DNV

WHEN TRUST MATTERS

OIL & GAS

THE TECHNICAL ADVISOR TO THE PIPELINE INDUSTRY

Pipelines and facilities services

MEETING INCREASING DEMANDS SAFELY AND RESPONSIBLY

More and more on- and offshore pipeline systems must traverse remote regions with extreme terrains or harsh environments. Transporting oil or gas cost-effectively, safely and responsibly to consumers, via what is often an ageing pipeline infrastructure, is not a simple task, particularly when pipelines cross territories that are subject to different regulatory regimes and requirements.

SERVICE OVERVIEW

Risk management advisory
DNV's enterprise risk management services provide companies with a complete overview of their total risk exposure, enabling them to manage risk in an integrated way. Our safety risk management services empower our customers to develop, implement, maintain and continuously improve best practices in safety risk management, while our asset risk management services support companies in their work to safeguard integrity and maintain optimal production safely and cost-efficiently.

Technical advisory
We provide qualification services to give our customers evidence that new technology will function reliably within specific limits, and with an acceptable level of confidence. We also provide technical assessments, concept development and engineering support, and process and integrity services.

Technical assurance
We ensure that projects are properly managed through transparent risk-based verification, certification and inspection services.

Noble Denton marine services
Our experts provide an extensive range of services to help customers reduce operational risk by partnering with a single global marine advisor.

Laboratory and full-scale testing and analysis
DNV provides a unique and broad portfolio of testing capabilities, driven by the strong multi-disciplinary knowledge and experience of our specialists in the global oil and gas industry.

Software solutions
Our advanced software solutions provide planning, simulation and management tools that help companies to manage risk and pipeline integrity.

Training
In addition to scheduled public courses, we offer standard and customized technical training to meet our customers' needs.

Backed by 150 years of experience and a global team of oil and gas experts, DNV works with operators, suppliers, governments and industry associations to safeguard life, property and the environment, and to support progress across the entire pipeline industry.

We are recognized as the leading advisor in the development and delivery of on- and offshore pipeline services, providing technical expertise and competence across all phases of an asset's lifecycle from inception, design and development to operation, maintenance, life extension and decommissioning.

An innovation powerhouse
DNV is an innovation powerhouse with the technical skills, scale and scope to tackle the oil and gas industry's most complex challenges. Formed after DNV and GL Noble Denton joined forces in September 2013, we have a goal to bring greater expertise and enhanced innovation capabilities to our customers. Our vision is to drive innovation and standardization on behalf of the entire sector, enabling safer, smarter and greener operations.

We have one of the highest levels of investment in research and development in the industry dedicating 5% of our annual revenue into new technologies that will enhance pipeline systems and facilities, and ensure that oil and gas is delivered safely and sustainably from source to people's homes.

MAKING THE RIGHT CHOICES WITH CONFIDENCE

Pipeline systems represent a significant financial investment for operators, and constitute a key element to the industrial and public value chain. Ensuring that a pipeline is designed, constructed, operated and maintained in a safe, reliable and cost-effective manner involves a multitude of professional disciplines.

Enterprise risk management

DNV provides a full range of services and capabilities related to the selection, development, operation and maintenance of pipeline systems. During the project strategy, concept and feasibility phase, we enable customers to select the most appropriate transportation solution for their needs by assessing factors such as technical risk, existing infrastructure, cost and projected revenue, in the context of the full proposed field development.

Our integrated enterprise-risk management model examines the various risks, uncertainties and dependencies that may impact a field development, such as:

- Uncertainties related to in-place volumes and recovery factors
- Availability and risks related to technical performance
- Frequency of component failures, duration of repairs, and waiting time and cost of repair resources
- Uncertainty in CAPEX, OPEX and tariffs
- Fiscal and allocation metering audits at gas custody transfer sites
- Uncertainty in timing of first oil/gas transportation
- Uncertainty in contracting and business case development.

By applying a risk-focused approach, we enable operators to consider all relevant uncertainties and their dependencies, thereby delivering a more thorough assessment of the total risk profile of any new project. Once identified, the major risk drivers, and their underlying causes and knock-on effects can then be further analysed.

Pipelines and facilities due diligence

DNV is recognized as one of the world's leading international providers of project due diligence services for prospective acquisitions, investments and project financing. We provide technical, commercial and regulatory due diligence support for oil and gas operations. This includes independent assessments and verification reviews of business issues, processes and specifications that cover internal audit support, project financing/investment reviews and partner reviews.

