




The Shell Petroleum Development Company of Nigeria Limited
Operator for the NNPC/Shell/Agip/EPNL Joint Venture

Pipelines Assets HSE Case

| | |
|--|---|
| Originating Company | Shell Petroleum Development Company |
| Document Title | Pipelines Assets HSE Case |
| Document Number | SPDC-2021-10-00000051 |
| Document Revision | Rev 08 |
| Document Status | Final |
| Document type | Manual |
| Author / Custodian | Nnogo, Chizube SE Lead Pipeline Asset SPDC-UPC/G/SP |
| Owner/Approved by | Griffiths Christopher Pipelines Manager UPC/G/U |
| Security Classification | Confidential |
| ECCN | Not subject to EAR, no US content |
| Issue Date | December 2021 |
| Retention | December 2026 |
| Revision History is shown next page | |

| | | |
|---|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|---|-------------------------------|-----------|

Approval Page

| | |
|------------------------|--|
| Author / Custodian | Nnogo, Chizube SE Lead Pipeline Asset SPDC-UPC/G/SP Sign/Date: |
| Owner / Approved by | Griffiths Christopher, Pipeline Asset Manager SPDC-UPC/G/U Sign/Date: |
| Reviewers | Ojiako, Uche SPDC-UPC/G/UP Hirse, Pankyes SPDC-UPC/G/UP Jackreece, Soki SPDC-UPC/G/UP Joshua, Olajire SPDC-UPC/G/UP Oraemeka, Oluoma SPDC-UPC/G/SM |
| Distribution | The Controlled version of this document is on SharePoint and can be accessed through SCiN HSE website |

Revision History

| Date | Version | Reason for Issue / Change |
|----------------|---------|---|
| December 2001 | 2 | Align with group standard |
| September 2010 | 3 | Incorporate SIEP Review comments/suggestion |
| March 2014 | 4 | Align with HSSE & SP CF, SEPCiN HSE MS & reflect Operating Integrity Requirements |
| September 2017 | 5 | Aligned with updated Pipeline Asset organization, HSSE & SP CF, SCiN HSE MS, Operating Integrity (OI) requirements and include new MAH. |
| April 2018 | 6 | Update MOPO |
| August 2020 | 7 | Various |
| 31/01/2021 | 08 | Change of Asset Manager; some material changes to the organisational arrangements and personnel levels. |


Copyright

The copyright of this document is vested in SCiN. All rights reserved. Neither the whole nor any part of this document may be reproduced, stored in any retrieval system or transmitted in any form or by any means (electronic, mechanical, reprographic, recording or otherwise) without the prior written consent of the copyright owner. The contents of this controlled document shall not be altered without formal approval of the document Owner.

Disclaimer

SCiN is not aware of any inaccuracy or omission from this document. No responsibility is accepted by SCiN or any person or company concerned with furnishing information or data used herein, for the accuracy of any information or advice given in or any omission from this document, nor for any consequences whatsoever resulting directly or indirectly from reliance on or adoption of this document, even if there was a failure to exercise reasonable care on the part of SCiN or any person or company as aforesaid.

This document may set requirements supplemental to applicable law. However, nothing herein is intended to replace, amend, supercede or otherwise depart from any applicable law relating to the subject matter of this document. In the

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

event of any conflict or contradiction between the provisions of this document and applicable law as to the implementation and governance of this document, the provisions of applicable law shall prevail

Revision Information

- Revised and re-formatted in line with [HSSE & SP Control Framework](#) requirements
- Revised to reflect current organisational structure
- Adapt SCiN HSSE MS
- To incorporate lateral lessons from incidents and other events
- Include a new Major Accident Hazard (MAH) for "Insufficient Oxygen in the atmosphere during Confined Space Entry"
- Compliance with Operating Integrity requirements

Document control

The only controlled and valid version of this manual is the document on the Pipeline Asset SharePoint of which UPC/G/UP is the custodian of the Case.

