Brisktrade

Company Overview
About us

Brisktrade Offshore Limited is a 100% Nigerian owned organization, which started operations in the Oil & Gas industry in 2014 with offices in Lagos and an operational base in Port Harcourt, Nigeria.

Our engineering capabilities are strengthened in partnership with Jee Limited, a specialist subsea engineering and training company who has been providing subsea engineering and training services to the Oil and Gas industry since 1988, and also Kaefer Limited a global market leader for offshore & onshore facilities integrity services and solutions in the oil & gas industry.

As a team, we provide specialist technical engineering solutions to the Nigerian Oil & Gas sector - from design, pigging and integrity management through to lifetime extension and decommissioning.

In addition, with an extensive portfolio of over 75 technical training courses, we have delivered public and in-house training in Nigeria to clients including Shell, Chevron, ExxonMobil, Total, First E&P, AMNI International, Saipem and many, many more.

Our Services

Engineering Design and Project Management

With our broad expertise and knowledge in pipeline and subsea engineering, we provide high quality advanced engineering solutions. With project management capabilities spanning across the life of field for both onshore and offshore oil & gas design projects, from the conceptual / feasibility studies to decommissioning.

In addition, the in-house design and project management capabilities of our highly experienced team ranges from stand-alone greenfield developments to brownfield development projects such as subsea tie-backs in shallow, deep and ultra deepwater environments.

Our extensive project management experience enables us to deliver value to our clients by ensuring our solutions are reliable, cost efficient, compliant and in accordance with international best practices.

Our engineering design and project management services include;

- Conceptual studies (pre-FEED)
- Front End Engineering Design (FEED), and Field development studies
- Fabrication design and manufacturing support for offshore platforms & subsea production systems
- Design re-modification and re-construction of existing offshore/subsea facilities
- SURF Design
- Flow assurance, hydraulic analysis
- Installation engineering analysis
- Repair design
- Fatigue/Stress/VIV analysis
- Operational Support
- Project Management
- Project Monitoring, Planning & Control
- Risk Assessment
- Decommissioning
Inspection, Maintenance & Repair

To ensure that subsea & topside assets operate with as little damage or environmental impact as possible, we provide a robust & cost-effective integrity management system, that improves the integrity of our client’s assets. We achieve this by using advanced analysis & engineering methods to develop highly maximized inspection and maintenance plans based on the recent codes and standards. These methods are executed using innovative and appropriate Inspection, Maintenance & Repair technologies within our disposal.

Our Inspection, Maintenance & Repair services include:

- Asset Integrity Management System (covering Pipelines, Subsea and Topsides)
- Advanced Non-Destructive Testing & General Inspection including;
  - General & Close Visual Inspection
  - Weld surface coating inspection
  - Eddy Current Inspection
  - Ultrasonic Inspection
  - Magnetic Particle Inspection
  - Dye Penetrant Inspection
  - Corrosion Under Insulation Inspection
  - Borescope Inspection
  - PCN Level 3 Services
- Pigging (In-Line Inspection/Cleaning)
- Risk Based Inspection (RBI)
- Surface Protection
  - Surface Preparation
  - Coating applications
  - Lining – Protect steel & concrete surfaces with epoxy, zinc silicate, vinylester & rubber linings.
  - Special solution coatings (PTFE)
- Repair of Pipelines, Risers & Umbilicals
- Maintenance & repairs of Subsea systems
- Wrap Technology for Pipeline/Piping Repairs

Thermal Insulation

Brisktrade in partnership with Kaefer Ltd a recognised authority on large-scale insulation projects and a member of TICA (Thermal Insulation Contractors Association) can provide effective ways by which the temperature levels required within our client’s facilities can be maintained.

Cold Insulations: areas of application

- LNG and ethylene plants
- Cryogenic storage
- CO2 plants
- Gas liquefaction plants
- Piping
- Vessels
Brisktrade

- Tanks

**Thermal Insulations: area of application**
- Refineries
- Chemical industry
- Heating, Ventilation & air conditioning (HVAC)
- Natural gas storage tanks

**Access Solutions**
The first step when it comes to tackling a challenging engineering project is gaining access to it. But access comes in many shapes and sizes. From scaffolding and rope access to elevated platforms and other specialist methods, Brisktrade in partnership with Kaefer Ltd offers the entire spectrum of solutions to tackle even the most challenging and difficult projects. We also go beyond offering the materials and services necessary to make your projects work. Innovations such as our dedicated Scaffolding Management Software ensure efficient and professional site management to maximise savings and streamline workflows.

Access solution services include:
- Scaffolding
- Rope Access
- Elevated Platforms
- Special Application

**Training & Manpower Supply Services**
Brisktrade is a strong advocate of human capital development to increase the local capacity of indigenous engineers. As an ambassador of local content development, Brisktrade provide tailored learning interventions to meet the needs of our clients.

In partnership with Jee Ltd and Kaefer Ltd, we provide training solutions for professional engineers. Our training portfolio is built on the back of our engineering capabilities, where our expertise in providing integrated “real-world” engineering services forms the backbone of the learning experience we deliver in the classroom.

Jee Limited has built a world-renowned reputation for excellence within the global oil and gas training sector. The diverse selection of topics and technical difficulties its training courses cover makes them invaluable to anyone within the industry from graduate engineers and support staff, through to senior engineers and professionals.

Also, we provide manpower supply services to the oil and gas industry, with the ability to scale up large requirements to support your manpower requests.
Project Case Studies

Client: Mobil Producing Nigeria Unlimited and Esso Exploration & Production Nigeria Limited
Project: Pipeline Engineering Pigging Assessments for 36” Ubit and Erha Pipelines
Location: Lagos, Nigeria & United Kingdom
Year: 2019 - ongoing

The project objective is to produce a pigging feasibility study report with strategy for executing pigging operations for the 36” 2.5 km Ubit gas pipeline, and the Erha pipelines in deepwater Nigeria.

The project involves:

- Collating pigging datapack and boremap for pipeline
- Reviewing pipeline geometry, drivers for pigging, and anticipated debris types within the pipeline
- Determining the preferred tool technology (UT/MFL)
- Determining the most preferred cleaning and inspection methodology
- Determining alternative methods of obtaining inspection data if ILI is not considered feasible.
- Recommending facility modifications if required

Client: Oriental Energy Resources Ltd
Project: Ebok Pipeline Integrity Management System & Piggability Assessment
Location: Lagos, Nigeria & United Kingdom
Year: 2019- ongoing

Brisktrade, in partnership with Jee is currently developing a pipeline integrity management system (PIMS) for Oriental Energy Resources. The project will assist Oriental to manage the risks associated with operating their existing (and future) pipelines within the Ebok Field, while also satisfying regulatory requirements.

Oriental Energy Resources operates four of 1.2KM length pipelines between West Fault Block (WFB) production platform and the Mobile Offshore Production Unit (MOPU) for oil, water and gas applications, in OML 67.

The project involves:

- The development of a Pipeline Integrity Management System (PIMS) for the Ebok pipelines
- The development of Technical Manuals including; a corrosion protection manual; In-line inspection manual, and a corrosion defect assessment and repair manual
- Undertaking a pipeline piggability assessment for the Ebok pipelines
Client: Amni International Petroleum Development Company

Project: *Ima Field Pipeline Revalidation Services*

Location: *OML 117, Offshore Bonny, Nigeria*

Year: *2018*

The project involved carrying out a Pipeline Integrity Re-validation exercise, on a 12” subsea export pipeline conveying processed fluid from the Langley OPU located in 8m depth of water, through to a Floating Storage & Offloading vessel (Ailsa Craig-1) located in about 25m depth of water, at the Ima Field, Offshore Bonny, OML 117, Nigeria.

Amni intends to increase the production of oil through the 12” export pipeline from 700bopd to 25,000bopd, hence Brisktrade carried out a pipeline integrity revalidation exercises to determine the fitness of the pipeline to handle the increased volumetric flow rate of the fluid.
Key Engineers

Tunde Olorunnaie, Brisktrade Technical Authority

Tunde is an erudite engineer with over 36 years of experience in the Oil and Gas industry. He worked for Chevron Nigeria Limited in various positions, starting from an Operations Engineer and progressing to the position of Operations Support Superintendent. He voluntarily retired in 2017 after working for Chevron for over 26 years.

Tunde has supervised many projects and has wide experience in engineering design, fabrication, and installation of pipelines /flowlines, Topsides Jackets, Spools amongst others. Some of the projects he has supervised are;

- Engineering design, fabrication and Installation of new flowline/pipeline, and modification/upgrade of existing facilities
- Emergency repair of damaged onshore flowline/pipeline.
- Fabrication of Offshore Topsides jackets for Produced Water disposal.
- Design, spool fabrication and installation to restore the integrity of the breached Okan Valve Platform and was completed 2 weeks ahead of schedule.

