

MICEDD

DEEPWATER DEVELOPMENT

28 - 30 March 2023 | Millennium Gloucester Hotel | London, UK

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IOGPs developing work on subsea carbon capture and sequestration (CCS)

MCEDD London 2023

Ryan Gola (ExxonMobil), David Saul (bp)



Agenda

- Who is IOGP
- IOGP Subsea Committee, update since we last presented at MCEDD
- CCS Overview
- IOGP Subsea Committee CCS Activity
- Forward Plan

About IOGP



We are the global voice of our industry



We bring the industry together



We drive good practices



We serve stakeholders around the globe as go-to experts

We speak on behalf of a global membership

IOGP has 88 Members (as of January 2023)

Companies



Associations



Associate Members



We drive good practice

- Our work is supported by sound science and data. We have, among others, the largest industry safety data base.
- We publish up to 40 guiding documents per year.
- Our publications are freely available on our Publications Library.
- Most popular publications:
 - Life Saving Rules
 - Safety Performance Indicators
 - Environmental Performance Indicators



We drive good
practices

Subsea Committee Vision

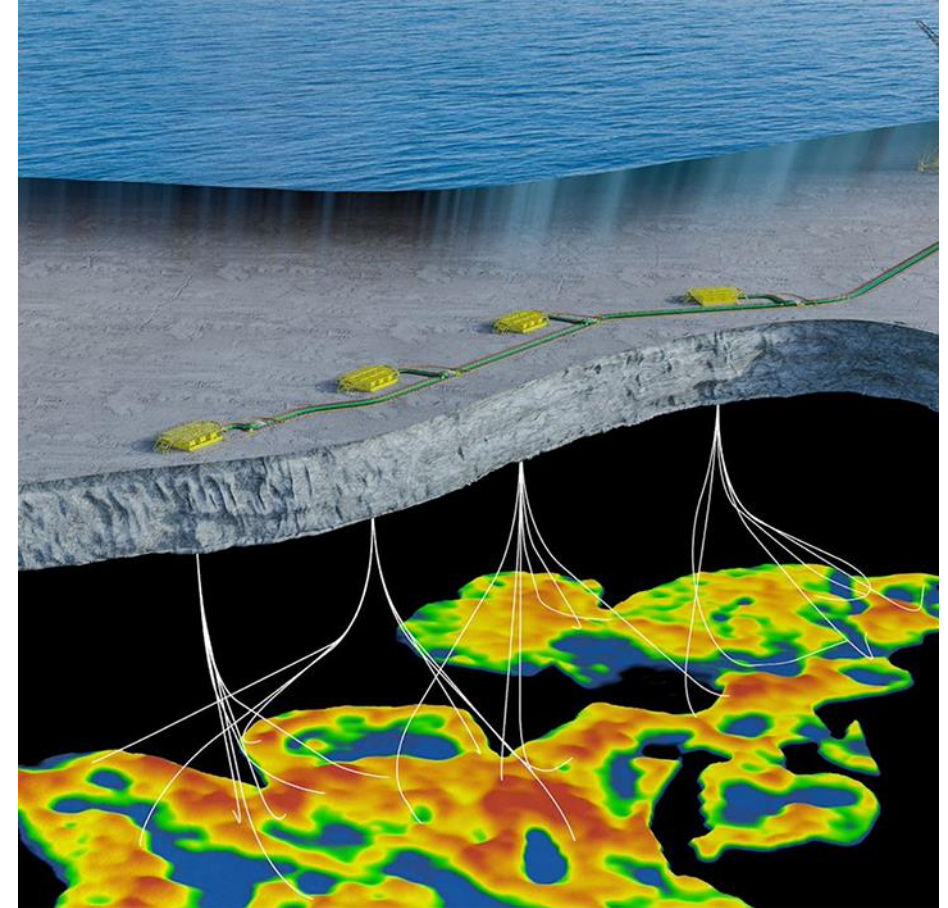
The purpose and vision of the Subsea Committee is to improve HSSE (Health, Security, Safety, Environment) performance and contribute to value creation.