Our specialist teams of PhD scientists, professional engineers and subject matter experts, together with our extensive network of laboratories and full-scale testing capabilities, offer unique in-house competence in highly technical issues related to an asset's material properties, mechanical integrity, operability and compliance.

Safety risk management

We work with our customers to develop, implement, maintain and continuously improve best practices in the safety risk management of pipeline systems. Our risk-based methods and advanced software tools enable operators to ensure that hazards are identified and understood throughout the lifecycle of projects and operations. Our flexible approach to service delivery enables us to adapt our extensive range of capabilities and experience to our customers' specific project challenges.

Our safety risk management services include:
- Hazard identification
- Frequency analysis
- Consequence analysis
- Consequence assessments
- Risk assessments
- Design accidental load and protection studies
- Management systems and performance standards
- Emergency planning, response and investigation
- Impact and risk management planning.

Environmental risk management

Environmental considerations must be taken into account for any new project. We provide a range of inter-related services in this area including:
- Environmental impact and risk assessment
- Dispersion modelling
- Spill preparedness, and response analysis and planning
- Biodiversity management
  - Environmental monitoring
  - Visual mapping of sensitive areas
  - Environmental ROV surveys
- Corporate social responsibility.

Asset risk management

DNV's independent asset risk management services enable customers to safeguard the integrity of their assets, minimizing the potential for incidents and maintaining optimal production. Our network of specialists monitors and validates the performance of assets and equipment to recognized industry standards.

Our services include:
- Benchmarking and gap analysis of management systems
- Development and optimization of work processes
- ISO55000 (Asset management) advisory and gap assessment
- Reliability and maintainability analysis and performance forecasting
- Safety integrity level, including FMECA analysis.

OPTIMIZING DESIGN AND OPERATION

Soil erosion, seismic activity, extreme free spans, ice scour induced loads, ground movement and use of materials in corrosive environments – we can help overcome these and other barriers with confidence.

With a highly experienced and well-trained global network of technical experts, DNV is well placed to meet the increasingly complex needs of on- and offshore pipeline operators. We offer tailored solutions throughout the lifecycle of pipeline systems, with an added focus on value and safeguarding life, property and the environment.

Technical analysis

Detailed engineering analysis forms part of all DNV's third-party verification activities. We use a range of state-of-the-art software packages to perform relevant technical analysis, including:

- Hydraulic network simulations
- Network capacity assessment
- Fiscal metering systems design review
- Structural design
- Global and local buckling
- Pipe reeling
- Pipe snaking
- Upheaval buckling
- Expansion curve
- Tie-in spool piece
- J-tube pull-in
- Fatigue analyses for free spans and VIV
- On-bottom stability
- Pipeline installation, dynamic and static.

Flow assurance services

We provide in-depth understanding of multiphase flow characteristics in pipeline systems at both normal and incidental operating conditions. This knowledge and insight guides customers in their work to optimize the design and operation of pipelines, providing cost-effective solutions, and supporting robust and effective pipeline performance.

Our flow centres in the Netherlands, Norway, the UK and the US, are some of the largest high pressure natural gas flow facilities in the world, delivering specialist services to the on- and offshore oil and gas pipeline industries. They have a worldwide reputation for technical expertise, quality and flexibility of service due to our experts' in-depth knowledge of flow measurement and control as well as the capabilities of the facility, which can test to a wide range of pressures up to 60 bar and flow rates up to 30 million scmd.

We are able to address the following key areas, either as part of an integrated approach or as standalone services: thermo-hydraulic analysis (pressure and temperature drop); capacity/line sizing; slug/terrain slugging; hydrate and wax prediction; insulation optimization/design; cool down/blow down; water hammer/pressure surge analysis; leak analysis; FAT testing; performance assessments; R&D for metering and separation technology; and fiscal metering systems design review.

Geotechnical design services

Geotechnical design requires a broad understanding of both structural responses and soil characteristics. We identify and solve soilpipe interaction issues by integrating geotechnical considerations into the design or verification process. We apply DNV standards, other recognized standards, national requirements and customer specifications to both on- and offshore pipelines, including:

- Geophysical surveys to identify potential hazards
- Seismic hazard studies
- Slope stability analyses
- Flow analyses of failed soil ('debris flow', turbidity flow)
- Optimum pipeline route selection
- Pipe soil interaction studies
- Heat isolation for cover
- Anchor or ice ridge hazards and impact loading.

