

DEP SPECIFICATION

# PREPARATION OF SAFEGUARDING MEMORANDA AND PROCESS SAFEGUARDING FLOW SCHEMES

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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 preparation of the Safeguarding Memoranda (SGM) and Process Safeguarding Flow Schemes (PSFS) to be prepared for each new construction and to be amended for modifications to existing installations that involve changes of the ultimate safeguarding design. It recognises that existing documentation.

The project manager is responsible for the delivery of a safeguarding memorandum as per this DEP prior to start up of the facility as part of the Statement of Fitness requirements.

The Principal is responsible for ensuring that the safeguarding of an existing unit is studied and developed before any modification is made to process conditions, equipment, piping or instrumentation.

The SGM and PSFS are controlled documents required to be managed and updated through the asset life cycle including Operating Management of Change procedures.

Depending on local practices, different nomenclature can be used for a Process Safeguarding Flow Scheme. Deliverable titles and nomenclature can be adjusted with agreement of the Principal to maintain consistency with established local requirements and practices.

Changes to the original design are recommended to be followed up by a re-assessment of the ultimate level of protection, including the re-sizing of the capacity determining components.

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

The Safeguarding Memorandum as described in this DEP might require more information than the minimum required for legal compliance. Additional requirements as per this DEP have to be managed as an internal Shell Group requirement.

This is a revision of the DEP of the same number dated February 2017; see (1.5) regarding the changes.

### 1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. 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.

The word **may** indicates a permitted option.

## 1.3.2 Specific definitions

| Term                                          | Definition                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Administrative Controls</b>                | Operational and maintenance procedures that, along with proper training and/or supportive measures, seek to ensure that personnel actions do not compromise overpressure protection. Refer to (2.15).                                                                                                                                                      |
| <b>Capacity determining components</b>        | Components (such as restriction orifice, NRV, etc.) that when open or removed can lead to – or contribute to – more than 25 % of the maximum defined relief load.                                                                                                                                                                                          |
| <b>Car Seal</b>                               | Tear resistant band or wire that has to be broken in order to change the valve position. Car seals installed on a valve inhibit unauthorized valve operation. A valve can be Car Seal Open (CSO) or Car Seal Closed (CSC). Have to be auditable, i.e., authorized operation of car sealed valves is ensured via structured procedures.                     |
| <b>Class 1 Check Valves</b>                   | Check valves (Non-return valves) that are inspected or tested according to a periodical, auditable schedule to assure reliable operation. Refer to DEP 80.45.10.11-Gen. for more guidance on Class 1 Check valves.                                                                                                                                         |
| <b>Final Element</b>                          | Part of the BPCS or SIS that implements the physical action necessary to achieve or maintain a safe state. (ref. IEC 61511)                                                                                                                                                                                                                                |
| <b>Hazard</b>                                 | An agent with the potential to cause harm to people, damage to assets, or an impact on the environment or community. Refer to HSSE&SP Control Framework for additional information concerning Hazards and Managing Risk.                                                                                                                                   |
| <b>Instrumented Protective Function (IPF)</b> | A function comprising one or more sensors, a Logic Solver and one or more Final Elements. The purpose of an IPF is to prevent or mitigate hazardous situations to achieve or maintain a safe state for the process, with respect to a specific hazardous event. In IEC 61508 and IEC 61511, an IPF is referred to as a Safety Instrumented Function (SIF). |

| Term                                           | Definition                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Instrumented Protective System (IPS)</b>    | The electromechanical, electronic and/or programmable electronic Logic Solver component of the Instrumented Protective Function, complete with input and output equipment. In IEC 61508 and IEC 61511 an IPS is referred to as a 'Logic Solver'. Synonymous with SSDS and SIS.                                                                                                                      |
| <b>Interlock System</b>                        | An interlock system is a feature that makes the state of two mechanisms or functions mutually dependent. An interlock can be a simple mechanical, electrical or electronic device or a sophisticated electronic and programmable system (IPF, HIPS).                                                                                                                                                |
| <b>Limiting Elements</b>                       | Devices or systems that are intended to limit the quantity/effect of a loss of containment (e.g., restriction orifice (RO), control valve (CV)).                                                                                                                                                                                                                                                    |
| <b>Locked Valve</b>                            | Chain padlock and/or key lock system installed around a valve has to be opened/closed with a key in order to change the valve position. Locks installed on a valve inhibit unauthorized valve operation. A valve can be Locked Open (LO) or Locked Closed (LC). The valve locks have to be auditable, i.e., authorized operation of locked valves is ensured via structured procedures.             |
| <b>Maintenance Drop Out system (MDO)</b>       | MDO (maintenance drop out) is an outlet from the chemical process equipment or piping to an enclosed containment for the purpose of preparing the equipment for maintenance.                                                                                                                                                                                                                        |
| <b>Management of Change (MOC)</b>              | <p>The application of management principles to a change situation to prevent unforeseen Consequences. The MoC process identifies risks arising from changes and manages these risks before and during execution of the changes.</p> <p>Refer to HSSE&amp;SP Control Framework for further details.</p>                                                                                              |
| <b>Mitigating Systems</b>                      | Systems or elements that function as barriers specifically included in the design to prevent process conditions or scenarios that would lead to activation of ultimate safeguards; and limit the consequences of an uncontrolled loss of containment. Examples: SIFs to prevent relief and/or impact on health, assets and environment; Class 1 check valves, ROVs, emergency depressuring systems. |
| <b>Pressure System</b>                         | An individual equipment item or groups of equipment including associated piping that, within its boundaries, remains open under all conditions, and it can be demonstrated that no blockage due to freezing, solidification, fouling, sublimation, damage of internals, scale, debris, foreign objects can occur within that system.                                                                |
| <b>Process Engineering Flow Schemes (PEFS)</b> | <p>Pictorial representation of a process or utility unit which shows all the equipment, including installed spares and the associated piping and piping components, instrumentation, heat tracing and insulation.</p> <p>PEFS are also known as Piping and Instrument Diagrams (P&amp;IDs) and Engineering Flow Diagrams (EFDs).</p>                                                                |
| <b>Project Managers</b>                        | The Project manager is the person representing the project organisation who is responsible for the project development and execution.                                                                                                                                                                                                                                                               |