Language:

In this document the recommendations for a course of action are made with varying degrees of emphasis. As a rule:

- The word '*may*' indicate a possible course of action.
- The word '*should*' indicate a preferred course of action.
- The word '*shall*' indicate a mandatory course of action.
- The abbreviation HSE and HSSE are used interchangeably within this document


Document flow

Document flow is managed in line with [Shell Information Management Manual](#)



Contents

| | |
|--|---------------------------------------|
| i. Purpose..... | 3 |
| ii. Who is this for?..... | 3 |
| iii. Scope..... | 3 |
| 1 OVERVIEW AND SUMMARY | 3 |
| CHANGE CONTROL | 4 |
| ROLES & RESPONSIBILITIES..... | 5 |
| DOCUMENT CONTROL | 5 |
| STATEMENT OF FITNESS | 8 |
| 1.1 CONTENT OF THE HSE CASE | 9 |
| 1.2 Objective of the HSE Case:..... | 9 |
| 1.3 HSE CASE SCOPE..... | 10 |
| THE OPERATIONS COVERED IN THIS CASE ARE AS OUTLINED IN TABLE 1.3 BELOW | 10 |
| 1.4 Facility Overview/Asset Description | 11 |
| 1.4.1 ASSET DESCRIPTION | 11 |
| 1.4.2 ENCROACHMENT STATUS OF PIPELINES FACILITY..... | 12 |
| 1.5 SUMMARY OR REMEDIAL ACTIONS..... | 12 |
| PART 2 MAJOR ACCIDENT HAZARDS..... | 14 |
| 2.1 PAST INCIDENTS | ERROR! BOOKMARK NOT DEFINED. 4 |
| HAZARD AND EFFECTS REGISTER | 15 |
| 2.3 MAH Identification & Management | 19 |
| 2.3.1 Hazard Identification (HAZID) | 19 |
| 2.3.2 Risk Ranking and MAH..... | 20 |
| 2.3.3 APPLICATION OF THE BOW-TIE | 22 |
| 2.3.4 HAZARD AND BARRIER ASSESSMENT..... | 22 |
| 2.3.5 BARRIER/CONTROL EFFECTIVENESS | 23 |
| 2.3.6 ALARP RISK MANAGEMENT FOR MAJOR HAZARDS..... | 23 |
| 2.3.7 OPERATING ENVELOPES | 24 |
| 2.4 MAH Assessment Sheets | 24 |
| 2.5 Bow-Tie Assessments | 24 |
| 2.6 Summary of Studies and Results | 32 |
| 2.7 Risk Reduction Philosophies | 33 |
| 2.7.1 General..... | 34 |
| 2.7.2 Overpressure protection..... | 34 |
| 2.7.3 Corrosion Management | 34 |
| 2.7.4 Fire Protection | 34 |
| 2.7.5 Active Fire Protection..... | 34 |
| 2.7.6 Explosion Overpressure Protection | 34 |
| 2.7.7 Prevention of ignition..... | 35 |
| 2.7.8 Fire and gas detection | 35 |
| 2.7.9 Manning..... | 35 |
| 2.8 ALARP Demonstration..... | 36 |
| 2.8.1 Objective..... | 36 |
| 2.8.2 Means of Demonstrating ALARP..... | 36 |

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

| | |
|---|-----------|
| 2.8.3 ALARP DETERMINATION..... | 37 |
| 2.8.4 Effectiveness of Controls:..... | 37 |
| 2.9 Manual of Permitted Operations (MOPO) | 39 |
| PART 3 SAFETY CRITICAL ELEMENTS (SCEs) | 41 |
| 3.1 Design Specification and Operating Philosophy | 41 |
| 3.2 Operating Philosophy..... | 41 |
| 3.2.1 Barriers and HSE Critical Elements & Performance Standards | 42 |
| 3.3 Safety Critical Elements (SCEs) & Performance Standards (PSs) | 42 |
| 3.3.1 Performance Standards | 42 |
| Facility SCE Mapping..... | 44 |
| 3.3.2 Facility SCE Features | 44 |
| 3.4 Drawing & Layout..... | 46 |
| 3.5 Technical Assessment Studies | 46 |
| 3.6 Process Safety Basic Requirements (PSBR) | 46 |
| PART 4 – HSSE MANAGEMENT SYSTEMS..... | 47 |
| 4.1 HSE-MS and Business Model..... | 47 |
| 4.2 Asset Organogram | 47 |
| 4.3 Critical Manning Levels & Competency Management | 47 |
| 4.3.1 Manning Levels..... | 47 |
| 4.4 Critical Tasks & Reference Procedures Listing | 47 |
| 4.4.1 Critical Task | 63 |
| 4.4.2 LISTING OF HSE CRITICAL PROCEDURES | 63 |
| 4.4.3 Register of HSE-Critical Legislation | 686 |
| 4.4.4 HSE Critical documents..... | 66 |
| 4.5 COMPETENCY REQUIREMENTS | 67 |
| 4.5.1 CRITICAL TASK COMPETENCIES | 67 |
| 4.5.2 Contractor HSE and Competency Management..... | 67 |
| 4.6 HSE Accountability Packs Activity Responsibility Matrix | 69 |
| 4.7 Emergency Response Arrangement..... | 69 |
| 4.8 BRIDGING INTERFACES | 70 |
| 4.9 Work Force Involvement | 70 |
| 4.10 Audits & Reviews/Assurance Process..... | 70 |
| PART 5 REMEDIAL ACTION PLAN | 70 |
| 5.0 Remedial Action Plan..... | 70 |
| Glossary..... | 71 |

