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DRAIN SYSTEMS FOR OFFSHORE INSTALLATIONS

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of contained deck drain systems for facilities to be installed offshore. These include fixed and floating oil and gas production facilities, facilities design to support crossing pipelines, compression and other transportation related facilities.

Floating Production, Storage and Offloading (FPSO) and Floating Liquefied Natural Gas (FLNG) facilities are not included in the scope of this DEP, although the requirements and recommendations in Section 4 of this DEP may be applied to such services.

This DEP covers the following:

- a. Rainwater and wash-down water from deck drains in non-hazardous / utility areas;
- b. Rainwater and wash-down water from deck drains in hazardous / process areas.

This DEP contains minimum guidelines for the design of facilities installed to treat deck drainage fluids.

This DEP does not cover the drainage of domestic waste water and sewage streams, closed module floor drains or drainage from drilling units. The following types of drainage are discussed only as they relate to the deck drains described above:

- a. Process drains (2.4.4);
- b. Specialty fluid recovery and disposal systems (2.4.5);
- c. Laboratory drains (2.4.6);
- d. Instrument drains (3.5);
- e. Helideck drains (3.6);
- f. Firewater drains (3.7).

Generic closed maintenance drains are not supported; however, hard piped drain systems to support specific utility systems are included under process drains (2.4.4).

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 – Application of Technical Standards.

This is a revision of the DEP with the same number dated February 2011 (including amendment February 2012); see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in facilities related to offshore oil and gas production facilities but may also be applied to onshore facilities located in bodies of water, i.e. in lakes and swamps. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local

regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
Cellar deck	The Cellar deck is the lowest deck on an offshore structure that operators can access by either ladder or stairway.
Closed module	Enclosed structures offshore such as bunk house buildings, laboratories, office buildings, generator / compressor buildings.
Closed maintenance drain	Historical term for a fully contained (hard-piped) system to route drains from process vessels and equipment to a common collection system.
Contained deck area	An area of a deck offshore in which the rainwater, wash water, or any other fluids that are allowed to land on or make contact, will be gathered for subsequent treatment. Fluids that land on other deck areas are not contained and will be directed to the sea.
Hazardous Area	An area in which flammable gases or vapours can be present in quantities sufficient to produce explosive or ignitable mixtures in the atmosphere. It may be identified as Zone 0 being an area in which an explosive gas atmosphere is present continuously, or is present for long periods; or Zone 1 being an area in which an explosive gas atmosphere is likely to occur in normal operation.
Non-Hazardous Area	An area in which flammable gases or vapours are not likely to occur in quantities sufficient to produce explosive or ignitable mixtures in the atmosphere. Refer to DEP 80.00.10.10-Gen. for details on area classification.
Rainfall	Each Project defines a regional rainfall volume that reduces the risk of sheening from drainage discharge to ALARP. Refer to (4.2.2).
Segregated	The complete physical separation (with no connections between) of the collection piping, vessels and water disposal routes of different drainage systems.
Treatment tank	Removes oily waste

Term	Definition
Very toxic (substances)	Substances that are very hazardous for the environment or human health, as specified in DEP 01.00.01.30-Gen. (which identifies toxic substances by reference to chemical substances databases). The process fluids on oil and gas production facilities are not normally classified as very toxic, unless there are substantial levels of hydrogen sulphide.

1.3.3 Abbreviations

Term	Definition
ALARP	As Low As Reasonably Practicable, as defined in Shell's HSSE Control Framework,
FPSO	Floating Production System Offshore (most commonly used when referring to a tanker shaped vessel)
GRE	Fibreglass Piping system
GRP	Glass-Fibre Reinforced Plastic
HVAC	Heating, Ventilation and Air Conditioning
IPF	Instrumented Protective Function
OHD	Open Hazardous area Drains
ONHD	Open Non-Hazardous area Drains
OWCS	Oily Waste Containment Sump
PEFS	Process Engineering Flow Scheme
TLP	Tension Leg Platform
WOT	Wet Oil Tank

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (5).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2011 (including amendment February 2012). This is a major rewrite and the changes are too numerous to mention in detail.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
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DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://www.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. DRAIN SYSTEMS PHILOSOPHY

2.1 GENERAL

Treatment of deck drain fluids is a permit requirement and one of the many requirements for Shell to conduct business.

1. The project should ensure from an early stage that adequate space and weight are allocated in topsides facilities for the proper treatment of fluids collected in deck drains.

2.2 PURPOSE AND FUNCTION OF FACILITY DRAIN SYSTEMS

1. Deck drain systems safely convey rainwater run-off and wash-down liquids from drip pans, plated and curbed (contained deck) areas, and flooring.
2. A drain system shall not provide a route for migration of a fire, flammable liquids, or vapours from one hazardous area to another, or to non-hazardous areas.
3. A separate Oily Waste Containment Sump (OWCS) shall be installed to collect drainage from process equipment or containment fluids (under engines, compressors, crane power packs, etc.) from sources where oily waste would normally be expected.

Fluids collected in the OWCS will be pumped for ultimate treatment in the production system or for disposal via departing pipelines.

4. Deck drain systems shall include containment areas under process equipment installed on topsides (on or above a cellar deck) to ensure fluids collected are properly treated to meet effluent criteria before being discharged into the sea.
5. Open sump piles or sump caissons shall not be considered a process component used for treatment of deck drainage fluids. See also (4.3.7).

Open sump piles or sump caissons, if installed, are simply intended as a final containment with oil skimming capacity should an upset occur.

6. Process drains shall be conveyed through a separate piping system that is designed in accordance (2.4.4) to take the pressure break prior to final treatment in the platform production system or via onshore disposal.