| <b>Term</b>                             | <b>Definition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Remote Operated Valves</b>           | Valves that are, from a safe location, manually and remotely actuated, intended to stop flows that could otherwise be released in the event of equipment failure. Also referred to as Emergency Isolation Valves (EIV), (Emergency) Shutdown Valves ((E)SDV), or Pressure Shutdown Valves (PSDV).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Safeguarding Memorandum</b>          | A controlled document with a summary of the documents, databases and drawings for the design basis, design and operation of the ultimate safeguarding systems of the process equipment. SGM can be fully or partially in electronic form, but need to be printable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Statement of Fitness</b>             | An affirmation that conditions are satisfactory to begin or continue operation, and that the minimum requirements of Process Safety (including Technical Integrity) are met.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Ultimate Safeguards</b>              | Devices or systems that prevent uncontrolled loss of containment and are designed to be highly reliable. Ultimate Safeguards can be divided in the following three groups: <ul style="list-style-type: none"> <li>• Inherently safe design: Equipment design pressure (or vacuum) and temperature to maintain system integrity during process deviation.</li> <li>• Mechanical safeguarding: Hardware, such as relief devices, restriction orifices, that prevent or mitigate the process upset which could otherwise lead to an uncontrolled loss of containment.</li> <li>• Instrumentation: High integrity or "protective" instrument systems that prevents the process deviation which could otherwise lead to uncontrolled loss of containment; e.g., protection against over temperature from runaway reactions.</li> </ul> |
| <b>Uncontrolled loss of containment</b> | Occurs when process variables (usually pressure or temperature) exceed limits to such an extent that process equipment fails to contain the process materials. Uncontrolled loss of containment can be due to ruptures, failures of seals, gaskets, welds, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 1.3.3 Abbreviations

| <b>Term</b>  | <b>Definition</b>                                                                 |
|--------------|-----------------------------------------------------------------------------------|
| <b>CSC</b>   | Car-Seal Closed                                                                   |
| <b>CSO</b>   | Car Seal Open                                                                     |
| <b>DCAF</b>  | Discipline Controls and Assurance Framework                                       |
| <b>EDP</b>   | Emergency Depressuring (system)                                                   |
| <b>EIV</b>   | Emergency Isolation Valve                                                         |
| <b>ESD</b>   | Emergency Shutdown                                                                |
| <b>HAZOP</b> | Hazard and Operability Study                                                      |
| <b>IPF</b>   | Instrumented Protective Function, now known as SIF (Safety Instrumented Function) |

| <b>Term</b>     | <b>Definition</b>                                       |
|-----------------|---------------------------------------------------------|
| <b>LC</b>       | Locked Closed                                           |
| <b>LO</b>       | Locked Open                                             |
| <b>MOC</b>      | Management of Change                                    |
| <b>P&amp;ID</b> | Piping and Instrumentation Diagrams, also known as PEFS |
| <b>PEFS</b>     | Process Engineering Flow Schemes, also known as P&IDs   |
| <b>PFD</b>      | Process Flow Diagrams, also known as PFS                |
| <b>PFS</b>      | Process Flow Schemes, also known as PFD                 |
| <b>PHA</b>      | Process Hazard Assessment                               |
| <b>PSFD</b>     | Process Safeguarding Flow Diagram, also known as PSFS   |
| <b>PSFS</b>     | Process Safeguarding Flow Diagram, also known as PSFS   |
| <b>RHA</b>      | Reactive Hazards Assessment                             |
| <b>ROV</b>      | Remotely Operated Valve                                 |
| <b>SGM</b>      | Safeguarding Memorandum                                 |
| <b>SIF</b>      | Safety Instrumented Function                            |
| <b>TERV</b>     | Thermal Expansion Relief Valve                          |

#### 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 (4).

#### 1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2017. This is an administrative update only to correct references to DEPs that have been involved in either a merge or a split.

## 1.6 COMMENTS ON THIS DEP

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

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

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.*