**i. Purpose**

Pipeline activity Risks to As Low as REASONABLY PRACTICABLE

ii. Who is this for?

All Pipeline Asset staff, managers and Supervisors and interfaces.

iii. Scope

The Scope covers SPDC pipeline Operations East and West, the TNP, TRP and TEP assets and adjoining manifolds.

1 Overview and summary

The HSE Case provides a documented demonstration that all the Severity 5A/5B and RAM red Hazards in the Pipelines Asset have been managed to As Low As Reasonably Practicable (ALARP). The document is in 5 parts as outlined below:

- Part 1: Overview/Summary
- Part 2: Major Accident Hazards
- Part 3: Safety Critical Elements
- Part 4: Systems
- Part 5: Remedial Action Plan

This HSE Case includes:

- Risk reduction philosophies that have been implemented to ensure that the Severity 5A/5B and RAM red risk are tolerable and ALARP
- HSE Critical Elements and their Performance Standards
- HSE Critical Tasks and responsible persons
- [SPDC Pipeline Hazard Effects Register](#)
- [Cooperate Pipeline HRA](#)
- Confirmation that Asset Manager is satisfied that the controls are in place and the asset can operate.

The physical boundaries of this case have been detailed in section 1.3

The table below presents a summary of the associated Severity 5A/5B and RAM red Hazards that have been identified and assessed within the HSE case. There are 8 High Risk Hazards associated with Pipeline Assets and Operations. These are referred to as Major Accident Hazards (MAHs).


| | | |
|---|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|---|-------------------------------|-----------|

Table 1.1 Major Accident Hazards applicable to Pipeline Asset Operations

| REF. | HAZARD DESCRIPTION | INHERENT RISK RATING | | | | |
|-------------|---|----------------------|----|----|----|----------------|
| | | P | A | C | E | Overall Rating |
| H-01 | HYDROCARBON (UNREFINED) UNDER PRESSURE | | | | | |
| H-01.002 | Condensate | 5B | 5B | 5B | 4D | H |
| H-01.003 | Hydrocarbon gas | 5C | 5B | 5B | 4C | H |
| H-01.005 | Crude Oil | 5B | 5C | 5B | 5C | H |
| | | | | | | |
| H-07 | DYNAMIC SITUATIONS | | | | | |
| H-07.001 | Land Transport | 5C | 2C | 1D | 3B | H |
| H-07.002 | Water Transportation | 5C | 2C | 1D | 3C | H |
| H-07.003 | Air Transport | 5C | 2D | 4B | 1D | H |
| | | | | | | |
| H-11 | ATMOSPHERE / MEDIUM | | | | | |
| H-11.001 | Insufficient Oxygen in atmosphere during confined space entry (Deep excavation/cofferdam) | 5C | 0D | 3B | 2C | H |
| | | | | | | |
| H-16 | SECURITY | | | | | |
| H-16.004 | Organised Crime (incl. Sabotage) | 5B | 5C | 5A | 4D | H |
| | | | | | | |

| | | | | |
|----------------|-------------|---|------------|--------|
| Legend: | People | P | Severity 5 | M (S5) |
| | Asset | A | | H |
| | Community | C | | |
| | Environment | E | | |

Change Control

Change Control Procedure is employed to ensure that any proposed change to the facility configuration or to the way it is operated is evaluated and approved at an appropriate level and any consequent change is properly engineered executed and documented to maintain technical/asset integrity.