The committees initial focus has been

- Priority area: **HSSE** (Health, Safety, Security, Environment)
- Priority area: **SSI** (Simplification, Standardization, Industrialization)
- Priority area: **Flexible Pipe**

With subsea CCS emerging in 2021 as a key development area the Subsea Committee felt early provision of industry guidance would 'short-cut' the SSI process. With endorsement from IOGP leadership **CCS** (Carbon Capture and Sequestration) was added as a further priority area in 2023.

A new CCS Expert Group was formed to foster discussion and alignment of important topics related to CCS.



Subsea Committee Structure

1



SUBCOMMITTEES

Flexible Pipes SubC

3



EXPERT GROUPS

Thermoplastic Composite Pipe
Remote Inspection
Subsea CCS

8



WORK AREAS

HSE lessons learned database
Emergency Preparedness
Digital strategy for Subsea
JIP33 Phase 3
Subsea Lifecycle Carbon Footprint
Thermoplastic Composites
Lifetime Extension
API TC17

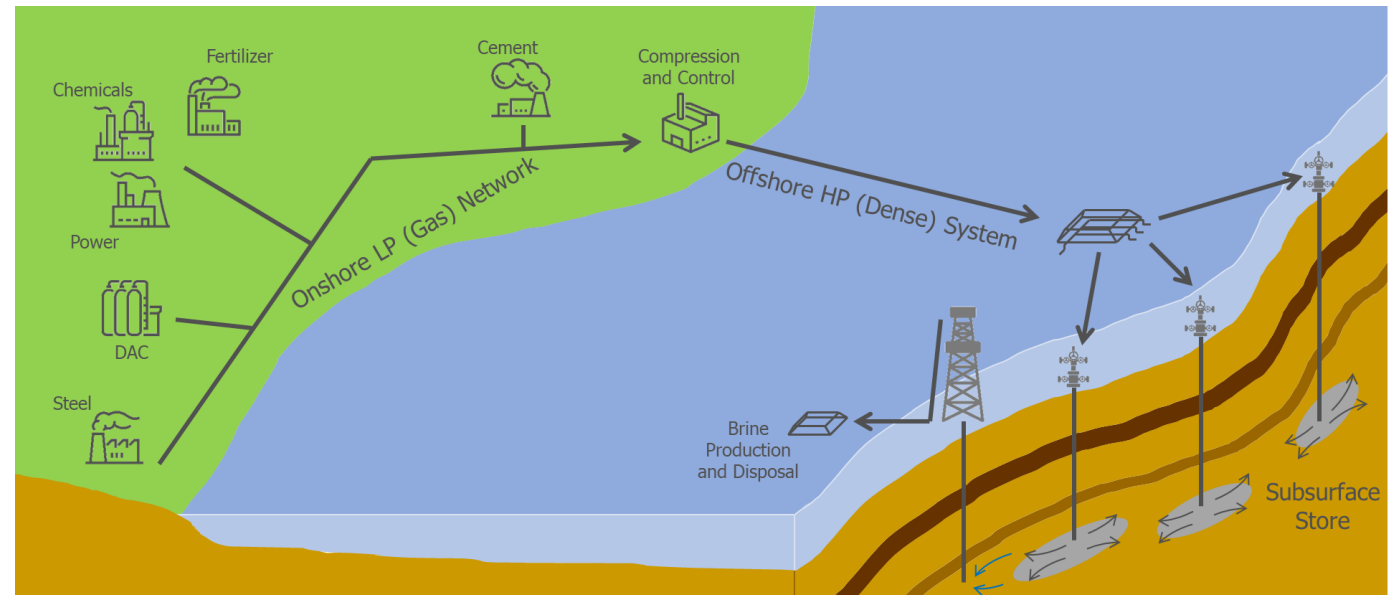
What is CCS and CCUS ?