Process drains are drains that are likely to convey residual hydrocarbons, produced waters, and complex production chemistries drained from vessels, piping, and instruments, resulting either from operational activities or from preparation prior to carrying out maintenance.

2.3 REGULATORY REQUIREMENTS

1. All operating locations should have mandated discharge limits for constituents such as oil and grease which would be found in deck drain systems.
2. The project shall identify the environmental requirements applicable in the area where the asset will ultimately be installed.
3. The Contractor shall ensure that the system proposed can be operated in compliance with regulatory limits, and seek clarification as necessary from the Principal's designated technical authorities on water treating.

2.4 DRAIN SYSTEM CLASSIFICATIONS

2.4.1 Open non-hazardous area drain system (ONHD)

This system provides drainage from those areas of the facility that have been designated non-hazardous. These generally include storage areas for utility liquid consumables such as diesel fuel and lubricating oils.

This type of drain system handles fluids collected from floors, drip pans and tundishes in non-hazardous areas and operates at atmospheric pressure.

2.4.2 Open hazardous area drain system (OHD)

This system provides drainage from those areas which are designated hazardous. These generally include all process areas and other locations in the facility where process hydrocarbons may be present.

Open hazardous drain systems handle liquids collected from plated decks, drip pans and tundishes in hazardous areas.

1. Open hazardous drain systems shall not be designed for use in draining residual hydrocarbon liquids from vessels or equipment prior to commencing maintenance or repairs.

2.4.3 Closed maintenance drains

1. Closed maintenance drain systems shall not be installed in new facilities or as a modification to existing systems.

Closed maintenance drains are no longer permissible on new construction under this DEP. Residual fluids containing hydrocarbons may quickly overwhelm the deck drains treatment system causing sheen to occur.

2.4.4 Process drains

Some operations and equipment in the process facilities require periodic and partial draining during operation to keep them working at peak efficiency. This drainage often occurs when the connected system is still operational.

1. Process drains shall not be connected to the deck drains system.
2. Process drains shall be designed as part of the overall process system with engineered barriers against hazards and appropriate standards for vessels, tanks, piping and overpressure protection.

Streams drained typically include, but are not limited to the following:

- emulsion layers in free water knockouts and oil dehydration vessels,
- condensate layers in glycol contactors and glycol surge tanks,
- refrigerant heavy ends blowdown,
- compressor suction scrubber drains where continuous liquid levels are not maintained.

3. Process drain systems may route fluids from one part of the process to another rather than to a dedicated collection or disposal facility.
4. Residual hydrocarbon liquids from vessels and equipment shall only be drained to the OWCS and subsequently pumped into a process component on the structure or into a suitable process connection.
5. On oil production facilities, it may be permissible via suitably engineered systems to dispose of some of the process liquids via the oil export pipeline.
6. Containment areas shall be designed to minimize the collection of liquids.

Sloped containment pans to a central gully or sloped gully on one end with a bottom drain is typically considered standard.

7. Liquid seal traps shall not be used under individual containment pans.
8. The volume of rainwater collected by containment designed to primarily collect hydrocarbon liquids shall be minimised.

2.4.5 Specialty fluid recovery and disposal systems

1. The following liquids shall be segregated and disposed separately from the open drain systems during normal operation and maintenance activities:
 - a. lube oils;

- b. diesel fuel;
- c. aviation fuel;
- d. hydraulic oils;
- e. methanol;
- f. glycol;
- g. amines and refrigerants;
- h. toxic fluids.

For example; a hose failure on a crane hydraulic power pack could release a significant quantity of hydraulic fluid, seals on pumps or compressors could also release lubricating oil or other fluid which could contaminate the deck drain treatment system. Containment areas covering these systems would discharge to the oily waste containment sump and not be directed to the open drain system.

- 2. Heat transfer fluids shall have a dedicated hard-piped collection system.
 - a. See DEP 20.05.50.10-Gen. for definition and specific requirements.
- 3. On oil production facilities, it may be permissible via suitably engineered systems to dispose of some of the specialty liquids via the oil export pipeline. These fluids drained initially to the oily waste containment sump (OWCS) shall subsequently be pumped to platforms wet oil tank or oil surge tank.
- 4. Containment areas which could collect these specialty fluids shall not be directed to the oil bucket or water side of the deck drains treatment system.
- 5. The design shall incorporate covers or removable lids to minimise the volume of rainwater/ wash water that can collect in containment areas which could collect specialty fluids.

2.4.6 Laboratory drains

- 1. Laboratory drains used for the disposal of hydrocarbon / water samples, chemicals and solvents shall be directed to the OWCS via a dedicated drain pipe with an air gap located outside the building.

A liquid seal would normally be installed under the laboratory sink followed by an air gap provided by a tundish after drain piping turns down to connect to the OWCS. (Refer to Appendix A, Figure A.1 for concept illustration).
- 2. If the only convenient drain is an open non-hazardous drain, then all liquids including hydrocarbons shall be collected in containers for onshore disposal.

3. DRAIN SYSTEMS DESIGN

3.1 GENERAL

- 1. Drainage SHALL [PS] completely segregate hazardous drains from the non-hazardous drainage system to eliminate the risk of hydrocarbon vapour transmission from hazardous areas into non-hazardous areas.
- 2. Liquid seal traps SHALL [PS] be incorporated into open drain piping upstream of the final treatment tank as follows to prevent potentially hazardous vapours from entering non-hazardous locations from the atmosphere inside the treatment tank:
 - a. one on the OHD system;
 - b. one on the ONHD;
 - c. one on the laboratory drain system (if applicable).

Liquid seal traps are also referred to as seal legs.