives it a pictorial logical methodology with clearly defined personal responsibilities.

The benefits of process mapping can be summarised as:

- Procedure represented by flowcharts
- Pictorial representation
- Personnel with responsibilities within the procedure always identified
- End user friendly
- Can be stand alone or intranet linked.

Astec Business Management Systems Consultants are experienced in the performing Process Mapping typically for client Safety Management Systems, whilst conducting technical review of the procedures.

#### Provision of Safety Advisors and Managers

ASTEC has many years experience in the provision of Safety Advisors and Managers through consultancy, short term problem solving, projects and client secondments.

#### Safety Organisation Development

The UK's Regulatory arrangements impose on the operators of high hazard facilities the requirement to have embedded in their organisation clear accountabilities for the safe operation of the plant. This must ensure adequate protection for the public, the environment and the operators.

The management arrangements must be clearly defined, be compliant with the statutory and regulatory requirements, and are subject to a wide range of audits. ASTEC has many years experience of assisting operators develop robust safety management systems, and can assist in preparing for audits and regulatory audits.

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### INTEGRITY MANAGEMENT AND INSPECTION

- Statutory Lifting Equipment Inspection under LOLER
- Lifting Equipment Written Schemes
- Lifting Equipment RBI (Risk Based Inspection)
- Crane Inspection
- Crane Design Verification
- Passenger/Goods Lift Inspection
- Metallurgy, Welding, Failure Investigation and NDT
- Stress Analysis, Fracture Mechanics, Fatigue and Corrosion
- Forensics
- Provision of Lifting Equipment Inspectors
- Provision of Engineer Surveyors
- Provision of Lift (passenger and goods) Inspectors

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### COMPETENCY AND TRAINING

- ATEX
- LOLER
- PUWER
- Competency and Training Audits
- Lifting Equipment Inspection Assessors
- Competent Personnel Supply
- Safety Case Authorship
- Safety Engineering Awareness - Offshore
- Safety Engineering Awareness - Nuclear
- COMAH Awareness
- PFEER Awareness
- Human Factors

For further information on any of our capabilities listed above please contact our office where one of our consultants will be able to help.

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