Material testing

Ensuring that the right material is selected, specified, delivered and installed is a key aspect of every successful pipeline project. DNV owns and operates material laboratories and testing facilities in Germany, Norway, Singapore, the UK and the US. We draw on a wealth of experience from failure investigations, corrosion studies, testing and R&D projects to help our customers select the optimal materials.

Our experience in welding and non-destructive testing also helps us to ensure that materials are properly joined. We have published a number of codes and standards to ensure that the international pipeline industry has easy access to best practices in the following fields:

- Assessment of ultimate pipe capacity
- Fracture mechanics and fatigue assessment
- Verification of material specifications and manufacturing documentation
- Mechanical testing
- Metallurgical investigations
- Corrosion testing
- Qualification of new materials
- Remaining life assessment
- Failure investigation.

Technology qualification

DNV's systematic and structured risk-based technology qualification process and procedure, described in DNV-RP-A203, has been adopted by many customers for qualifying new technology. Qualification is the process of providing the evidence that the technology will function reliably within specific limits, and with an acceptable level of confidence.

DNV's global technology qualification services are delivered across a wide range of assets and geographies within a framework that addresses early-stage concept evaluation, execution and the process of putting the qualified technology into use.

INSTILLING CONFIDENCE

Our transparent approach to verification, certification, quality surveillance and marine operations enables operators to reduce and manage risk, and to ensure a successful project outcome.

As many of the world's regulatory authorities move from prescriptive risk regimes to goal-setting forms of governance, operators need to be able to demonstrate that they adhere to clear and measurable safety objectives. Verification and certification play a key role in any risk-based strategy; however, the depth of involvement, or level of verification, has not always been as transparent as it could be.

DNV broke new ground by becoming the first organization to introduce a fully transparent risk-based approach to verification and certification. The DNV-OSS-301 *Verification and certification of submarine pipelines* originally published in October 2000, is the first, and only, publicly available guideline for technical assurance for pipeline systems.

In January 2014, we published DNV's service specification DSS-316 *Verification of onshore pipelines*, which falls under the top-level document DNV-OSS-300 *Risk-based verification*. DSS-316 provides criteria for, and guidance on, verification of complete onshore pipeline systems and verification of the integrity of parts or phases of an onshore pipeline system.

Risk-based verification

We developed our risk-based verification service to assure our customers that they were receiving high quality, independent asset assessment to confirm:

- It is fit for its intended purpose
- Its level of integrity is as high as reasonably practicable
- The associated risk to health, life, property and the environment is as low as reasonably practicable (ALARP).

One of the main advantages of our risk-based verification approach is that it enables our customers to maximize efficiency on a project-by-project basis, as it directs them to prioritize the areas which may benefit the most.

DNV-OSS-301, as well as DNV-DSS-316, sets out in detail the scope of work for verification at three risk-based levels, allowing for selection of the degree of DNV verification involvement in compliance with the overall risk objective for any new project. In addition, it emphasizes the importance of early involvement for risk-based verification services. This is crucial if operators are to identify and reduce any uncertainties as early as possible.

Quality surveillance and inspection

Guided by our assessments of the inherent risks, we support our customers from the very beginning of a project. During the fabrication and installation phase, we provide:

- Quality surveillance during pipe manufacturing and coating
- Inspection services and construction supervision through pipeline installation and commissioning.

Depending on the operator's risk level, our attendance varies from an audit-based approach to full 24/7-onsite team attendances.

Noble Denton marine services

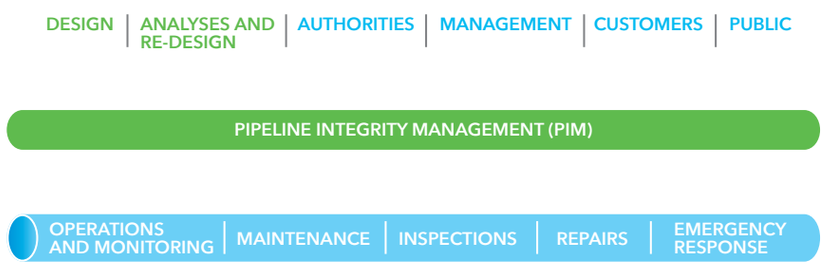
Our Noble Denton marine services teams have been active in the marine warranty market for over half a century, technically auditing the readiness of marine operations and providing independent and impartial advice for vessel owners, including vessel installation owners, operators and underwriters.

