

Managing the CO₂ specification through the CCS value chain

Why they matter • how limits are set • how compliance is demonstrated

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01 | Introductions

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- Chemical engineer
- Labs & Testing, Business Advisory
- Gas quality
 - Instrumentation
 - Combustion properties
 - Impurity risk management
- CO₂ across capture, transport and storage

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- 01** Introductions
- 02** What a specification must achieve
- 03** Impurity and infrastructure requirements
- 04** Understanding risk
- 05** Can compliance be demonstrated?
- 06** Conclusions

01 | DNV – Understanding and managing risk

01

EMPIRICAL EVIDENCE

Spadeadam and JIPs such as Skylark generate large-scale evidence on releases, dispersion and infrastructure performance.

02

RISK INTERPRETATION

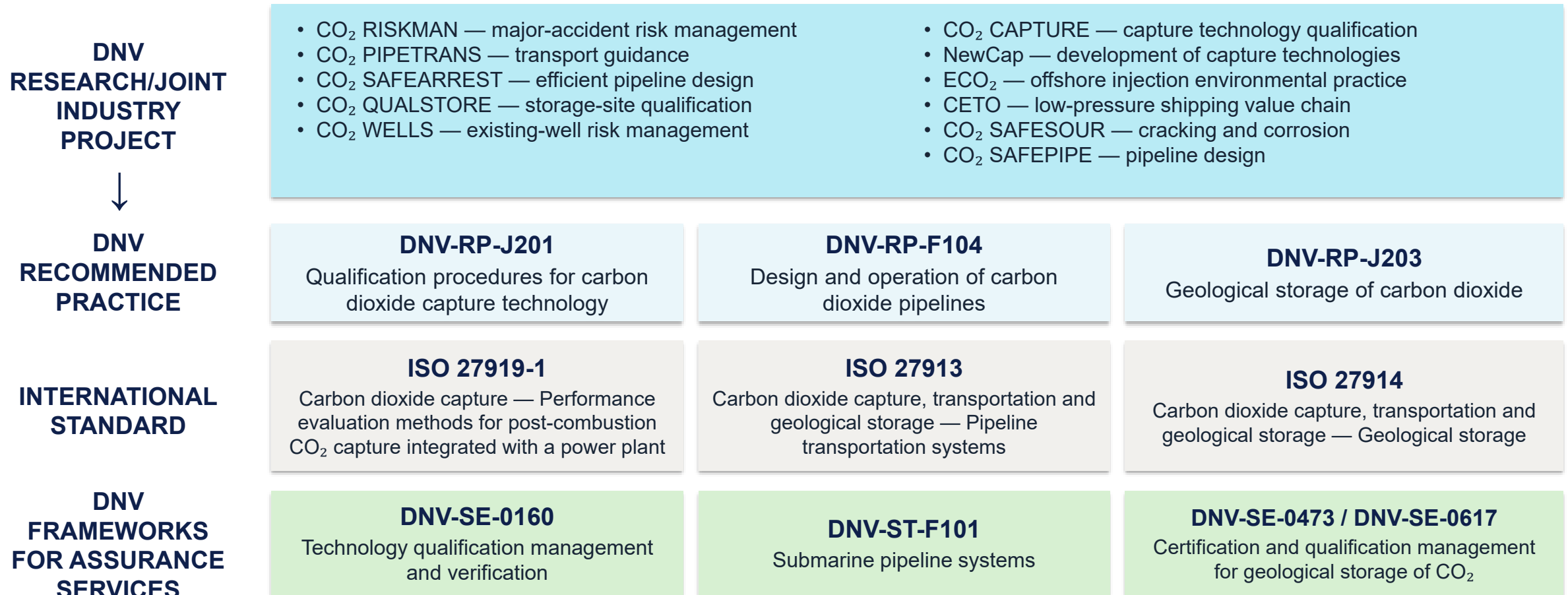
Advisory, HSE, integrity and gas-quality teams translate evidence into project decisions.

03

STANDARDS AND GUIDANCE

Industrial experience and JIPs inform recommended practices, international standards and guidance.

01 | Evidence flows from research into standards and recommended practices



01 | DNV supports decisions across the full CCS value chain

01

CAPTURE & CONDITIONING

Technology qualification, composition assessment and independent advisory.