Tel: +234 818 099 9992
Email: pa01@brisktradeng.net

Solomon Idoghor,

Solomon has 35 years’ experience in both upstream and downstream operations in the oil & gas industry. He worked for Chevron and exited in 2017. Some of his skills are;

- Strong Installation and commissioning functions management
- Proficient in rotating equipment and production equipment maintenance
- Foreign project assignment and major equipment factory acceptance testing
- Familiarity with International Codes and Standards applicable to the Oil & Gas Industry

Adeola Adewujuon,

Adeola has 25 years’ hand-on-work experience on rotating equipment; including

- Solar Gas Turbines
- Nuovo Pignone Gas Turbines
- GE Gas Turbines
- Nuovo Pignone Centrifugal Compressors

He also has project management skills, with experience in the;

- Construction, Installation, Commissioning of 2No MS 5001 Turbo-generators
- Installation and commissioning of 2No Reciprocating Compressors for SPDC-Okoloma/Afam Gas Plant Project
- Upgrade of PGT 25 turbo-generator for ENI Congo
- MK-VIE Speedtronic Control System upgrade at Nigeria LNG

Graham Wilson, Head of Integrity Management

Graham is a Principal Engineer and Head of the Integrity Management discipline at Jee. He has particular expertise in the integrity management of pipelines and subsea equipment at all stages of the asset life cycle. Graham provides the overall technical excellence, quality assurance and commercial leadership for all integrity management projects performed by Jee.

Email: info@brisktradeng.net
John French, Head of Design

John is an experienced chartered mechanical engineer who has been working in the oil and gas industry since 2002. He joined Jee Ltd as a Senior Engineer in 2007 and is now a Principal Engineer and Jee’s Head of Design. John has experience of a wide range of subsea pipeline and riser design activities including buckling analysis, fatigue assessments, corrosion assessment, stability calculations, expansion analysis and wall thickness calculations. John is also skilled in finite element analysis, third party verification, pipeline integrity assessments.

Email: info@brisktradeng.net

Paul Otway, Head of Pigging and Plugging

As Jee’s Head of Pigging and Plugging, Paul has managed and executed many offshore campaigns and is responsible for the technical quality of pigging and plugging projects at Jee.

Email: info@brisktradeng.net
Appendix A

Capability Statements
Brisktrade

Design capability and track record

Introduction

With our broad expertise and knowledge in subsea engineering we provide expert services at the field development, conceptual, FEED, detailed design and verification phases of oil and gas and renewables projects. We have worked on over 100 subsea design projects including, but not limited to, the design of pipelines, risers, J-tubes, caissons, cathodic protection systems, subsea structures, structural clamps, pig launchers and cable protection systems. Our project portfolio spans both onshore and offshore design, with subsea design in water depths up to 3000 metres. With this extensive experience behind us, we ensure the most efficient, cost effective and safest practices are followed, providing a valuable and lasting contribution to our clients’ offshore projects.

Our team ensures that solutions are compliant with industry best practices and code requirements but are also practical, seeking to avoid design solutions based on overly restrictive code guidance if there is a clear advantage for the project and a deviation can be safely justified. We have highly experienced analysts and as such are able to utilise a number of different analysis tools such as FEA software, Mathcad and OrcaFlex to provide solutions to complex problems.

Our independence sets us apart and means we have our client’s best interests at the core of all decisions. We have no separate owner, venture capitalist, bank, manufacturer or contractor to influence us. We align ourselves 100% with our client’s business objectives thus guaranteeing impartial, unbiased advice at all times.

Details of selected deliverables provided by Jee

Pre-FEED and conceptual design

Jee has a proven track record in pre-FEED engineering and has carried out studies for all types of subsea pipelines, systems and their components including risers, flowlines, protection systems, manifolds and wye pieces. For example, we carried out a feasibility study for a North Sea operator that assessed the options for bringing five new fields online and exporting to existing nearby infrastructure. The assessment considered numerous combinations in terms of cost and technical feasibility, identifying the preferred options for progression to the next phase of engineering. In addition, we have significant experience of providing feasibility and conceptual design studies to offshorewind and CCS projects.

FEED

We appreciate that front end engineering and design can require different levels of engineering depending on the clients approach to project execution. Jee tailors the level of detail to your needs. We have experience of completing FEED to a high level of detail that is sufficient to enable procurement of long-lead items, and to a lower level of detail sufficient for definition of project scope for EPIC tendering purposes.

Detailed design

Building on the FEED results, we develop the design to a final solution ready for construction offering fabrication and procurement support through to final commissioning. We have an established suite of calculations that can quickly be applied to your project based on common industry codes including PD 8010, DNV-OS-F101 and ASME. These can also be tailored to meet the requirements of project and company specifications. Whilst the importance of a safe design is at the forefront of everything we do, we strive to remove conservatism and avoid carbon copy designs,
challenging code requirements where efficiencies can be made without compromising safety. Our track record for design includes complete pipeline systems, tie-in spools, risers and structures. We have also been involved in a wide range of smaller niche projects such as caisson replacement, design of repair clamps and specialist components such as wyes and flanges.

**Installation analysis**

Jee has completed installation analysis for numerous major installation contractors, ensuring the most efficient, cost effective and safest practices are implemented. We can provide clients with guidelines based on limiting sea states for installation and procedural analyses for the offshore installation of subsea structures, pipelines, cables, J-tubes spools and risers.

**Verification and certification**

Our engineers have worked on a wide variety of design projects and are ideally suited to offer high-value verification work for subsea applications. We look at the methodology and criteria used to carry out the analysis from start to finish, and offer expert advice accordingly. Our independence positions us ideally for this work.

**Supporting studies**

**Stability analysis**

Jee has an extensive track record in performing on-bottom stability analysis of pipelines, cables and umbilicals. Conventionally stability analysis is relatively straightforward but Jee also offers extended stability analysis services to assess mattress stability, rock berm stability and cable stability (with and without CPS) including assessments in more challenging environments such as breaking wave regions and close to end restraints where typical stability analysis methods don’t apply.

**Fishing interaction and overtrawlability**

As experts in this specialist field, we can help you manage the risk of fishing interaction by assessing the need for protection of pipelines or other subsea structures. We have a long track record of designing overtrawlatable structures and are experienced in conducting scale model tests. Our engineers are expert analysts and use finite element analysis methods according to design codes such as HSE OTH561 and DNV-RP-F111 to ensure regulatory compliance.

We can help you gather the evidence you need and provide guidance on what infrastructure can be buried/trenched and derogated. We also have significant experience in assessing fishing interaction in-line with decommissioning and derogation requirements.

**Buckling assessments**

Buckling analysis is typically carried out as part of a larger FEED or detailed design study but Jee has the expertise to offer specialist support to the main project contractor to reduce conservatism and improve accuracy. Jee has developed modelling techniques that allow for the simultaneous inclusion of pipeline route, seabed bathymetry and residual lay tension to remove unnecessary conservatism, eliminating results that would otherwise require expensive buckle mitigation measures.

**Re-rating projects**

Sometimes pipelines are required to operate under different conditions from which they were originally designed. If you have a requirement to change the operating temperature, pressure or other flow conditions due to changing reservoir conditions or the tie-in of a new well, Jee can provide an engineering assessment to confirm if your existing
asset is suitable. Through our probabilistic approach, we are able to assess the current condition of the pipeline even with limited inspection information, ensuring an acceptable operating risk using Monte Carlo analysis.

**Repair design**

Not every project design will perform as intended and Jee has the capability to provide engineering services for the repair of failed pipelines and components. Jee can provide a bespoke design service for your repair to reinstate your asset to safe working conditions. Examples of repairs designed by Jee include:

- Reinforcing clamp for repair of a failed subsea riser clamp
- Welded sleeve repair to reinforce a riser with heavy corrosion loss
- Third party review of bolted repair clamp design
- Re-design of riser deadweight support
- Cut-out and replacement of subsea corroded pipe sections
- Design of remedial stabilisation for unstable pipeline
- Assessment of dragged pipelines to assess remediation requirement
- Replacement of corroded flowlines
Jee design trackrecord
A selection of our experience in design.