CCS – Carbon Capture and Storage

CCUS – Carbon Capture and Utilisation and storage

Both systems;

- Capture the CO₂ generated by large-scale energy intensive processes
- Sequester underground for safe and permanent storage
- Preventing the CO₂ entering the atmosphere and contributing to climate change
- CCUS adds the potential to use some of the sequestered CO₂ in other industrial processes – e.g. food



Add ref to graphic source

The stages of CCUS & CCS

Feedstocks

Anything containing carbon

- Natural gas
- Oil
- Biomass
- Municipal solid waste
- Petcoke

Sources

Many sectors and hard-to-decarbonize industries

- Gas processing
- Power generation
- Iron and steel
- Cement production
- Hydrogen production
- Ammonia production
- Synthetic fuels
- Ethanol fermentation
- Atmosphere

Capture

Using the safest and most cost-effective technologies

- Processes with inherent CO₂ separation
- Solvents (amines)
- Emerging:
 - Advanced solvents
 - Solid adsorbents
 - Membranes
 - Cryogenic process

Transport

Providing the link from source and sink

- Compression and conditioning
- Modes of transport:
 - Pipeline
 - Shipping
 - Rail

Storage

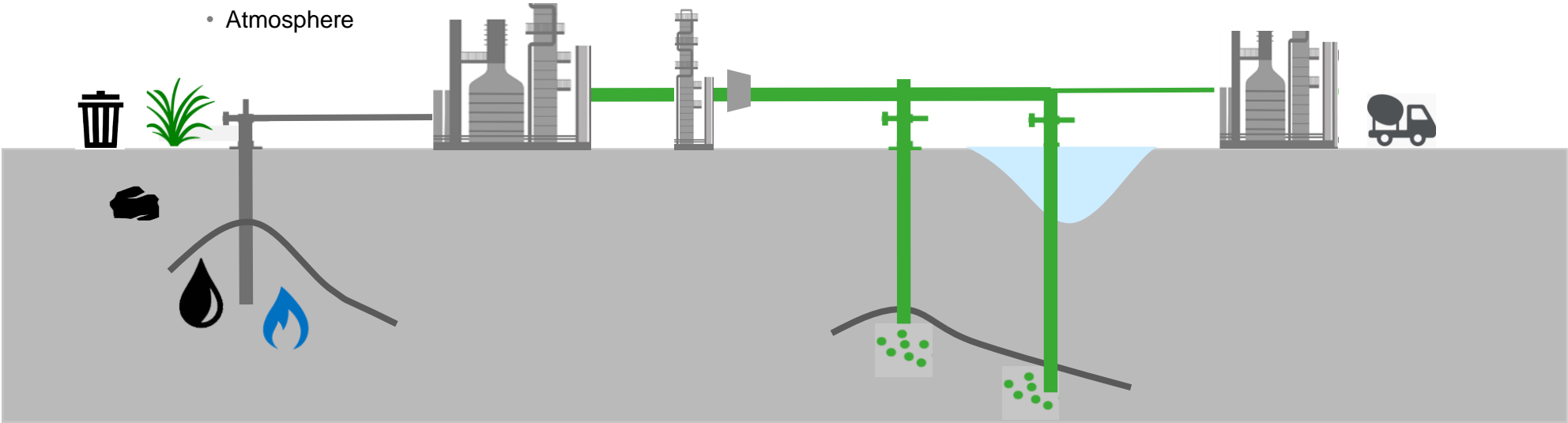
Injected underground for geological sequestration

- Deep saline formations
- Depleted oil and gas fields

Utilization

Reducing the carbon intensity of products

- Cement curing
- Building materials
- e-fuels
- EOR
- New products



Graphic courtesy bp

IOGP Subsea CCS Activity

Objective:

1. Provide an introduction to CCS systems and subsea applications to members not familiar with the technology
2. Keep members abreast with ongoing and planned CCS developments
3. Keep members abreast with subsea CCS technology development
4. Provide members with an overview of key risk areas relevant to CCS
5. Provide a forum for open discussion by operators and suppliers on the above topics.
6. Identify and align on areas for IOGP subsea committee member work in respect to subsea CCS systems

Workshop – October 2022

Day 1 - Agenda 19th October		
Item	Time (UK)	Topic
1	1300-1310	Welcome & connect
2	1310-1320	CCS Workgroup scope & boundaries
3	1320-1400	CCS '101'
4	1400-1430	Regulations and standards relevant to subsea CCS
5	1430-15:00	Current planned / ongoing CCS projects (5-10 minutes from each Operator) <ul style="list-style-type: none"> - Project location (country/region) - Estimated number of wells - Water depth for wells and field layout/concept (cluster, template, in-line wells) - Planned injection amount (millions of tonnes of CO2 per year) - Project status (on-going, planned, early concept)
		Break
5	1515-1545	Current planned / ongoing CCS projects (continued)
6	1545-1615	Risk areas relevant to CCS
7	1615-16:45	CCS Operational considerations
8	1645-1700	Review and summary outputs from the day
	1700	Day 1 Close

Day 2 - Agenda 20th October		
Item	Time (UK)	Topic
1	1300-1315	Welcome and Day 1 recap
2	1315-1415	SPS Supplier update (Opportunity for SPS vendors to present on their plans for supporting subsea CCS) <ul style="list-style-type: none"> - Component or system supplier - Dedicated / existing tree design - Current TRL numbers
3	1415-1445	CO ₂ Failure considerations (Building on risk discussion from yesterday)
		Break
4	1500-1530	CCS Reservoir Monitoring & leak detection (technologies / need for)
5	1530-1600	Re-purposing existing subsea equipment for CCS
6	1600-1650	What next? (How can the IOGP subsea committee help to add value to subsea CCS, - with specific focus on suppliers?)
7	1650-1700	Review of agreements
	1700	Closure

Subsea CCS Expert Group - ToR

Key elements of the Terms of Reference

Background: as industry embraces the “energy transition” and seeks to reduce carbon emissions, operators and suppliers are planning projects that involve capture carbon and storage offshore

Objective: define the role & requirements for subsea systems in the carbon capture space

Develop: guidance and alignment

- Regulations applicable to subsea
- Supplier design simplification, standardization and alignment on core functionality

Define: Operator requirements for subsea CCS projects

- Guide what Suppliers develop for broad applicability
- Facilitate discussions on regulations

Mission & aims

As industry embraces the “energy transition” and seeks to reduce carbon emissions, operators and suppliers are planning projects that involve capture carbon and storage offshore. The IOGP Subsea Committee will set up an Expert Group in 2023 with the objective: Defining the Role & Requirements for Subsea Systems in the Carbon Capture Space.

Key Areas for Guidance and Alignment

- Regulations applicable to Subsea (e.g. barrier philosophy, materials, well monitoring/barrier testing, controls design)
- Supplier design simplification, standardization and alignment on core functionality

Define Operator Requirements for Subsea CCS Projects, with the aim to:

- Guide what Suppliers develop for broad applicability
 - Product offerings that meet safety, and functional requirements for CCS applications
- Facilitate discussions on regulations
 - Regulatory requirements still forming, leading to uncertainty on design requirements
 - The goal is to develop minimum requirements with clear rationale which can provide a basis for regulations
 - Liaise with regulators such as the International Regulators Forum (IRF)

Scope will include the following subsea equipment:

- Pipeline and Riser systems
- Subsea Trees
- Manifolds/PLETs
- Control Systems including Umbilicals

The scope will not include:

- Onshore facilities or processing
- Offshore platforms (anything above waterline)
- Well completion design or downhole equipment
- Subsea separation and re-injection/pumping

Objectives

1. Enable a forum for Expert Group Members and subsea equipment suppliers to share knowledge, experience and strategies pertaining to subsea CCS system design
2. Develop industry guidelines for key design considerations for subsea CCS systems
3. Develop functional requirements for subsea CCS equipment which can later be considered for the JIP33 Program

Resources required

The Subsea CCS Expert Group will require the participation of dedicated members of the Subsea Committee, Suppliers, and an IOGP secretariat resource support. An Expert Group lead will be appointed from the participating SMEs and time contribution (2 hours a week on average) of participating members will be required to produce deliverables.