Our FMEA analysis of pipe and cable lay/storage systems, along with detailed assessment and FMEA analysis of installation vessel propulsion and station keeping systems, ensures the required safety features exist, and are correctly designed, installed and tested.

Throughout the transport and installation process for subsea components, we provide confidence to our customers that marine activities are carried out in accordance with sound standards and practice. 0029/ND Rev 0 - 22 June 2013 - *Guidelines for submarine pipelines installation* sets out the guidelines on which DNV approval of pipeline installation by laying, pulling or towing, is based.

SAFELY EXTENDING THE LIFESPAN

The optimization, maintenance and life extension of operational assets provide their own set of challenges, particularly as those assets approach the end of their projected design lives.



PIPELINE INTEGRITY MANAGEMENT

DNV's integrity management services and systems connect key operational activities with assessment and stakeholder requirements.

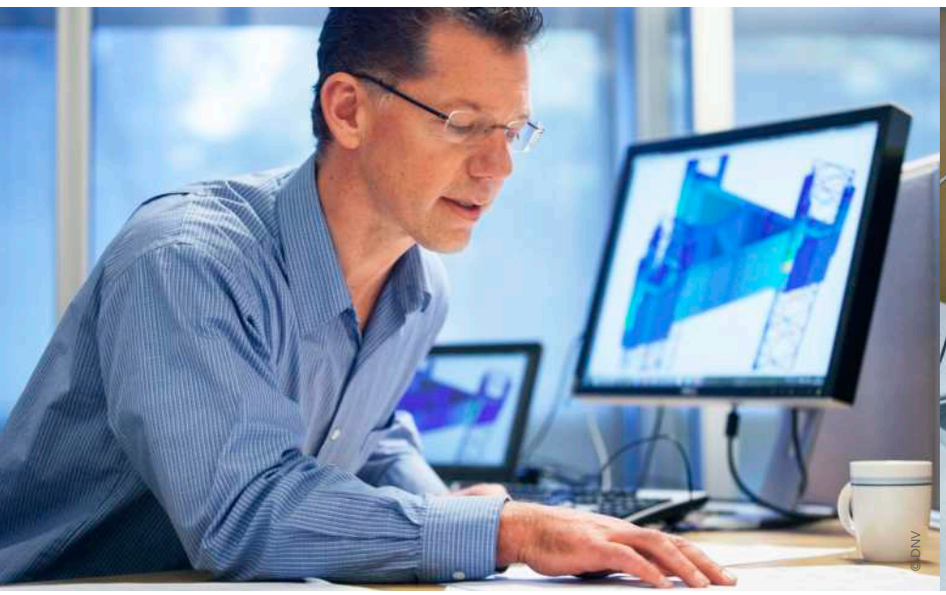
DNV provides a variety of services addressing issues related to pipelines in operation. These services focus on reducing operating costs, while still maintaining an acceptable reliability and safety level. Our experts team up with operators to establish the most cost-efficient solutions for each pipeline system.

Many of our services for pipelines take place during the operational phase; however, we also provide operations-related services at the early design phase. These services include the assessment of network expansions and (greenfield) design by means of advanced network simulation and optimization tools. This ensures that sound pipeline operational integrity is built into the pipeline system during initial planning, design and construction. Our investment in pipeline codes and standards, and our participation in joint industry projects, enables us to support operators throughout the full lifecycle of their assets.

Our pipeline services cover:

- **Pipeline integrity management systems (PIMS)**, involving all activities required for control and documentation of a pipeline system's integrity during its operational life.
- **Condition assessment** for pipeline systems and components, including assessment of metal loss defects, dents and cracks (i.e. defect assessment), fitness-for-service assessment, as well as evaluation of global pipeline behaviour (i.e. freespan condition, lateral buckling response, etc).
- **Network simulation and optimization** for gas transmission and distribution networks in order to assess available capacities in networks and the optimal network expansion based on well-defined design parameters and scenarios.
- **Inspection and maintenance planning**, using the results from the condition assessment to prioritize inspection and maintenance activities based on risk of failure balanced against cost of prevention work.
- **In-line inspections (ILI) support**. DNV maintains an expert staff of ILI specialists who have detailed knowledge of ILI technologies, operations, and analysis.
- **Network capacity management and balancing reviews**, which are used for detailed network capacity calculations.
- **Pipeline operability reviews** that allow pipeline operators to identify and assess every important area of potential operational improvement (with regard to both management and technical solutions) against a set of 'best practices', based on our experience from major projects and international operators.