Pre-FEED and concept evaluation

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<th>Client</th>
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<tr>
<td><strong>Clipper South re-routing feasibility study (SNS)</strong></td>
<td>Jee carried out the feasibility study for the Clipper South pipeline as part of the re-routing assessment for the pipeline. The assessment included hydraulic analysis, pipeline sizing and routing, control system assessment, risk assessment, integrity review and cost estimate development.</td>
</tr>
<tr>
<td><strong>Block A/B development study (SNS)</strong></td>
<td>Jee conducted an assessment of the Block A and B development options, with specific emphasis on comparison between subsea completions and dry trees. The scope of work included pipeline routing, field layout assessment, flow assurance and cost estimate development.</td>
</tr>
<tr>
<td><strong>Wingate-B feasibility study (SNS)</strong></td>
<td>Wintershall planned to install a second wellhead platform approximately 4km South of the existing Wingate A platform in the UK sector of the Southern gas basin. Jee performed a study to determine the feasibility of using subsea tie-in at the base of the Wingate A platform. A variety of different subsea tie-in options were considered.</td>
</tr>
<tr>
<td><strong>Pre-FEED for Skarfjell development</strong></td>
<td>Two engineers were seconded to the FMC office in Surrey to work with their field development team on the pre-FEED of a number of subsea tie-back options for this new development in the Norwegian continental shelf.</td>
</tr>
<tr>
<td><strong>Grove North-East feasibility study</strong></td>
<td>Jee performed a feasibility study on the Grove North-East development considering three different development options for Centrica. The scope of work included high level mechanical design, risk assessment, installation methodology review, topside equipment modification review and cost estimation.</td>
</tr>
<tr>
<td><strong>CCS concept design</strong></td>
<td>Jee provided a high-level study of possible offshore pipeline routes and landfall options, as well as a detailed costing model. Jee also reviewed the coverage and robustness of the White Rose CCS FEED cost estimate and schedule. A technical assurance review exercise was undertaken on the quantities, duration, unit rates and bases upon which the estimates were derived. In some areas, potential savings in the region of £10M were identified.</td>
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### FEED and detailed design

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| **Allseas** | **Offshore loading system (OLS)**  
Jee carried out the detailed design of three 20” subsea pipelines forming part of the Hebron Offshore Loading System (OLS). The scope also included design of the subsea spools connecting the pipeline to the gravity based structure and to the offshore loading bases. |
| **Apache** | **Forties Charlie and Bravo multiphase riser FEED and detailed design**  
Jee undertook the detailed design for two new 14” risers to replace corroded 20” risers. The scope of work included concept selection and a full design package taking into account the installation approach, mechanical design of the risers, preparation of procurement and construction specifications, support for verification and regulatory interfaces and the design of structural supports/installation aids. |
| **Apache** | **Forties Delta and Charlie multiphase pipeline FEED and detailed design**  
Jee undertook the design for two new 8” risers, a multiphase pipeline and the associated tie-inspools. The scope of work included concept selection (considering the installation approach), mechanical design of the risers, pipelines and spools, preparation of procurement and construction specifications, support for verification and regulatory interfaces and the design of structural supports/installation aids. |
| **Apache** | **Forties Bravo caisson FEED and detailed design**  
Jee carried out the design of the retrofitted fire pump and mudflow caisson along with the support guides. The scope of work included concept review and selection, stress analysis of the caissons and supporting structures (guides/clamps), preparing specifications and design drawings and turnover to the installation contractors. |
| **Perenco** | **Leman South-East FEED and detailed design (SNS)**  
Perenco carried out the Leman South-East prospect adjacent to one of their existing Southern North Sea Leman gas field. The field development involved a new subsea tieback to the existing platform via a 9 km long 8” pipeline and piggybacked umbilical.  
After completing the initial FEED design, we designed a rigid 8” trenched pipeline solution tied-in with two rigid expansion spools to an existing platform riser. The pipeline was piggybacked with a 110 mm wellhead control umbilical and we ensured the design was optimised for a two-phase installation process. The scope included detailed design for the umbilical J-tube allowing for integrated fabrication and installation.  
We carried out a full suite of pipeline mechanical design for process, strength and fatigue including pipe sizing, routing, stability, buckling, corrosion protection, flow assurance, crossings, bottom roughness, protection, specifications, commissioning procedures. |
| **Perenco** | **Leman South-West FEED and detailed design (SNS)**  
Following the successful completion of the Leman South-East project, Perenco wanted to develop the area further by tying a new well, Leman South-West, on to the chain via a 6” tie-back. Jee carried out the detailed design of the pipeline system and tie-in spools, and provided engineering support during fabrication and construction phases. We also provided detailed design of a 6” daisy chain subsea tieback connecting. |
### Client Details

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<tr>
<td><strong>new Leman South-East to existing Leman South-East including rigid pipeline and umbilical.</strong> Davy East and Bure North developments detailed design (SNS) Jee completed the detailed design of the Davy East and Bure North pipelines including pipeline routeing, pipeline design, design of subsea manifold, corrosion design, bottom roughness analysis, protection design and development of specifications.</td>
<td></td>
</tr>
<tr>
<td><strong>Doris Engineering (Total) FEED</strong> Jee prepared the basic engineering documentation for a large deep-water tie-in development in preparation for the invitation to tender. We were responsible for SURF documents/specifications such as basis of design, field layout, cathodic protection, subsea valves, insulation and pigging feasibility.</td>
<td></td>
</tr>
<tr>
<td><strong>Laggan Tormore FEED</strong> Jee carried out the FEED for the Laggan-Tormore development, involving design calculations and associated reports for the export pipeline, two import flowlines and a MEG flowline. Project challenges included the deep water depth, the long pipeline length and the high design temperatures and pressures at the two separate tie-ins.</td>
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### Verification

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<td><strong>Spool verification</strong> Jee conducted FEA verification of a spoolpiece to determine stresses due to thermal expansion as a result of over specification of rock dump.</td>
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<tr>
<td><strong>West Franklin bundle</strong> Jee provided third party verification on behalf of Bureau Veritas for the West Franklin bundle (designed by Subsea 7 for Total). We reviewed the documents, calculations and drawings on topics from stress analysis of bulkheads to anode calculations to towhead structural design.</td>
<td></td>
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<tr>
<td><strong>Alma Galia</strong> Jee carried out legislation review of pre-operation documents for new flexible system.</td>
<td></td>
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<tr>
<td><strong>Scolty Crathes</strong> Jee conducted an as-laid upheaval buckling analysis to verify that rock dump quantities proposed by the installation contractor were sufficient to prevent upheaval.</td>
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### Supporting studies

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<td><strong>Scott-Telford</strong></td>
<td>Jee performed a third party review of the spool design for the Scott-Telford pipeline system. Scott Export pipeline. Jee performed a third party review of the full export pipeline detailed design.</td>
</tr>
<tr>
<td><strong>Faragon and Cyrus bundle analysis</strong></td>
<td>Jee carried out a detailed as-built bottom roughness and span assessment for two bundles in the North Sea. The bundles both contained pipe-in-pipe production lines, gas lift lines, methanol lines and control umbilicals. Detailed analysis was able to demonstrate that identified spans were acceptable and no rectification was required.</td>
</tr>
<tr>
<td><strong>Installation analysis</strong></td>
<td>Jee has performed numerous installation and deployment analyses and rigging checks for spoolpieces, umbilicals and subsea structures and frames using OrcaFlex and Abaqus. Projects include Don, Victoria, Janice, Lochranza, Huntington, Arkright, Gryphon, Tyra, Arbroath and Leadon. Design of lifting pins. Jee completed the design of a pair of lifting pins that were used to facilitate the removal of four existing caissons from the Fulmar A platform in the North Sea. Design of sea fastenings — Solan. Jee was appointed to design all sea fastenings necessary for the two-phase mobilisation of equipment/structures for the installation of a large piece of subsea infrastructure.</td>
</tr>
<tr>
<td><strong>Pipeline crossing design</strong></td>
<td>Jee carried out the design for a cable crossing for the Culzean field development. The design accounted for stress analysis, rock berm stability and berm optimisation, impact analysis and berm settlement.</td>
</tr>
<tr>
<td><strong>Various</strong></td>
<td>Jee has carried out numerous overtrawling trials to demonstrate that subsea structures do not snag fishing gear. The trials use scale models and are conducted in a controlled test tank environment where loads acting on the fishing gear and structure are recorded. The designs can be modified during the testing until acceptable results are achieved.</td>
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Introduction

Jee has been providing integrity management services since the formation of the company in 1988. Indeed, our longest continuous client relationship with BP for IM related services began at the formation of the company. A number of example projects and contracts are shown at the end of this document.

Integrity management is a cyclic assurance process, comprising of planning, implementing, assessing and improving. The diagram below shows how each stage of the cycle feeds into the next, with success only achievable with high-quality at all stages. With expert knowledge in all these areas, we are able to offer a completely integrated and objective approach.

Jee has a proven track record in efficiently managing the complex documentation that forms the foundation of the PIMS structure employed by many major operators.