Operating envelope and the Case content are in alignment all the time. Any changes are made only after consulting the Case. The Case is kept current and in accordance to the latest HSE Case standard.

Pipeline facilities shall be operated in accordance with the arrangements described in this HSE Case. In the event of deviation to the asset or activity arrangements described within this HSE Case, requests for deviation or step-out shall be handled through the [PD Operations Deviation Control](#) and such a deviation recorded in the Facility Status Report (FSR).

Furthermore, in the event of any change (temporary or permanent), the impact to asset conditions, activity scope, HSE Critical Elements and organization shall be assessed prior to allowing operations and activities to continue. The Pipelines Asset Management team shall identify the need for a change and justify the change to the facility by following the Corporate Change Management Procedure.



Modifications, demolition, addition and temporary changes to existing Pipeline facilities and equipment shall be carried out and documented in accordance with the [Management of Change \(MOC\) procedure](#). The MOC ensures that changes to engineering projects or existing infrastructures (not like-for-like) are approved, implemented and closed-out such that design integrity is maintained in a technically auditable manner. The HSE Case shall be updated accordingly.

The Pipeline Asset Manager has the accountability for the MOC Process being effective in Pipeline operations. The Technical Authorities shall review MOCs and provide technical recommendations as well as conduct assessments to ensure adequate technical reviews are being performed.



It is also vital that before changes are made to any Pipeline asset or the way it is operated that the Case is consulted as part of the change decision-making process. Change control is an important aspect of a Case to keep it up-to-date, relevant and useful.

Roles and Accountabilities

Two key accountabilities in relation to this HSE Case are:

- Case Owner (Pipeline Asset Manager) and
- Custodian (Head, Pipeline Operations and Maintenance Management).

| Role | Accountable Party | Accountabilities |
|------------|---|--|
| Custodian | Leads, Pipeline Operations and Maintenance Management | <ul style="list-style-type: none">• Responsible to the owner for management of the HSE case• Maintenance and accuracy of the HSE Case, so that it continues to reflect the management of major accident hazards.• Ensures that updates to the Case are prepared and communicated when necessary.• Ensures that the distribution of the case and its revisions and updates are adequately controlled |
| Case Owner | Asset Manager | <ul style="list-style-type: none">• Approval authority for the contents of the Case.• Accountable to Company Leadership for ensuring that major accident hazards management is in accordance with the measures described in this HSE Case. |

Document Control

The only controlled and valid version of this manual is the document on the Pipelines Asset SharePoint site, and the Pipeline Asset Manager (UPC/G/U) remains the custodian of the HSE Case. The HSE Case arrangements and documentation shall be reviewed and updated in line with review criteria stated in Business Control Framework i.e. [EP2005-0310-ST 4.6](#). A record of review indicating the scope of each review and update shall be maintained.

- HSE Case Preparation:

This HSSE Case was developed with input from Pipeline Asset Operations personnel, HSSE specialists and HSSE Management Systems specialists. The experience and involvement of Pipeline personnel promoted ownership of the Case and provided accurate documentation of the operations.

- Case Administration:

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 5 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|------------|



The Pipeline HSSE Case describes how the HSSE Case shall be managed and describes roles and responsibilities of the key personnel involved in Case implementation. The HSSE Case shall be stored in the SharePoint site accessible to all Pipeline staff.

- **HSSE Case Owner:**

The Pipeline Asset Manager is the Case Owner. The Case Owner is accountable for the HSSE management of the operations covered by this Case and is the approval authority for the contents of the Case. The Case Owner is accountable to management to ensure that the HSSE management of the operations is in accordance with the measures described in this HSSE Case.

- **HSSE Case Custodian:**

The Lead HSE and Leads (Operations and Maintenance, Pipeline Integrity, OSSR, RoW, IAP and Pipeline Engineering) are the Case Custodian as it related to each case responsibility. The Case Custodian is accountable for the maintenance and accuracy of the HSSE Case so that it continues to reflect the management of HSSE for Pipeline Asset Operations. The Case Custodian ensures that updates to the Case are prepared and communicated when necessary.

- **HSSE Case Acceptance:**

The Pipeline Asset HSSE Case is approved and issued by the Case Owner. The original issue of the Case was presented to and reviewed by key Pipeline personnel, including the Pipeline Manager. The panel decided upon the acceptability of the Case. When the HSSE Case was accepted, the Pipeline Manager approved its operationalization.