Bi-Weekly remote online meetings. Cadence can be adjusted by the Expert Group as required.

Deliverables

- Evaluate and generate list of key design considerations for subsea CCS equipment design
- Guideline for the Design of Subsea CCS Equipment.
 - o The guideline will provide a framework to assist Operators and Suppliers in designing both Subsea CCS Systems and Subsea Equipment for CCS applications.
 - o The guideline will include functional requirements for various Subsea Equipment for CCS applications.
 - o This guideline will be made available on IOGP’s publication library for IOGP Members and Non-Members.

Subsea Committee Carbon Capture & Storage Expert Group

Stakeholders & Communication



- Leverage/reference other standards, including the IOGP CCS Committee work
- Generate guidance unique to subsea applications
- Help the reader understand the applicability of other CCS related work to subsea applications

End Product Vision

Objective: Develop design guideline for subsea CCS systems and equipment.

Design Guideline Components – Two Parts

1. Systems Design Considerations
2. Equipment Functional Requirements

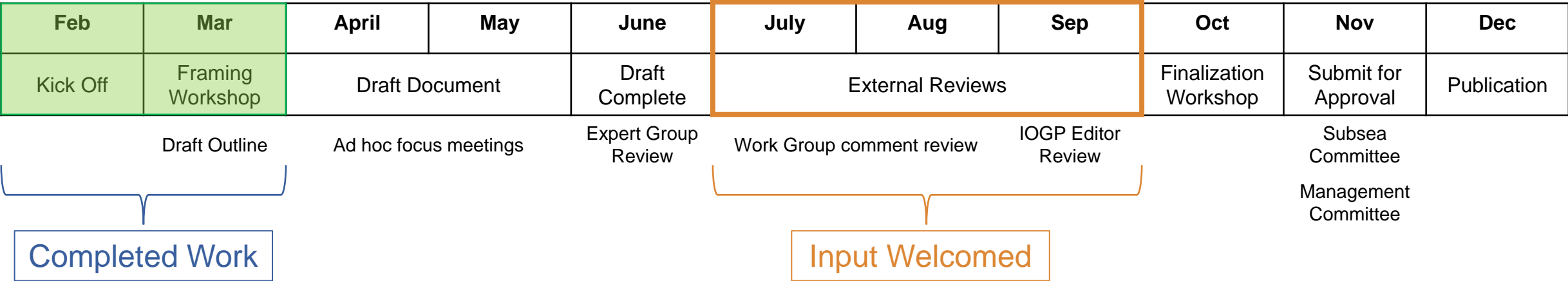
Equipment Sections – Will form Section Work Groups to refine each

- Pipeline and Riser Systems
- Subsea Tree Systems
- Manifolds/PLETs/FLETs and Connection Systems
- Controls Systems including Umbilicals

Scope and Boundaries of Applicability

1. Applicable only to systems and equipment designed for the purpose of CO₂ transport subsea and injection into a well for permanent sequestration in a geologic reservoir.
 - Not intended for CCUS applications, where the CO₂ is transported or injected for some other useful purpose
2. Content applies only to equipment submerged underwater.
 - Not intended to cover offshore structures (e.g., platforms), equipment on offshore structures or equipment above the waterline.
3. Requirements are for new build systems and equipment unless specifically noted that the content applies to reuse of existing systems or equipment.
4. Wells are assumed to be designed, drilled, and completed for the purpose of CO₂ injection and sequestration.
 - This work is not intended to apply to reuse of existing wells or sidetracks of existing wells.
5. Subsea pumping or compression is not in scope.