Figure 1 - Jee Integrity Management process
Integrity Management Services

Jee’s integrity management services cover pipelines (onshore and offshore) and subsea systems, including:

- Integrity management processes and plans
  - Pipeline Integrity Management System (PIMS)
  - Subsea Integrity Management System (SIMS)
  - Major accident prevention document (MAPD)
  - Corrosion management strategy
  - PIMS audit / review / gap analysis
- Pipeline spares strategy
- Pipeline Emergency response plan (ERP)
- Pipeline Preparedness and response scheme (PRS)
- Provision of Pipeline Competent Person (PCP)
- Right of way (ROW) management
- Lessons learnt
- Due diligence

- Engineering assessments
  - Risk based assessment (RBA)
  - Condition based assessment
  - FMECA
  - ICCP assessment (impressed current cathodic protection)

Specialist engineering analyses

As part of our integrity management offering Jee have a range of specialist engineering services that we deliver worldwide for clients:

- Riser analysis
- Fatigue analysis
- Upheaval & lateral buckling analysis
- Engineering Critical Assessment (ECA)
- Girth weld assessments
- Dropped object analysis
- Corrosion defect assessment
- Dent assessment
- Span assessment and vibration monitoring
- Stability assessment
- Anchor drag assessment

- CP assessment (cathodic protection)
- Anomaly assessment
- Defect assessment
- Fitness for service / Fitness for purpose
- Pipeline repair or remedial specification / analysis / design

- Inspection and maintenance planning
  - Risk based inspection (RBI)
  - Inspection programme and plans
  - Inspection and maintenance routine (IMR)
  - Key Performance Indicators (KPIs) / Process Safety Performance Indicators (PSPIs)
  - Subsea inspection strategy
  - Inspection work scope
  - Pipeline anomaly criteria

- Pipeline annual condition reporting
  - Annual corrosion assessment
  - Annual pipeline integrity statement
  - Technical integrity assessment

- Trawl gear interaction study
- Fishing interaction study
- Berm calculations
- Burial assessments
- Root case analysis
- Internal corrosion direct assessment (ICDA)
- External corrosion direct assessment (ECDA)
- Structural reliability analysis
- Internal erosion assessments
- Subsea controls
- Offshore technical representation
# Jee integrity management track record

## Current IM term contracts

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<th>Location</th>
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<tr>
<td>UKCS</td>
<td>Jee have been providing pipeline integrity and support services on a call-off agreement to a major operator for a number of years spanning the entire integrity spectrum. Work includes: Preparedness response schemes, pipeline cleaning, pipeline technical support, pipeline validation, structural reliability assessments, developing written schemes of examination, pipeline technical authority, decommissioning technical authority, peer review panels, lifetime extension assessment, corrosion health checks, QRAs, TRAs and a vast array of inspection pigging, assurance work, plugging and related validation activities.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Jee has provided ad-hoc pipeline integrity support services to a major operator since 2003 and has provided on-going annual pipeline integrity management services since January 2005. Over this period, Jee has formed a strong relationship with the client. Recently Jee has successfully provided the client with support to incorporate gas assets into their IM system as part of a wider transition programme. Jee has developed and implemented a truly Risk Based Inspection (RBI) campaign, allowing the client to save money and focus resources on the areas where they are most required.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Jee are currently the Subsea Integrity Management Contractor for our client's UK assets. Jee is currently providing the pipeline and structures competent person in support of their Subsea TA. The workscope for the contract includes: annual update of the RBA and IMR documentation; preparation of offshore scopes of work; assessment of inspection results including anomalies; corrosion assessment and annual reporting. In addition maintenance and update of the existing IM documentation and advice on changes to legislation are included within the scope.</td>
</tr>
</tbody>
</table>
**Selected ad-hoc scopes**

<table>
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<tr>
<th>Location</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Middle East &amp; Caspian</td>
<td>Development of an integrity management system across the whole asset chain including pipelines, structures, pressure equipment, rotating machinery, critical safety systems, lifting equipment, electrical equipment and export terminals. This involved the systems engineering design of the entire asset integrity management framework including strategy, operation, maintenance, inspection and monitoring data capture and storage, processes, and staff.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Jee have worked closely with our client to help develop and manage risks associated with the integrity of their assets. Some of the work Jee has carried out includes: develop and prepare annual Technical Integrity Assessments, compile remedial actions, RESDV and SSIV testing and reporting procedures, ESDV fire protection assessment, span assessments, verification, contingency plans, pipeline support, MAPD review and updates.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Jee have provided assistance on numerous projects including piggability assessments, high level subsea IM assurance assessment of all the client’s operational assets and compliance review during transition of duty holdership.</td>
</tr>
<tr>
<td>Global</td>
<td>Support to our client’s global integrity arm to develop the company-wide IM standards for pipelines, subsea systems, wells, facilities and structures. Locally to the UK, Jee has developed IM system documentation for their asset portfolio. This includes PIMS, subsea inspection strategy, RBA procedure, ESDV test procedure, and the anomaly procedure. We have also carried out the RBA of their current assets and performed the first annual integrity review for a subsea system.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Jee have provided many pipeline and integrity management functions to our client including: Pipeline Works Authorisations/Interim Pipeline Regimes, writing PIMS, span assessments, lifetime extension assessment, writing operational pipeline documents, writing technical, databooks and spares assessments.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Criticality assessment of subsea system, which involved running a qualitative risk assessment on all aspects of the subsea system, which resulted in a number of high-risk items. These high-risk items were then subjected to a detailed assessment to determine what preventative/maintenance was actually in place compared to what was recorded as set in place in order to reduce the risk scores. Updated risk scores were generated from the detailed assessment and the output was a set of recommendations on how to reduce the future risk scores of those items which still remained high-risk.</td>
</tr>
</tbody>
</table>
Jee has provided our client with integrity management support since 2005. This has included: Review and update of the PIMS, derivation of anomaly limits for typical anomalies such as spans and exposures on each pipeline, completion of the annual integrity assessment, lifetime extension assessments, dropped object assessments, horizontal pigging assessment and dent & gouge assessment, derivation of ESDV closure time and leak rate anomaly limits for each valve and determining the requirements for ESDV leak testing.

<table>
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<tbody>
<tr>
<td>Netherlands</td>
<td>Jee has provided our client with integrity management support since 2005. This has included: Review and update of the PIMS, derivation of anomaly limits for typical anomalies such as spans and exposures on each pipeline, completion of the annual integrity assessment, lifetime extension assessments, dropped object assessments, horizontal pigging assessment and dent &amp; gouge assessment, derivation of ESDV closure time and leak rate anomaly limits for each valve and determining the requirements for ESDV leak testing.</td>
</tr>
<tr>
<td>Asia Pacific</td>
<td>Carried out a Level 2 Engineering Criticality Assessment (ECA) on a severely damaged section of pipeline to determine whether it is fit to operate in the short-term. This includes fracture and fatigue studies conducted to BS 7910, focused on the circumferential girth welds.</td>
</tr>
<tr>
<td>UKCS</td>
<td>Pipeline spares to be assessed for suitability for 4 pipelines. Specific spares relating to repairs from damage from 3rd party incidents only. Procurement information obtained for pipeline components and repair equipment including hot taps, clamps, linepipe, bends and flanges</td>
</tr>
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Brisktrade

Pigging capability and track record

Introduction

The purpose of this document is to outline Jee’s capability and track record in the assurance, technical support and project management of pipeline pigging and in-line inspection projects.

Whilst each project is unique and has its own critical features, the typical sequence that Jee has worked to when supporting pigging projects to execution is shown below, along with standard deliverables. Jee’s involvement has ranged from single activities to involvement throughout the whole project process.

Many of Jee’s pigging projects involve looking into niche or complex specialist pigging applications. These have included inspection of “unpiggable pipelines”, multi-diameter pipeline cleaning and inspection, riser inspections using tethered or bi-directional tools and techniques, subsea launching and receiving, or launching/receiving pigs from compact pigging valves.

Jee is happy to provide support for ad-hoc requirements or to fulfil a technical advisory role, in whichever form the operator may require.

Figure 1 - Jee process for pigging projects
Details of selected deliverables provided by Jee

**Pigging feasibility studies**

Jee has carried out many pigging feasibility studies for lines that have never been pigged, or for operations that have specific operational, logistical or geometrical complexities. For this process, Jee reviews the pipeline system geometry and operating conditions, and the aims of the operation. Then suitable conceptual options for the system and its specific complexities are identified (end-to-end pigging, bi-directional, tethered inspection etc.) and the feasibility of each option assessed, determining vendors/tools potentially able to fulfil the requirements and identifying key risks/benefits associated with each concept. Such studies are used as the groundwork for the detailed engineering of the subsequent pigging operation.

**Pipeline bore mapping (pipeline geometry review)**

Jee has completed pipeline geometry reviews to assess project feasibility options using bore maps for many pipeline systems around the world. The bore map forms one of the fundamental documents used to review the ‘piggability’ of the pipeline (i.e. ability to convey the pig from launcher to receiver) and suitability of pig geometry and is essential for preparation of subsequent pig and operations assurance.

**Pig/ILI tendering and tool selection**

Jee has supported many clients in the technical and commercial selection of tools and vendors for cleaning and inspection pigging operations. This has included screening the market for suitable vendors to include in the tender using Jee’s detailed knowledge of the main pigging vendors’ tools, generating tender documentation to be submitted to vendors to bid against, as well as reviewing the received tenders and making techno-commercial recommendations to the operator regarding which vendor and tool to select.

**Tool development and testing support**

Jee has experience of working alongside operators and vendors in the development of new tools; reviewing tool designs/modifications, qualification plans and technology readiness assessments. Jee has also specified test loop requirements, reviewed loop designs and test plans to ensure they replicate all key features and parameters of the actual pipeline system and adequately mitigate the passage risks identified within the line, and conducted site witnessing of final testing on behalf of operators.