- **Change Control:**

The *HSE Case* arrangements and documentation shall be reviewed and updated in the following circumstances:

- As part of any significant changes to the facility, operation, or surrounding environment that may have a potential impact on the risk profile
- When it cannot be verified that the performance of safety critical elements meets the performance standards set in the *HSE Case* and/or when mitigation measures have been employed for extended periods to compensate for this shortfall
- Prior to /immediately following any material changes to the organisational arrangements or personnel levels
- Following a major incident involving the facility or operation or, from lateral learning from other major incidents applicable to the facility or operation
- Enhancements in knowledge or technology that changes the basic assumptions on which the risk tolerability and ALARP demonstration are based
- Change of Pipeline Asset/Operations Manager
- At a maximum interval of five years.

Process Improvement Actions

Maintenance Integrity Execution (MIE) has been rolled out and sustained annually in Pipelines Asset to assure the integrity of our SCE.

Operating Integrity (OI) has also been embedded in Pipeline Assets to assure that facilities are operated safely following the prescribed standards and guidelines.

Conclusion

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 6 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|------------|



The Pipeline Asset HSSE Case addresses pipeline activities over which the Shell Petroleum Development Company has influence, either directly with its own resources or indirectly through a contractor, that have the potential to incur an HSSE incident.

This HSSE Case is specifically intended for use by the Pipeline Leadership Team. It is their responsibility to recommend amendments to its contents whenever a change is made that affects HSE.

The HSSE Case Custodian has accepted the conclusions and the Statement of Fitness is approved by the HSSE Case Owner.

The Federal Government regulates facets of Pipeline Asset / Operations through various enforcement agencies (e.g. NURC, FMEnv, SMEnvs, NOSDRA, NNRA, CNC etc.). These agencies set requirements for facilities within their area of authority. The regulatory requirements include areas of safety and health, process safety management, environmental risk management, pipeline integrity, clean air standards, and clean water standards, among others. Pipeline Operations have developed programs to meet these regulatory requirements and ensure future compliance.

Based on the information set forth in this Case, it can be concluded that:

- There is a systematic approach to HSSE Management for Pipeline Asset / Operations that follows the Shell Group HSSE Management System. Any deficiencies have been noted and actions put in place to remedy them.
- HSE-critical activities that contribute to the control of Major Hazards have been defined, and all HSE-critical documents are maintained via the SharePoint site.
- The features of the Pipeline areas relevant to HSSE and Emergency Management have been described and HSSE-critical systems that manage HSSE hazards have been identified.
- A hazard register has been developed that identifies and categorizes the Pipeline Asset / Operations' HSSE hazards. Assessment of the Major HSSE hazards has been performed. Measures have been or will be taken to reduce the risk from the high- and medium-risk HSSE hazards to a level that is As Low As Reasonably Practicable (ALARP).
- HSSE assessments have been performed, including Hazards and Effects Management Process (HEMP) Studies. In addition, proactive Hazards and Effects Management is performed throughout the Pipeline Operations primarily via Management of Change, Permit to Work, and Behaviour Based Safety Management processes.
- Asset integrity was verified. Management of Change, compliance with the performance standards described in the Asset Integrity Management System, inspection, preventive maintenance and audit programs are used to ensure continued integrity during the operating phase.
- Contractor HSSE Management for Pipeline Asset / Operations is performed in accordance with the Contractor HSSE Management Process.
- The remedial actions are detailed in the remedial action plan for this HSSE Case, some of which are closed. Target completion dates for these actions have been defined, tracked and followed up.



Statement of Fitness

This statement of fitness confirms for Pipelines Asset that:

1. The HSE case has been developed in accordance with the requirements of the HSSE & SP Control Framework.
2. All Major Accident Hazards have been identified and the risk reduction philosophies and measures identified for ensuring that the risks are tolerable and have been implemented. The Remedial Actions Plan in section 5.0 will be implemented to further manage the risks to ALARP.
3. The Asset shall be operated in accordance with these arrangements.

The Asset therefore meets the criteria to operate it safely and therefore signed off accordingly.