Timeline and Status





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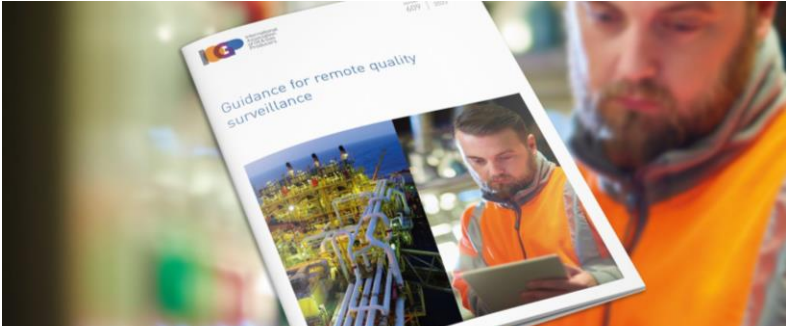
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Subsea Committee, Published Documents



Guidance for remote quality surveillance



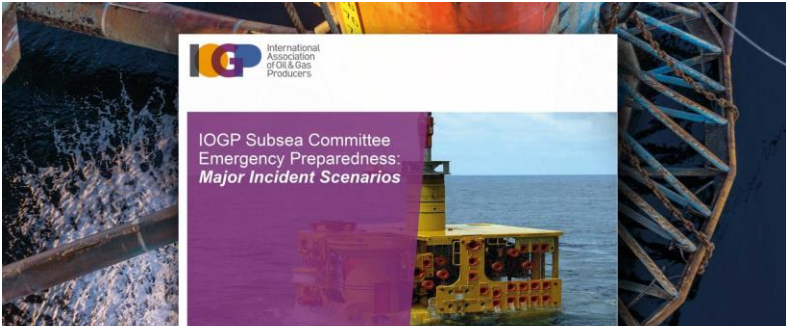
IOGP Subsea Committee workshop summary – April 2022



Recommended test procedures for the qualification of internal pressure sheaths of flexible pipes



Lifetime Extension of Flexible Pipe Systems



Subsea emergency preparedness: Major Incident Scenarios



Subsea intervention hazard identification – checklist

Subsea Committee, Work Areas to Date

Lifecycle Carbon Footprint of a Subsea System

- Assess the Lifecycle Carbon Footprint of a subsea system from manufacture and construction through operation to decommissioning.
- Workshop held in April 2021 on CO2-reduction and Remote inspection with its Members and the Vendor community.
- There was agreement that Subsea is not a big emitter (Subsea has a lower carbon footprint than a Topside Facility) but could be an enabler, in particular in the CCS space.

Develop Thermoplastic Composite Industry Guidelines

- Assess the technology qualification gaps in industry practice DNV-ST-F119.
- Develop an industry-wide consensus of qualification addendum.
- Shared with vendor community for feedback
- Present addendum for consideration in the next revision of the DNV practice in November 2021

Digital strategy for Subsea

- Existing work in the area of digital strategies Mapped out
- Potential areas of collaboration agreed

Emergency Preparedness

- Monitor the development and potential use of subsea emergency response equipment and procedures

JIP33 Phase 3

- Ongoing support to JIP33 Phase 3 Program Subsea Specifications
- Including – Trees [S561]
Subsea Fasteners [S726, S725, S724]
Subsea Pipeline Valves [S708]

Lifetime Extension

- Continued to share best practice on Life Extension.
- Early 2021 - Undertook a survey of Members to gauge the focus areas for further Life Extension work by the Committee.
- Held a virtual workshop in July 2021 to discuss the survey results, and Members best practice documents

HSE lessons learned database

- Database setup for capturing the lessons learned and take measures to prevent and mitigate

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