**Pig design checksheet**

The pig design checksheet is a best practice compliance checklist, assembled for numerous Jee pigging support projects. This document has evolved from many years of collaborative experience in pigging projects, benefitting from lessons learnt through Jee, tool vendor and operator experience. It is a detailed review that covers nine different aspects of the pig/inspection tool suitability for the system, considering:

- Pig functionality for the specific cleaning/ gauging/inspection requirements of that run
- Tool design suitability for operating conditions, system geometry and features, robustness and coupling design, tracking, signaling
- Detailed bypass design calculations considering tool velocity limits, runtime, minimum flows for stall conditions
- Handling and logistics around worksites
- ATEX compliance considerations

The checksheet uses a ‘traffic-light’ system to identify the degree of compliance with best practice and whether any form of non-compliance is considered acceptable or not, including recommendations for any mitigations or proposed adjustments to the tool design or operational parameters.
Risk assessment

Jee has been responsible through various pigging projects for the organisation, facilitation, technical leadership, attendance and scribing of risk assessments (HAZID, HAZOP, TRLs etc.). This can be carried out utilizing an operator’s risk assessment procedure or Jee can outline alternative assessment processes/methodologies through a bespoke Terms of Reference.

Stuck pig guidance

Jee can provide stuck pig guidance documents, identifying the most likely indications of a stalled or stuck pig to monitor for, the immediate steps to be taken in each case, and the longer term considerations in the event of a stuck pig. The document examines the specific pipeline system in question and presents guidance in clear flowcharts with supplementary descriptors to assist site operators in decision making if there is an indication of a pig stalling; the aim being to ensure no responsive actions are undertaken that could worsen the situation. The document clearly shows at what point additional support is to be sought from onshore expert teams, and the roles or individuals that should be involved in any response team.

Offshore execution management

Jee has provided site representatives to provide technical oversight of site activities during the execution phase of inspections. The Jee engineer would typically take on the role of pigging project representative on site, managing the vendors and 3rd parties associated with the pigging operation, and providing a single project interface with the platform personnel and management during the operation.

Project management

Jee is able to provide full project management services for pigging and inspection projects covering the entire project process, and has fulfilled such scopes for projects in various global regions in recent years. As such, Jee is used to managing and acting as the primary vendor interface through pigging projects. This has included overseeing the tendering process, monitoring project progress, planning logistics and facility readiness checks, and leading site visits and the site execution of ILI campaigns. Jee also leads lessons learnt sessions at the end of many pigging projects to ensure all parties record both successes and areas for future improvement.
### Jee pigging projects track record