Christopher Griffiths (UPC/G/U)
Pipelines Manager



1.1 Content of the HSE Case

The contents presented below represent the main elements of the Operations HSE Case. They have been aligned with the group HSE Case Standard [EP2005-0310](#) i.e. EP Business HSE Control Framework – HEMP requirements, Tool and Techniques & the HSSE & SP Control framework.

The document is in 5 parts as outlined below:

- Part 1: Overview/Summary
- Part 2: Major Accident Hazards
- Part 3: Safety Critical Element
- Part 4: Management Systems.
- Part 5: Remedial Action Plan.

1.2 Objective of the HSE Case:

The objective of this HSE Case is to provide a documented demonstration that all the Severity 5A/5B and RAM red Hazards in Pipelines Asset have been identified, assessed and managed to ALARP.

The HSE Case includes details of:

- Risk reduction philosophies that have been implemented to ensure that the Severity 5 or High Risks Hazards are tolerable and ALARP
- HSE Critical Elements and their Performance Standards
- HSE Critical Tasks and responsible persons
- Confirmation that Asset Manager is satisfied that the arrangements are in place and asset can operate.

This HSE Case is a demonstration that all the MAH have been identified, that appropriate barriers have been provided and there are robust activities, procedures and competencies in place to ensure these barriers remain effective over the life of the facilities.

The following are in place in Pipelines Asset to assure operationalization of this HSE Case.

Operating envelope and the Case content are aligned. Any changes are made after consulting the Case. The Case is kept current and in accordance to latest HSE Case standard.

Installation maintenance schedules for SCEs are set into SAP, and tasks are set in accordance to prescribed Performance standards. Performance is monitored against these standards.


Major Accident Hazards are identified and known to the Asset operator. Management of MAHs are demonstrated in Bow-Ties and documented in the Operations HSE Case. Everyone can differentiate between hazardous and safety critical activities.

Compliance to ALARP principles is demonstrated and documented through HEMP

Accountabilities are agreed and understood by all levels of the organization.

Remedial action plan tracking process is in place and functioning.

Engagement session by management on regular basis to reinforce understanding on HSE Case intent.

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

1.3 HSE Case Scope

The following physical boundaries in the table below are covered in the Pipelines Asset HSE Case:

Table 1.2: Facilities included/excluded from the HSE Case.

| Facility | Status | Scope/Boundary |
|------------------------------|----------|---|
| Cathodic Protection stations | INCLUDED | Covers all CP solar cell panels, batteries (rechargeable), ground-beds, fittings and others |
| Block Valve Stations | INCLUDED | Covers block valves at river crossings on all delivery and trunk lines. |
| Pipelines | INCLUDED | Covers all pipelines evacuating hydrocarbons from the various flow stations and manifolds. |
| Pipeline Right of Way (RoW) | INCLUDED | Covers all Pipeline right of ways, surveillance guard huts and movement breakers where they exist. |
| Pipeline Manifolds | INCLUDED | Covers all pipeline facilities (launchers & receivers) located within flow stations, gas plants and pipeline manifolds. |

The operations covered in this Case are as outlined in table 1.3 below

Table 1.3 Operations included in this Case

| Operation | Status | Scope |
|----------------------------------|----------|---|
| Normal Operations | INCLUDED | Normal Pipeline operations, including routine maintenance, pigging, CP monitoring, chemical injection, water sampling, and RW surveillance. |
| Pipeline Repairs and Maintenance | INCLUDED | Covers valve changeout, planned and emergency Pipeline repair operations |
| Oil spill response | INCLUDED | Covers reporting, containment, recovery and evacuation of hydrocarbon spills across SCiN assets. |
| Remediation | INCLUDED | Covers clean up, site remediation and certification across SCiN assets. |
| Primary Logistics Operations | INCLUDED | Covers Land and marine transport operations. (Primary Logistics is covered under the Logistics HSE Case) |

Some of the activities and their associated hazards are not entirely limited to the normal operations of Pipeline assets. Thus, there are interactions with other HSE Cases as listed in the table below:


| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

Table 1.4: Interfaces with other HSE Cases

| Activity | Interface | Reference |
|---------------------|--|--|
| Logistics | Hazards associated with air transport, land/marine logistics and accessing some locations. | Corporate Logistics HSE Case |
| Production Hubs | Hazards associated with Crude oil under pressure, Hydrocarbon gas as per loss of containment at the production facilities and Terminals. | Land Hub Central Hub Swamp Hub Sea Eagle |
| Security Operations | Management, Interface and hazards associated with security operations and personnel are managed under Corporate Security HSE-MS | SCiN Security Management System Manual (reference SREM) |
| Projects | Management, Interface and hazards associated with Project operations and personnel are managed under Project HSE Case as applicable. | HSE Case as applicable |

1.3.1 Interface Activities/ Bridging Document

There are several Interface activities (Internal and External) undertaken to sustain Pipeline Asset's processes of managing MAHs.