- **Pipeline uprating**, achieving increased capacity at a fraction of the capital expenditure incurred by new-build work. We apply a proven fitness-for-purpose methodology for demonstrating safe operation of pipelines at design factors greater than the limiting value given by design codes.
- **Operational support** in connection with pipeline repair and intervention, including grouted tees and grouted repair sleeves, onsite support and technical advice, decommissioning, and training.
- **Fiscal metering audits** combined with equipment verification measurements to determine whether the measurement uncertainty is fit-for-purpose and to ensure no systematic errors are present.
- **Pipeline remnant life and life extension studies** as required for lifetime extension, change of use of the pipeline systems, or modifications and repairs due to damage.
- **Degradation mechanisms and mitigation** (corrosion, cracking, fatigue, assessment, monitoring, mitigation and modelling).
- **Corrosion management planning**, incorporating principles of risk management to reduce corrosion failures.
- **Welding consultancy/in-service repair**, including: weld procedure specification and qualification; weldability testing; hot tap welding; audit of on-site welding operations; development of weld repair strategies; assessment of new weld techniques; and failure investigation of in-service welded components.
- **Support for regulatory compliance**, including interpretation of regulations, consultancy during planning and implementation, information management and meetings with regulators.
- **Network access solutions**, including capacity product definition, network balancing regimes and tariff calculation in different regulatory settings.
- **Forensic investigation/failure support/litigation support** – our experts apply DNV's knowledge of industry practices gained by years of working closely with pipeline operators, and augmented by understanding and application of pertinent codes and regulations.



PUTTING OUR EXPERTISE TO THE TEST

DNV operates 14 laboratories across three continents, offering a broad range of testing services. By combining advanced testing with technical expertise and industry standards we help our customers to apply technology safely, efficiently and cost effectively.

Whether we are investigating the failure of inch-long valves, conducting full-scale validation tests to a load of 2,500 tons, or retrieving organisms from the Arctic seabed, we provide global insight and local expertise for safer, smarter and greener operations.

Our laboratories span eight dedicated testing disciplines:

Environmental services
We support customers with environmental data and analysis to improve performance, aid decision-making, and support regulatory compliance.

Flow testing and calibration
As the transportation and processing of gas and liquids becomes more complex, we support customers with flow assurance and processing, and metering and custody transfer testing services to enhance safety and manage costs.

Failure investigation
We investigate the failures of individual components and complete asset infrastructures to determine the root causes and prevent future occurrences. For this, we leverage more than 50 years laboratory experience.

Materials qualification and testing
We help customers to improve safety and technical performance, and reduce risks and costs by enabling a better understanding of material performance. We test materials in simulated service conditions for customized fitness for service assessments. We also verify material properties by conducting standardized testing according to recognized specifications or codes.

Full-scale testing
Seven full-scale test laboratories, and our 3,500-hectare Spadeadam Test site, help to qualify and verify technology through destructive and non-destructive tests in realistic environments. Tests are conducted using state-of-the-art instrumentation and logging equipment.

Verification and testing of control systems software

Protecting operations against undesired incidents and non-productive time, DNV tests functionality of control systems and their robustness and failure handling capability.

Battery and energy storage testing

Our standards-based battery testing services support customers in using battery solutions that operate correctly and safely according to specifications.

High power and high voltage testing

We provide accurate and confidential power and voltage testing to improve asset safety and reliability. Our high power and high voltage testing services support customers with independent testing and certification of medium and high voltage components used in electrical infrastructures.

A BROAD RANGE OF CAPABILITIES

Our work is built on knowledge gained from more than **2,000** failure investigations

We investigate over **50%** of the major onshore pipeline failures in North America

We can cycle full-scale offshore components to fatigue failure facilitating equipment life extension

We run the world's largest fire and explosion test site

We simulate hydrocarbon single or multiphase flow, and calibrate flow meters of 1"– 40" diameter

We simulate some of the world's most complex field conditions for advanced materials testing

We test power transmission and distribution equipment rated up to 1,200 kilovolts

We weigh modules up to **20,000** tonnes

We investigate more than **100,000** marine organisms

SMART SOFTWARE SOLUTIONS

DNV is a world-leading provider of software for operational efficiency and business optimization, securing return on asset investments and managing risks in the oil and gas industry. Our software supports our service delivery by responding to a variety of business critical activities, including design and engineering, asset integrity and performance, asset simulation and optimization, QHSE and enterprise risk, and process safety, risk and reliability.