02

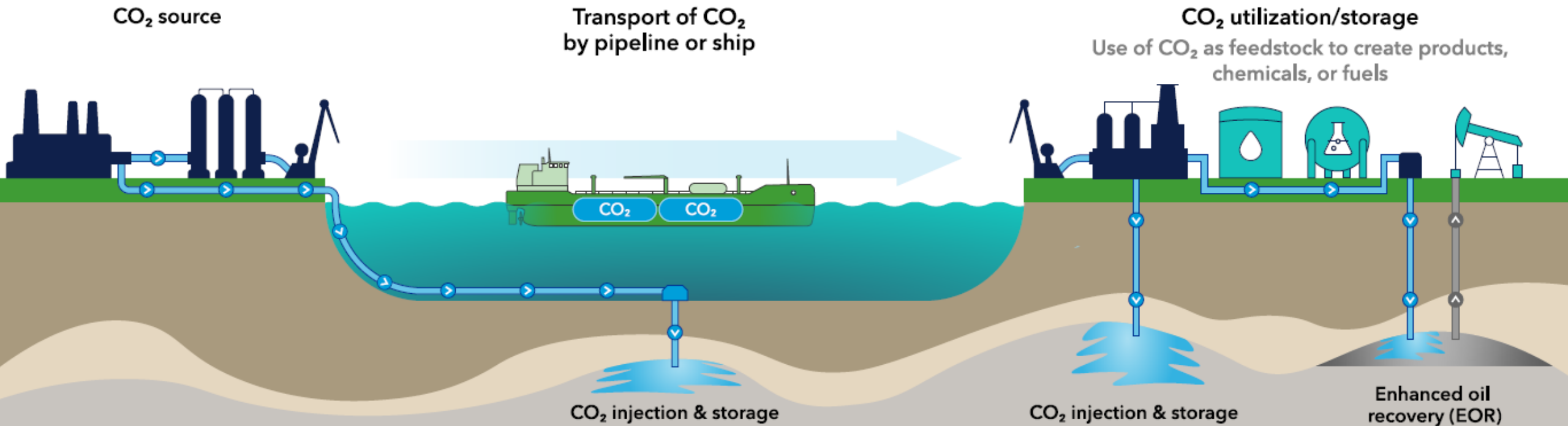
TRANSPORT

Testing, integrity, flow assurance and pipeline or shipping guidance.

03

INJECTION & STORAGE

Well and storage qualification, monitoring, assurance and verification.



02 | What is a CO₂ specification?

01

DEFINE LIMITS

List potential impurities and set upper or minimum operating limits.

02

CONTROL A RISK

Trace each limit to a mechanism—for example, water dew point and corrosion.

03

FIT THE SYSTEM

Match emitter profiles, operating envelope, transport, injection and storage.

03 | Composition determined upstream but depends on downstream requirements

UPSTREAM

creates the impurity profile

- 01 **SOURCES**
cement • steel • power • H₂ • biogenic
- 02 **CAPTURE**
amine capture • oxy-fuel
pre-combustion
- 03 **CONDITION**
dehydrate • compress
liquefy • glycol carry-over

THE HAND-OFF



phase + operating envelope

DOWNSTREAM

sets the acceptance envelope

- 04 **INJECT**
well and operating limits
- 05 **STORE**
reservoir geochemistry +
acceptance

A robust specification considers likely impurities and vulnerable assets

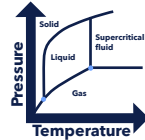
04 | Risk mechanisms

Assess each impurity, mixture and operating condition against:



HSE:

Toxicity, exposure and dispersion after release



Flow assurance:

Phase change, free water, hydrates and solids



Material integrity / chemistry:

Corrosion and reactive-phase formation



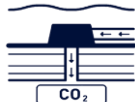
Pipeline integrity:

Decompression, cracking and running fracture (F104)



Tank / ship design:

Capacity, materials, erosion and seal performance



Well / storage integrity:

Injectivity, equipment and geochemistry (J203)



Measurement & compliance:

Accuracy, frequency and traceability



Regulation & variability:

Permits, start-up, ramp-down and off-spec flow

05 | Compliance begins with a representative sample

The analyser is only one part of the evidence chain

01

OBTAIN

Representative sample

Bulk flow, location and timing

02

CONDITION

Composition to the inlet

Pressure • temperature •
phase • adsorption / reaction

03

MEASURE

Suitable method

Online for response;
laboratory for specialist trace
species

04

CONTROL

Defensible result

Validate • calibrate • maintain •
quantify uncertainty

SAMPLE RISK The measured composition changes before it reaches the analyser.

ANALYTICAL RISK Published performance may not hold in a realistic CO₂ matrix.

05 | Defensible limits are project-specific and measurable



THE REMAINING GAP

Industry alignment

CO₂ SpecChain JIP — a unified framework for defining, assessing and managing composition across the full value chain.

Align specifications • close knowledge gaps • strengthen monitoring and off-spec handling

06 | Risk-based. Project-specific. Measurable.

Key takeaways:

1. Specifications control risk
2. The impurity profile and exposed infrastructure determine the risk
3. Measurement systems are required to demonstrate compliance

Questions?

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