The Internal interfaces comprise activities provided by other Shell departments (Land Transport, Marine Logistics, Production Hubs, External Relations and the Security Department,) and are guided by regular [SLA](#), while the External Interfaces comprise activities/services provided by Mode 2 Contractors (as defined in [HSSE&SP Control Framework - Contractor HSSE Management](#)) and are guided by HSE-MS Bridging documents to align with SPDC's HSE-MS requirements. This detail bridging information used to clarify accountabilities, roles and responsibilities for the management of HSE-critical activities and captured as part of the Project HSE Plan where necessary.

All Service Providers and Company employees assigned to Pipeline's work sites or installations described within this document or directly responsible for the support operation shall be made aware of the content of this document and relevant supporting information. Copies of all required Permits and procedures relevant to the management of HSE of the contract shall be provided.

All work activities on pipelines shall therefore be carried out under SPDC HSE-MS, except for Mode 2 Contractor operations, where Bridging Documents are employed to cover interface activities.

1.4 Facility Overview/Asset Description

This section contains the summary description of Asset covered in the HSE Case. This HSE Case covers the Pipelines Asset facilities (Land and Swamp).

1.4.1 Asset Description

The Pipelines assets has been depicted in the [Pipeline Asset Register](#)

The document provides a listing of all SPDC Pipeline assets.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 11 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|




1.4.2 Encroachment Status of Pipelines Facility

Encroachment has been identified as an area of great concern in Pipelines Asset operations. These encroachments are either in the form of buildings, farmlands, or Right of Way (ROW) being used as roads.

The Pipeline Asset management has taken steps to address the concerns posed by this.

1.5 Summary of Remedial Actions

Remedial actions have been identified as follows [Pipeline HSE Case RAP Actions Activity Plan](#) as contained in the part 5 of this HSE Case

| | | |
|---|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|---|-------------------------------|-----------|

This page is intentionally left blank

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 13 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



PART 2 MAJOR ACCIDENT HAZARDS

2.1 Past Incidents

A summary of High-Risk Incidents that have occurred in Pipeline Asset Operations and other significant incidents can be found in [SCiN Incident Management Folder](#)

Lessons from incidents are normally implemented via [SCiN LFI Library](#); [Group LFI Database](#); [LFEs](#) and captured in HAZOP updates, where required.

2.2 Hazard and Effects Register

Hazard and Effects Register

The purpose of the Pipelines HSE Case is to give an overview of all Severity 5A/5B and RAM red Hazards, associated risks and how they are managed through controls (barriers, recovery measures). Criteria for the evaluation of HSE hazards are given in detail in the procedure [SPDC Procedure for Evaluation and Registration of Hazards HSE P-14](#). The evaluation involves an assessment of the HSE hazards, following the definitions of probability and consequences as stated in [Shell Risk Assessment Matrix \(RAM\)](#).

For each Severity 5A/5B or RAM red Hazard, the register lists:


Table 2.1 RAM Register list for Severity 5A/5B or RAM red Hazards

| Heading | Explanation |
|-------------------------------|---|
| Hazard Reference | Unique reference number (ref. <i>EP2005-0300-SP-01</i>) |
| Hazard Source | Activities involving hazard or that exposes personnel to hazard (hazardous activities) |
| Location/Process/Area: | Where to find the hazard |
| Threats | What can go wrong (that can trigger the release of the hazard to cause harm or damage) |
| Responsibility | Overall responsible party for providing /managing identified controls |
| Top Event | Undesired Outcome/ Event (first outcome that occurs when a threat releases a hazard) |
| Consequences | The effect or impact on HSE. This can be: P: Personal A: Asset C: Community E: Environment |
| Inherent Risk | The risk if we were not managing the hazard – no barriers nor recovery measure is working. Credible worst-case scenario. |
| Barrier | All management activities that prevent the threat from releasing the hazard into a top event |
| Recovery | If the Top Event (accident/incident) has happened; what do we do to limit the severity of the effect/impact/consequence |
| Residual risk | The risk as it is now in Pipeline facilities; taking the effectiveness of all barriers and recovery measures (controls) into consideration. |