<table>
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<tr>
<th>Date</th>
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<tbody>
<tr>
<td>2005</td>
<td>FE and fatigue assessment of loading of riser during daily pigging.</td>
</tr>
<tr>
<td>2006</td>
<td>Pigging feasibility study for a number of new pipelines.</td>
</tr>
<tr>
<td>2007</td>
<td>Review the intelligent pigging options (onshore &amp; offshore disposal) for a pipeline system and provide technical assurance on the scope &amp; cost of both these options. Review the new pipeline option and provide technical assurance on the scope &amp; cost.</td>
</tr>
<tr>
<td>2008</td>
<td>Produce a 10 year plan for validation of pipelines by ILI (76 pipelines).</td>
</tr>
<tr>
<td>2008</td>
<td>Support to a number of routine ILI runs, including assessment of the pigs to be run, assessment of other damage and features of the gauging pig following receipt, and identification of any modifications required to the pig design based on these assessments.</td>
</tr>
<tr>
<td>2009</td>
<td>Develop approaches for carrying out intelligent pigging of a number of pipelines; determine modifications needed to be made, select preferred pig types, determine cost and timescale for each pigging approach, and assess pipelines for each of the generic approaches.</td>
</tr>
<tr>
<td>2009</td>
<td>Provide support for intelligent pigging programmes on a number of subsea pipelines, including identifying suitable tools and vendors, assurance activities, procedures, piggability checks, logistics support, vendor liaison.</td>
</tr>
<tr>
<td>2009</td>
<td>Prepare for the hydrocarbon freeing and cleaning of pipelines for decommissioning. Provide supervision to the contractors during the hydrocarbon freeing and cleaning activities, ensuring that the cleaning is carried out in accordance with operator’s procedures and legal requirements.</td>
</tr>
<tr>
<td>2009</td>
<td>Assessment of run times of various pigs in a subsea export line to determine cause of late running. Provide new and better predictions of run times than those provided by vendors.</td>
</tr>
<tr>
<td>2010</td>
<td>Carry out a review of the reports from in-line inspections which had recently been carried out for one oil and one gas pipeline to determine whether the analysis and reporting was in accordance with operator in-house criteria, summarise of the key findings, identify areas which should be re-addressed with the inspection company, and identify any lessons learnt which need to be fed back into the client in-house procedures.</td>
</tr>
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<tr>
<td>2010</td>
<td>Project management and technical assurance support for intelligent pigging of 4 pipelines, including one requiring subsea launching. Collate piggability datapack and generate SoW, prepare documentation to facilitate ILI tool selection and necessary QA/QC documentation needed to support pipeline and pigging assurance.</td>
</tr>
<tr>
<td>2011</td>
<td>Review and revalidate ILI baseline strategy for a new pipeline system in Norway comprising of multiple pipelines of different diameters.</td>
</tr>
<tr>
<td>2011</td>
<td>Provide support to a major global operator's Pipeline Validation Project, set up to validate all North Sea pipelines over a 5 year period. Workscopes include assurance support on pigging and in-line inspection activities and project management support of ILI programmes. This covered support to 18 pipeline operations in 2011 including conventional ILI runs and subsea pig launching.</td>
</tr>
<tr>
<td>2011</td>
<td>Prepare documentation to facilitate ILI tool selection and necessary QA/QC documentation needed to support pipeline and pigging assurance for an onshore pipeline.</td>
</tr>
<tr>
<td>2011</td>
<td>Complete pipeline questionnaires and boremaps for each of three hybrid rigid-flexible pipeline systems from a new FPSO in West Africa ahead of specifying the baseline ILI requirements.</td>
</tr>
<tr>
<td>2011</td>
<td>Pigging technical assurance support to the pipelines team in regards to the inline inspection activities to be completed in 2011 and preparation for 2012 inspections. This covered support to 15 pipeline operations including conventional ILI runs and subsea pig launching.</td>
</tr>
<tr>
<td>2012</td>
<td>Selection of appropriate ILI tool and vendor(s), and identification of other pig runs required during the programme. Create a justification document summarising the ILI programme and indicative budget costs. Initial assurance on pigs and launcher basket.</td>
</tr>
<tr>
<td>2012</td>
<td>Continued support to a major global operator’s Pipeline Validation Project. This covered support to 15 pipeline operations in 2012 including conventional ILI runs, subsea pig launching and use of tethered crawlers.</td>
</tr>
<tr>
<td>2012</td>
<td>Provide project management and technical support to the baseline ILI project for two FPSO flowlines in West Africa, starting in 2010. Manage project including: tool specification; vendor/tool selection; offshore site survey and assistance to topsides readiness; management of tool vendors through design and manufacture including loop testing; assurance of pig design; HAZOP of new procedures; ETP checks; offshore documentation (stuck pig doc, bridging doc etc.); offshore management during two pigging campaigns; review of vendor reports; lessons learnt and close-out report.</td>
</tr>
<tr>
<td>2012</td>
<td>Assessment of material selection for pig trap door closure.</td>
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<tr>
<td>2013</td>
<td>Assessment of the effect of closing balance line on the DP generated across the pig in 10&quot; condensate pipeline (pig was stalling within minor barrel) and the potential for impacting the trap door (denting energy and stress calculation).</td>
</tr>
<tr>
<td>2013</td>
<td>Support for re-introducing operational pigging on a 14&quot; pipeline, starting in 2011. Review risks of long term debris build-up after c. 10 years of no pigging, requirements for modifying existing pig design, multi-diameter considerations (14&quot;/16&quot;, dropping into 36&quot; oil export line). Support prior to and during initial runs with the new pigs, including procurement of pigs, onshore testing, and contingency options for stuck pigs.</td>
</tr>
<tr>
<td>2013</td>
<td>Pigging support for 8&quot; condensate pipeline, starting in 2011. The pressure drop across the pipeline was reaching a critical level due to wax build up. Scope includes proscribing a cleaning pig campaign and remedial pigging activities to remove wax.</td>
</tr>
<tr>
<td>2013</td>
<td>Continued support to a major global operator's Pipeline Validation Project. This covered support to 21 pipeline operations in 2013 including conventional ILI runs, subsea pig launching and use of tethered crawlers.</td>
</tr>
<tr>
<td>2013</td>
<td>Laser scan survey of FPSO turret in Ivory Coast for retrofitting pig traps including detailed CAD design, technical specifications for manufacture and installation of pig launcher and receiver including associated spools and components and update of P&amp;ID's and isometric generation.</td>
</tr>
<tr>
<td>2013</td>
<td>Prepare a pigging philosophy document for a pipeline which takes account of previous relevant documentation and experience to date, including flow assurance requirements, required pigging frequency as determined from studies and requirements to enable the pipeline to be intelligently pigged.</td>
</tr>
<tr>
<td>2013</td>
<td>Fitness for purpose assessment including defect assessment, stuck pig review, concept design of pipeline replacement, repair and corrosion review.</td>
</tr>
<tr>
<td>2013</td>
<td>Conceptual study into the use of pigging valves for the pigging of 3 infield lines for an FSO development, including market research into available suppliers and products, common features and design considerations, assessment of proposed topsides design and statement of requirements.</td>
</tr>
<tr>
<td>2014</td>
<td>Provide project management and technical support to the planning for baseline ILIs on three FPSO flowlines in West Africa including flexibles, CRAs and multi- diameter sections, starting in 2012. Scope includes: project documentation (decision support packages, sparing strategies, concept development studies etc.); tool and test loop specification; vendor and tool selection; cleaning strategy; offshore site survey and assistance to topsides readiness; management of tool vendors including loop testing; assurance of pig design &amp; build; HAZOP of new procedures; ETP checks; offshore documentation (stuck pig doc, bridging doc etc.); offshore management during pigging campaign; lessons learnt and close-out report.</td>
</tr>
<tr>
<td>Date</td>
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</tr>
<tr>
<td>2014</td>
<td>Continued support to a major global operator’s Pipeline Validation Project. This covered support to 15 pipeline operations in 2014 including conventional ILI runs and use of tethered crawlers.</td>
</tr>
<tr>
<td>2014</td>
<td>Design of a maintenance pigging strategy for five production flowline loops from two FPSOs in West Africa. Scope includes: SoR for all pigs to be procured; techno-commercial evaluation of 6 tenders; pigging assurance checks (design checks, ETP checks, stuck pig guidance); arranged of HAZOP of pigging procedures; topsides readiness for pigging operations; and offshore supervision of first cleaning campaign on FPSO.</td>
</tr>
<tr>
<td>2014</td>
<td>Assistance to client in tendering for an ILI vendor to provide tools and services for all pigging activities over a 3-5 year period in West Africa. Technical assistance to client team, generating tender documentation and lead technical reviewer of tenders received.</td>
</tr>
<tr>
<td>2014</td>
<td>Attendance as an independent technical expert at technology readiness review sessions for a new ILI tool being developed for use in a complex pipeline system at a new facility, including diameter variations from 8” to 12”, vulnerable materials and passage of multiple wye pieces.</td>
</tr>
<tr>
<td>2014</td>
<td>ILI project to revalidate a 10” Norwegian gas pipeline for return to use, including provision of a piggability report to determine the most suitable course of action for the pigging campaign, review and comparison of the ILI tools available and design assurance on the selected pigs/tools, as well as checking that pigging activities comply with operator’s group practice requirements for pigging operations.</td>
</tr>
<tr>
<td>2014</td>
<td>Technical project support to the planning of baseline inspections of 3 pipelines of varying diameter at a new FPSO facility in Norway. Scope includes; project management documentation (decision support packages, project execution plan etc.); piggability review and SoRs for tooling; tool tender review and selection; cleaning strategy; facilitation of risk assessments.</td>
</tr>
<tr>
<td>2014</td>
<td>Feasibility study for a small diameter pipeline with no pig launch/receipt facilities, requiring subsea launch and topsides receipt. Scope includes identifying possible pig trap locations, isolation options and requirements and the impact on production for both the subsea launcher and topsides receiver; piggability review cleaning strategy definition; determine whether ILI is suitable after discussions with potential vendors.</td>
</tr>
<tr>
<td>2014</td>
<td>Provide pigging supervisor for planning the inspection of two 24” gas pipelines. Scope includes generating RFQ for vendors and tender review and vendor selection, liaison and management of vendor and topsides readiness issues, including site survey and risk assessment prior to operation.</td>
</tr>
<tr>
<td>2014</td>
<td>Dynamic simulation of pig runs through test loop looking for velocity excursions in pig including effects of friction, pressure ahead of and behind pig and dead legs using Scilab 5.4.</td>
</tr>
<tr>
<td>Date</td>
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<tr>
<td>2014</td>
<td>Structural assessment to justify the design of a family of pig loaders, trolleys, rails and fixings. Calculations to BS EN 1993-1-1:2005 using a combination of bespoke MathCAD calculations and FE analysis.</td>
</tr>
<tr>
<td>2015</td>
<td>Continued support to a major global operator’s Pipeline Validation Project. This covered support to 15 pipeline operations in 2015 including conventional ILI runs, use of tethered crawlers and bi-directional “spring-back” techniques.</td>
</tr>
<tr>
<td>2015</td>
<td>Validation of pigging stress analysis and piggability checks for a major export pipeline.</td>
</tr>
<tr>
<td>2015</td>
<td>Review of the options for inline inspection of an export pipeline and recommendation of the best technology to inform the fitness for purpose of the pipeline. The study also comments on the operational requirements for proposed options, especially with respect to increasing the operating pressure for the duration of the pigging activities and the risks associated with this.</td>
</tr>
<tr>
<td>2015</td>
<td>Piggability review of a 24” gas export pipeline in the Southern North Sea, investigating the pipeline geometry, pigging facilities, operating conditions and pigging history to determine suitability for an ILI campaign. The study identifies possible flow issues due to low line pressures which would affect the probability of a successful ILI run and recommends options to overcome this.</td>
</tr>
<tr>
<td>2015</td>
<td>Review available sphering, liquid hold-up and integrity information and provide recommended frequencies and ‘next-steps’ for the sphering of one operational pipeline and one new pipeline, each with no documented reasons for the specified sphering frequencies.</td>
</tr>
<tr>
<td>2015</td>
<td>Technical assurance of an ILI campaign to inspect a riser and 500m zone in order to allow re-rating of the pipeline to its original MAOP. The scope includes; production of the pipeline datapack/boremap in order to highlight risks to pigging, technical input to the HAZID and an offshore site survey of the pigging facilities / pipework accompanied by a detailed report.</td>
</tr>
<tr>
<td>2016</td>
<td>Technical assurance for an ILI tool being modified to be suitable for a waxy, low pressure pipeline. Scope includes reviewing tool design and vendor loop testing programme, as well as risk assessment support.</td>
</tr>
<tr>
<td>2015</td>
<td>Study into the effect of a pig striking a check valve plate at various speeds, determining the impact forces and consequences.</td>
</tr>
<tr>
<td>2016</td>
<td>Continued support to the a major global operator’s Pipeline Validation Project. This covered support to 9 pipeline operations in 2016 including conventional ILI runs, use of tethered crawlers and bi-directional “spring-back” techniques.</td>
</tr>
<tr>
<td>Date</td>
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<tr>
<td>2016</td>
<td>Carry out subsea pig trap design review, feasibility studies for pig launching and receiving options, launch and receipt procedure writing and presentation of procedures at HAZOP for a new field development with subsea infrastructure that would require life of field pigging capability including subsea pig launch and subsea pig receipt once in operation.</td>
</tr>
<tr>
<td>2016</td>
<td>Provide engineering analysis for an inspection using a tethered crawler in Trinidad, including capstan calculations for pull-back limits on the tether and a stuck tool guidance document for use if the crawler hung-up anywhere in the pipeline.</td>
</tr>
<tr>
<td>2016</td>
<td>Assessment of the options for flushing, pigging and conditioning of a network of pipeline infrastructure for decommissioning and to advise an optimised base case cleaning methodology to be taken forward to the detailed engineering phase.</td>
</tr>
<tr>
<td>2016</td>
<td>Engineering support, starting in 2014, to the inspection of a pair of pipelines which had never been pigged and which suffer from significant bore restrictions due to scale deposits. Scope includes: reviewing the original pigging philosophy; generating SORs for cleaning and inspection tools and testing; pigging strategy definition; offshore site survey; witnessing of tool testing; pig design checksheets for all tools and checks of associated equipment; stuck pig guidance documentation; review of 3rd party procedures; project team representation offshore to oversee pigging operations; review of ILI tool data and detailed fitness for service assessment including FEA of defects.</td>
</tr>
<tr>
<td>2016</td>
<td>Review of pig trap facilities at two platforms, checking current integrity of facilities and adherence to best practice (operator group practices, Jee best practice guidance, industry standards and codes), followed by design work required for reinstatement, and liaison with potential vendors to define specifications (primarily material and welding) and SORs for equipment.</td>
</tr>
<tr>
<td>2016</td>
<td>Provision of seconded engineers to multiple decommissioning projects to define and manage the pigging operations to make pipelines hydrocarbon-free ahead of decommissioning.</td>
</tr>
<tr>
<td>2016</td>
<td>Provision of a seconded engineer to define and manage the ILI operations for a number of operational pipelines within the SNS.</td>
</tr>
<tr>
<td>2016</td>
<td>Independent technical review of issues being encountered launching, driving and recovering spheres from a new pipeline. Review of historical sphering data, reports of the issues encountered from tool vendors, and make recommendations for the adaptation of the pipeline sweeping philosophy to improve efficiency and success of sweeping operations.</td>
</tr>
<tr>
<td>Date</td>
<td>Details</td>
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<tr>
<td>2016</td>
<td>As an independent third party, perform a corrosion risk assessment to quantify the risk of unacceptable levels of corrosion occurring on pig trap doors over their design life, taking into consideration their respective operating conditions.</td>
</tr>
<tr>
<td>2017</td>
<td>Technical assurance of the first pigging operation in an ultra-deepwater pipeline which was believed to include a significant bore restriction. Jee provided design checks of the pigs to be run and the operation, including coaching of the local team to execute the project offshore, and remote support during the offshore execution. Jee’s scope also included providing guidance on operational efficiencies to minimise the impact of pigging operations on production.</td>
</tr>
<tr>
<td>2017</td>
<td>Technical assurance to the ILI of an ultra-deepwater pipeline including pig and ILI tool design checks, coaching of the local team to execute the project offshore, and remote support during the offshore execution.</td>
</tr>
<tr>
<td>2017</td>
<td>Jee prepared pig launch and receipt procedures for a pair of pipelines at a new development, each requiring a subsea launch and onshore receipt. Scope included presenting the procedures at HAZOP and finalisation of documentation to include HAZOP recommendations.</td>
</tr>
<tr>
<td>2017</td>
<td>Continued support to a major global operator’s North Sea pipelines team pigging operations. This covered support to 5 pipeline operations in 2017 including conventional ILI runs, use of tethered crawlers and bi-directional “spring-back” techniques.</td>
</tr>
<tr>
<td>2017</td>
<td>Given significant challenges associated with deployment of an isolation plug for an offshore ESDV changeout, Jee defined an alternative isolation methodology and assisted in the planning of the execution of this operation, including attendance at HAZID and HAZOPs, and management of the procurement of pigs to execute the project.</td>
</tr>
<tr>
<td>2017</td>
<td>Jee provided technical assurance support to the first time inspection of a pair of gas pipelines running from 2 NUIs to an onshore terminal. Scope included attendance and project HAZOP, technical assurance of the design and operability of UT wall thickness and crack detection tools run in a batching process, generation of a stuck pig guidance document and detailed review of procedures.</td>
</tr>
<tr>
<td>2017</td>
<td>Jee reviewed the opportunities and risks associated with pigging a severely waxed pipeline to clean the pipeline for flow assurance purposes. The proposed operation included not only debris challenges but also subsea launch and receipt considerations, or topsides modifications to handle pigs. Jee conducted wax deposition flow assurance studies to define the extent of the waxing issued and proposed operations to clean and maintain the line with pigs or pipeline modifications. Jee also investigated potential issues on downstream pipelines if the wax was removed from the pipeline.</td>
</tr>
<tr>
<td>Date</td>
<td>Details</td>
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<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>2017</td>
<td>Jee provided a seconded engineer to work in the client team for 6 months to manage a number of project workscopes across five separate assets. Scopes included pigging operations covering use of novel pigging techniques (smart foam pigs), aggressive pigging of an oil export pipeline, and tendering for ILI operations.</td>
</tr>
<tr>
<td>2017</td>
<td>Provision of a seconded engineer to define and manage the ILI operations for a number of operational pipelines within the SNS.</td>
</tr>
<tr>
<td>2017</td>
<td>Jee provided an independent review of possible p</td>
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</table>
Late life capability and track record