Integrity management and performance

Synergi™ Pipeline

DNV's Synergi Pipeline provides a complete plan-do-check-act cycle and data management platform to allow proactive integrity and risk management of pipeline systems. It promotes safe and cost-efficient operation, maintenance and life extension of distribution networks, and on- and offshore pipeline systems for gas, liquid and slurry pipelines.

Simulation and optimization

Synergi Gas

Synergi Gas network modelling software identifies, predicts and helps operators to address their assets' operational challenges, enabling customers to deliver day-to-day operational efficiency for both distribution and transmission networks.

Synergi PipelineSimulator

Synergi PipelineSimulator (SPS) is a hydraulic modelling software solution for liquid and gas. It is used for pipeline and network design, 'flight simulator' style training, or integrated with SCADA to provide online pipeline management and real-time leak detection.

Synergi Water

Synergi Water is a simulation software package used to model and analyse closed conduit networks of pipes, regulators, valves, pumps, reservoirs, tanks, wells and boreholes.

Synergi AccessManager

Synergi AccessManager comprises a suite of web-enabled software designed specifically to support the hydrocarbon accounting and commercial operations of gas companies involved in the production, transmission, storage and sale of gas.

Strength and fatigue analysis

Sesam™ Pipeline

Sesam Pipeline is a suite of programs for ultimate strength and fatigue analysis of offshore pipelines, comprising:

- DNV-OS-F101 for *Code compliance of submarine pipeline systems*, including wall thickness calculations, based on DNV-OS-F101
- FatFree for fatigue analysis of free span pipelines based on DNV-RP-F105
- PET, a pipeline engineering tool for early phase pipeline assessment based on DNV-RP-F103 and DNV-RP-E305
- SimBuck for lateral and upheaval buckling of exposed and buried pipelines based on DNV-RP-F110
- StableLines software for pipeline on-bottom stability analysis based on DNV-RP-F109.

INNOVATION THAT COUNTS

At DNV, we offer our customers access to unparalleled investment in innovation, a global network of technical experts and a focus on developing solutions for even the most complex industry projects. Our proud heritage in the oil and gas sector and our attention on future-focused innovations and technologies allows us to deliver a broad portfolio of technical services, covering every stage of the oil and gas lifecycle.

For 150 years, DNV has been meeting customer and societal needs. Dedicating 5% of annual revenue to the research and development of new technologies and solutions for our customers, we have established thousands of initiatives for innovation and technology development. Our 170 sector-leading standards and recommended practices support and promote overall industry safety and growth, while our annual programme of 70 internal technology projects ensures that we remain at the forefront of new developments.

Our approach to innovation covers many levels:

- **The long-term perspective:** Our Research and Innovation Unit focuses on long-term strategic research programmes to develop new knowledge and competence.
- **Extraordinary innovation projects:** We conduct short-term, intense projects where our teams work full-time on specific challenges. These extraordinary innovation projects delve into challenging industry issues, combining existing technologies with concepts that can be further matured by the industry.
- **Joining with the industry:** DNV's cutting-edge portfolio of services is built up with input from our expert colleagues from around the world. We run joint industry projects (JIPs) to develop services, solutions, standards and new recommended practices that add value by solving industry challenges in collaboration with our customers. For example, one current JIP aims to develop and share best practice for demonstrating continued fitness-for-service of ageing pipelines, while another technically reviews high voltage AC interference on buried pipelines.
- **Technology development:** DNV's Technology Leadership programme is centred on its core technical disciplines, and is driven by our subject matter experts. The objective of the initiative is to maintain and further develop state-of-the-art technology.

There will always be a need for developments and enhancements in order to guide and support the industry in relatively unchartered territories, such as the Arctic, ultra-deep waters, or on projects with challenging repair circumstances. We are willing and able to deliver on this industry need today and in the future.

Read more about DNV's joint industry projects at:
dnv.com/oilgas-jips

TAKING THE INDUSTRY FORWARD

Over the years, DNV has created a series of internationally recognized standards, service specifications and recommended practices together with the pipeline industry. Our first pipeline code was issued in 1976. It has achieved global recognition, winning prestigious industry awards and currently 65% of all new projects globally are designed to it.