As oil and gas fields mature and assets approach or exceed their design life, late life management is essential to continue safe and profitable operation until CoP. This requires a clear understanding of the condition of existing assets and how that condition changes over time to determine the best strategy. Early planning and engagement is essential to realise cost efficiencies and manage risks.

Drawing on our extensive integrity management experience and the expertise of our late life engineers, we help asset owners to understand the condition of their assets and make the most appropriate late life decisions, whether that be lifetime extension or decommissioning. The following flow chart presents an overview of our capabilities in each area.

<table>
<thead>
<tr>
<th>Late life assessments</th>
<th>Preparatory decommissioning studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lifetime extension assessment of rigid and flexible pipeline and riser systems</td>
<td>• Material inventory development</td>
</tr>
<tr>
<td>• Remnant life assessment of both rigid and flexible pipeline and riser systems</td>
<td>• Cost estimation and project gate refinement</td>
</tr>
<tr>
<td>• Review and update of PIMS</td>
<td>• Cleanliness assessments and cleaning approach selection</td>
</tr>
<tr>
<td>• DPN/IPR/PWA submission and amendment</td>
<td>• Decommissioning scoping studies</td>
</tr>
</tbody>
</table>

Decommissioning strategy

- Identification and screening of decommissioning approaches in line with Oil and Gas UK guidelines
- Stakeholder identification and engagement strategy
- Activity scheduling, sequencing and optimisation
- Contractor identification and tendering support

Decommissioning programme

- Comparative assessment (CA) of suitable options, including supporting studies as required
- Preparation of environmental impact assessments (EIAs)
- Decommissioning programme development
- Liaison with the regulatory bodies

Decommissioning execution

- Project / programme management
- Permitting and consents
- Safety case update and update of inspection and maintenance requirements
- Offshore technical representation and support
- Procedure development
- Verification of contractor approaches and procedures
- HAZID / HAZOP

Post decommissioning activities

- Inspection and monitoring regimes, including overtrawling trials
- Lessons learnt and procedure update
- Decommissioning best practice and guidance documents

Figure 1: Jee’s late life asset services
**Lifetime extension**

We have supported our clients for over a decade in the justification of continued operation of ageing rigid and flexible pipeline assets beyond design life. For every lifetime extension assessment that we perform, we quantify the remnant life of the pipeline system based on our assessments, giving the operator confidence in the fitness-for-service of the system until the predicted end of life. Where the assessment is based on assumptions due to a lack of available data, timeframes for further inspection activities or assessments required to confirm those assumptions will be specified.

As authors of the ISO TS 12747 for lifetime extension and convenor of the associated ISO working group 17, we have first-hand knowledge and experience of the lifetime extension approaches adopted in the UK. Due to an observed need within the industry, Jee is currently in the process of updating this document to incorporate the lifetime extension assessment of flexible pipe.

**Lifetime extension key deliverables provided by Jee**

Our core lifetime extension services include:

- Full lifetime extension assessment of rigid pipeline and riser systems, to the methodology defined in ISO TS 12747
- Full lifetime extension assessment of flexible pipeline and riser systems, supplementing the ISO TS 12747 approach for rigid pipeline LTE with:
  - Guidance from API 17B, API 17J, Norsok Y-002 and Norsok U-009
  - Jee internal flexible riser system dynamic analysis capability
  - Jee internal experience of flexible pipe material degradation mechanisms
- Remnant life assessment of both rigid and flexible pipeline systems, assessing the time dependent degradation mechanisms and utilising a robust operator PIMS to manage additional threats to the system
- Review and update of PIMS to reflect late life operational risks, considering incorporation of preparatory activities for decommissioning such as survey to minimise additional spend in the decommissioning phase

**Decommissioning**

With over 10 years experience, Jee is an expert in the decommissioning of oil and gas assets. Complemented by our integrity management and lifetime extension capabilities and expertise, we provide a suite of decommissioning services to support our clients through all stages of a decommissioning project, from initial feasibility studies and cost estimations, through detailed engineering and offshore activities, to project completion and close-out. This includes:

- Identification of optimum decommissioning strategy through technical assessments and cost modelling;
- Decommissioning cost estimation and independent review of ABEX estimates
- Assessment of decommissioning methods for structures, pipelines and risers through onshore studies. This includes performance of both screening level and full comparative assessments;
- Development and writing of decommissioning programmes and procedures;
- Determination of cleaning approaches and management / technical assurance of offshore activities;
- Review of structural and pipeline inspection requirements at various stages in the decommissioning process, accounting for changes in the risk profile;
- Project management and support of decommissioning programme execution and close-out, including liaison with the regulatory bodies;
- Definition, management and assessment of overtrawling surveys following completion of decommissioning works;
- Management of disused pipelines following cessation of production and of pipelines decommissioned in-situ.

We have practical experience in decommissioning project engineering, including well abandonment, pipeline decommissioning, topsides removal and jacket removal (or derogation). From this experience, we have developed an in-depth understanding of:

- The issues involved;
- Equipment available for decommissioning at present and emerging technologies;
- The associated vessel rates and typical timeframes for the decommissioning of certain components;
- Scheduling and sequencing efficiencies to be gained in the decommissioning of hubs;
- The recycling / disposal routes and associated costs.