Pipelines are an effective and highly reliable means for hydrocarbon transportation over short and medium-range distances. But they represent a large investment for a field development or gas-export transport system. These investments are highly influenced by the application codes for design and construction of the pipeline.

Selecting the best code

Many national and international pipeline codes in use today worldwide are subject to various safety regimes and operator preferences. What are the criteria for selecting the 'best design code'? Is it the code giving the minimum wall thickness, or something else? DNV believes the selection criteria are threefold:

- The code shall ensure at least a minimum safety level that is acceptable to society
- Given the above, the best code is the one that gives the minimum lifecycle cost
- The code should comply with the overall ISO standards.

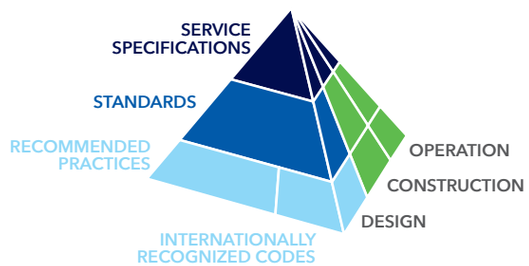
A family of best practices

Based on our project experience, research and joint industry development work, DNV issues a number of pipeline codes. These comprise service specifications, standards and recommended practices, and are highly regarded within the international pipeline community.

The DNV-OS-F101 *Offshore standard for submarine pipeline systems* provides acceptance criteria and design procedures for pipelines. The standard applies modern limit-state-design principles with 'safety classes' linked to consequences of failure.

The DNV standard is complemented by several recommended practices (RPs), which give detailed advice on how to analyse specific technical aspects according to stated criteria:

- DNV-RP-C205 *Environmental conditions and environmental loading*
- DNV-RP-F101 *Corroded pipelines*



STRUCTURE OF DNV CODES

A clearly set structure accommodates the different DNV codes.

- DNV-RP-F102 *Pipeline field joint coating and field repair of linepipe coating*
- DNV-RP-F103 *Cathodic protection of submarine pipelines by galvanic anodes*
- DNV-RP-F105 *Free-spanning pipelines*
- DNV-RP-F106 *Factory applied external pipeline coatings for corrosion control*
- DNV-RP-F107 *Risk assessment of pipeline protection*
- DNV-RP-F108 *Fracture control for pipeline installation methods introducing cyclic plastic strain*
- DNV-RP-F109 *On-bottom stability design of submarine pipelines*
- DNV-RP-F110 *Global buckling of submarine pipelines*
- DNV-RP-F111 *Interference between trawl gear and pipelines*
- DNV-RP-F113 *Pipeline subsea repair*
- DNV-RP-O501 *Erosive wear in piping systems*
- 0029/ND Rev 0 - 22 June 2013 - *Guidelines for submarine pipeline installation*.

Some of the above RPs were originally developed for offshore pipelines, but are also relevant for onshore pipelines.

All DNV pipelines codes can be downloaded free of charge at: www.dnv.com

LOCAL EXPERTISE WITH A GLOBAL PRESENCE

DNV offers access to oil and gas industry technical experts around the world.

WE HAVE MULTIPLE OFFICES IN A RANGE OF KEY COUNTRIES:

The Americas
- Brazil
- Canada
- Mexico
- Trinidad & Tobago
- United States

Asia Pacific
- Australia
- Brunei
- China
- Japan
- Korea
- Indonesia
- Malaysia
- Singapore
- Thailand
- Vietnam

Europe
- Belgium
- Denmark
- France
- Germany
- Italy
- The Netherlands
- Norway
- Russia
- United Kingdom

Middle East & Africa
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- Angola
- Egypt
- Kazakhstan
- Kuwait
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About DNV
Driven by our purpose of safeguarding life, property and the environment, DNV enables organizations to advance the safety and sustainability of their business. Operating in more than 100 countries, our professionals are dedicated to helping our customers in the maritime, oil and gas, energy and other industries to make the world safer, smarter and greener.

DNV is the technical advisor to the oil and gas industry. We bring a broader view to complex business and technology risks in global and local markets. Providing a neutral ground for industry cooperation, we create and share knowledge with our customers, setting standards for technology development and implementation. From project initiation to decommissioning, our independent experts enable companies to make the right choices for a safer, smarter and greener future.

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