**Training**

Our combined engineering and training expertise means we can support your and your team’s projects and development at all stages. From reference material for competent engineers to refresh their knowledge on-demand, to engineering support, training and mentoring, we can support your engineering team in delivering successful projects. We offer the following courses in the area of late life:
- A two hour ‘Introduction to decommissioning in the North Sea’ workshop
- A two day ‘Planning, executing and managing decommissioning projects in the North Sea’ course
- A two day ‘Lifetime extension of rigid pipelines and flexibles’ course
## Jee lifetime extension track record

<table>
<thead>
<tr>
<th>Client</th>
<th>Details</th>
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</table>
| **Centrica** | **Project: Flexible pipeline remnant life assessment**  
Centrica identified a need to extend the operating life of a flexible pipeline and asked Jee to perform a remnant life assessment to determine if it could be used for a further five years. The flexible pipeline was installed in 2002 with an initial design life of 10 years. Jee’s study assessed the corrosion of the armour wires in the flexible, degradation of the HDPE and fatigue of the flexible pipeline. Risks were highlighted and recommendations put forward. |
| **TAQA**   | **Project: Lifetime extension studies**  
Jee has undertaken LTE assessment of multiple North Sea pipelines for TAQA and provided recommendations for continued operation. This has involved assessment of time dependent degradation mechanisms in both rigid and flexible pipeline components, along with the assessment of additional threats anticipated during late life that could result in a change to the overall risk profile. |
| **Centrica** | **Project: Multi-field lifetime extension assessments**  
Jee completed lifetime extension assessments for eight subsea pipeline systems in the Southern and Northern North Sea including pipelines, risers, expansion and tie-back spoolpieces. A variety of design and time-dependent threats were reviewed in accordance with ISO/TS 12747, for carbon steel and CRA construction materials. A number of potential corrosion mechanisms were evaluated for the different production fluids present throughout the fields. |
| **Marathon Oil Corporation** | **Project: Lifetime extension study for West and Central Brae**  
Jee carried out lifetime extension assessments of nine pipelines in the West Brae and Central Brae fields for Marathon Oil UK. This included an oil export pipeline, infield pipelines in oil production and gas lift service, and the accompanying platform risers. Assessments were completed using methodologies aligned with NORSOK Y-002:2010 (life extension for transportation systems) and ISO/TS 12747:2011 (recommended practice for pipeline life extension). |
| **EnQuest** | **Project: Heather and Thistle lifetime extension**  
The development plan for both the Thistle and Heather fields involved continued operation significantly beyond expiry of the original design life. EnQuest asked Jee to conduct a lifetime extension study to determine the remnant life and demonstrate that risks due to extended operation remained within acceptable limits. As part of this work a full riser fatigue analysis was performed. This involved the creation of FE models of the riser which were then used to determine stress ranges of the riser spans and fatigue damage due to vortex-induced vibrations (VIV). |
| **Chevron** | **Project: Helder and Haven lifetime extension assessment**  
Jee performed lifetime extension assessments of the Helder and Haven pipeline systems in accordance with NORSOK and ISO codes, making use of the available ILI data for assessment of identified corrosion defect growth as part of the remnant life assessment. |
| **P** | **Project: Lifetime extension study**  
Jee carried out a lifetime extension study for two main oil export pipelines in the UKCS (operated by EnQuest). The assessment included corrosion forecasting and pressure containment, corrosion protection (CP) assessment and a detailed riser fatigue finite element analysis (FEA) to determine the level of fatigue damage experienced to date and therefore the remaining fatigue life. |
### Project: Lifetime extension study
Jee performed lifetime extension assessments for six Maersk pipelines in the Danish sector of the North Sea prior to expiry of the original design life. This resulted in periods of extended operation of up to 25 years.

### Project: Hoorn lifetime extension studies
Jee performed lifetime extension assessment of the Hoorn pipeline system in accordance with NORSOK and ISO codes. Areas considered included corrosion, fatigue, stability and protection requirements.

### Jee decommissioning track record

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>MAERSK OIL</td>
<td><strong>Project: Provision of subsea decommissioning services</strong>&lt;br&gt;Jee was contracted to provide project management functions for the decommissioning of the well head protection systems and subsea infrastructure of a Southern North Sea field. This covered the entire decommissioning process from desktop studies to offshore operations, including CoP planning and justification, decommissioning cost estimation and review, regulatory liaison to ensure all necessary documentation (such as decommissioning programmes, PWA variations and the derogation case to enable both buried and structurally unsound mattresses to be left in-situ) was produced, submitted and approved and project management of the execution phase. In addition, Jee also oversaw the development of novel technology to remove grout from the piles holding subsea structures in place, allowing them to be cut and the structure lifted, minimising diver intervention and seabed disturbance.</td>
</tr>
<tr>
<td>PETROGAS</td>
<td><strong>Project: Provision of infield decommissioning services</strong>&lt;br&gt;As part of a SNS decommissioning project, Jee supplied project engineers to support pipeline decommissioning activities (including generation and submission of required regulatory documentation such as PWA variations) and participate in the development of the associated platform complex dismantling safety case for submission to the UK HSE. Jee also provided experienced offshore representatives, responsible for supervising and coordinating operations including well isolations and interventions, barrier testing, corrosion inhibitor injections and pipeline cutting and removal across the field.</td>
</tr>
<tr>
<td>P R E N C O</td>
<td><strong>Pipeline cleaning approach definition</strong>&lt;br&gt;In order to prepare a North Sea pipeline system for decommissioning, Jee defined the base case approach for the removal of hydrocarbons. This considered the available cleaning options, the existing infrastructure and operational status of the assets, the required sequence of cleaning activities and in-field DSV activities for scope optimisation. Disposal routes for the associated fluids were also identified.</td>
</tr>
<tr>
<td>CENTRICA</td>
<td><strong>Review of submitted decommissioning programmes and ABEX estimates</strong>&lt;br&gt;Galp are a non-operating partner of a number of assets offshore Angola and, as such, receive decommissioning programmes and ABEX estimates from their partners for approval. Jee supported GALP in the review of these documents, challenging decommissioning approaches where appropriate to eliminate unnecessary activities and verifying that the cost estimates submitted were appropriate.</td>
</tr>
<tr>
<td>Client</td>
<td>Details</td>
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</tbody>
</table>
| Decom North Sea | **Project: Decommissioning of concrete mattresses**  
Jee was commissioned by Decom North Sea (DNS) to write an industry paper on concrete mattress decommissioning, considering the options for leaving in-situ, disposal and re-use and highlighting innovative technologies applicable to the process. The paper was published and presented at a DNS conference in May 2015. You can download the associated paper here for free. |
| bp              | **Project: NW Hutton**  
Jee was contracted to provide the pipeline technical authority for the NW Hutton decommissioning project. This covered the entire decommissioning process from desktop studies to offshore operations and included the provision of an offshore representative for the pipeline decommissioning phase, responsible for the provision of technical support to the offshore team and liaison with the onshore project team.  
Following completion of the offshore works, Jee produced the decommissioning close-out report for BEIS, along with the first ever OSPAR close-out report – this was the first steel piled platform to be left in-situ, giving Jee unique experience in this area. |
| bp              | **Project: Decommissioning best practice**  
Utilising experience developed over numerous decommissioning projects, Jee has written a Pipeline Decommissioning Guidance document which covers all of the legislative requirements to be considered when decommissioning a pipeline as well as providing general guidance on the process and incorporating lessons learned out in the field. |
| bp              | **Project: Don pipeline cleaning**  
Jee provided supervisory functions during the Don pipelines hydrocarbon freeing and cleaning activities, ensuring that cleaning was carried out in accordance with BP’s procedures and legal requirements. |
| bp              | **Project: Don and Miller pipeline TA**  
Jee acted in the role of Technical Authority (TA) for the Don and Miller pipelines decommissioning assessments, responsible for the budget preparation and monitoring, TIA preparation and approval, input into the decommissioning works, decommissioning programme and tendering scope. |
| PremierOil      | **Project: Decommissioning cost comparison**  
As part of a project to evaluate decommissioning costs, Jee developed a robust cost estimation tool for the decommissioning of subsea assets. This included all subsea infrastructure and, as such, significantly streamlined the decommissioning planning phase. |
| bp              | **Project: SNS Decommissioning studies**  
Jee carried out a detailed material inventory, historic study and remaining life assessment of the 10 Amethyst and 3 Wollaston and Whittle pipelines and umbilicals. Jee then performed comparative assessment of the decommissioning options along with a cleaning study. |
| TAQA            | **Project: Decommissioning feasibility study**  
Jee undertook a high-level feasibility study considering the decommissioning of the oil storage on the Cormorant Alpha platform. This included assessment of the implications of decommissioning on the associated Brent bypass system, hydrocarbon import and export risers, platform ballast water system and level controls, conductor cell cooling systems and the service water system. |
<table>
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<tr>
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</table>
| **TULLOW OIL** | **Project: Mattress decommissioning assessment**  
As part of the Tullow SNS decommissioning activities, Jee was engaged to perform a study to identify the most appropriate decommissioning approach for the stabilisation materials present. This included safety and environmental assessments, review of inspection data to determine the likelihood of buried components becoming unburied with seabed movement, liaison with key stakeholders such as fishermen and BEIS and investigation into new technologies available (inspection and removal) prior to the completion of the comparative assessment (CA). |
| **CNR International** | **Project: Decommissioning appraisal project**  
Jee performed decommissioning appraisal studies for a variety of CNR subsea infrastructure. This included a 10” rigid pipeline with concrete coat, a 4” rigid pipeline and an assortment of flexibles and umbilicals of different sizes. The studies performed concerned the development of material inventories, completion of comparative analyses to determine the most suitable options for decommissioning, cost provisioning and completion of HAZID sessions. |