Table 2.2 MAH Register

| Hazard | Threat | Top Event | Consequence | P | A | C | E |
|-------------------------------------|--------------------------------------|----------------------------|---|----|----|----|----|
| H-01.005 – Crude oil under pressure | Maloperation/ Incompetent operator | Loss of containment | Environmental pollution – Spill to land/water | C5 | C5 | B5 | C5 |
| | Equipment failure/plant modification | | Injury/Health effect (Acute: eye, respiratory tract ... | C5 | C5 | B5 | C5 |
| | Dropped object impact | | Fire (Spill with subsequent ignition resulting in ... | C5 | C5 | B5 | C5 |
| | Corrosion/Erosion | | Emissions to air (smoke from fire and evaporation) | C5 | C5 | B5 | C5 |
| | Sabotage | | | | | | |
| | Vehicle / Vessel impact | | | | | | |
| | Source of ignition (spark) | | | | | | |
| | Over pressurisation | | | | | | |
| H-01.002 – Condensate, NGL | Maloperation/ Incompetent operator | Loss of containment | Fire (Spill with subsequent ignition resulting in ... | C5 | B5 | B5 | B4 |
| | Vehicle/vessel impact | | Injury/Health effect (Acute: eye, respiratory tract ... | C5 | B5 | B5 | B4 |
| | Over pressurisation | | Environmental pollution – Spill to land/water | C5 | B5 | B5 | B4 |
| | Dropped object impact | | | | | | |
| | Sabotage (theft) | | | | | | |
| | Equipment failure/plant modification | | | | | | |
| | Corrosion / Erosion | | | | | | |
| H-01.003 – Hydrocarbon Gas | Source of ignition (spark) | Release of hydrocarbon gas | Fire (gas ignition resulting in fire & explosion) | B5 | B5 | B5 | B4 |

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

Equipment failure/plant modification
Sabotage (theft)
Vehicle /Vessel impact
Dropped object impact
Maloperation/ Incompetent operator
Over pressurisation
Corrosion/Erosion

Un-ignited gas cloud
Injury/Fatality

| | | | |
|----|----|----|----|
| B5 | B5 | B5 | B4 |
| B5 | B5 | B5 | B4 |

H-07.001 – On land transport (driving)

Driver physically unfit
Driver error (poor behaviour/wilful misconduct, lack ...
Load in/on vehicle (overloaded/instability weight & ...
Driving under the influence of alcohol, drugs or ...
Fatigue (mental stress leading to (loss of ...
Equipment (vehicle, tyres) failure/in poor vehicle ...
Road and environment (Poor design and maintenance of ...
Logistics/transport planning
Other road users (other vehicle driver's poor ...
Bad weather/Reduced visibility conditions (dust, fog, ...
Excessive speed for conditions

Loss of Control

Damage to asset

Driver or passenger LTI

Third party LTI

| | | | |
|----|----|----|----|
| C5 | C2 | D1 | B3 |
| C5 | C2 | D1 | B3 |
| C5 | C2 | D1 | B3 |

H-07.002 – On water transport /H-08.04 Boat Collision to other ...


Others (Logistics/transport planning, Poor ...

Loss of control / buoyancy

Damage to asset

| | | | |
|----|----|----|----|
| C5 | C2 | D0 | C3 |
|----|----|----|----|

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 17 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

Over speeding
 Load in/on craft (instability and overloading, bulk ...
 Hazardous area/alternative route
 Extreme weather condition (thunderstorm, fog, rain, ...
 Craft (poor maintenance, inappropriate for task)
 Boat crew physically unfit (poor vision, illness)
 Operator error (lack of competence)
 Other water way users (Other waterway users poor risk assessment)

Third party LTI
 Boat crew or passenger LTI

| | | | |
|----|----|----|----|
| C5 | C2 | D0 | C3 |
| C5 | C2 | D0 | C3 |

Same as above

| | | | | | | | |
|--|---|---|--|----|----|----|----|
| H-11.001 Insufficient Oxygen in atmosphere during confined space entry (Cofferdam) | Mal operation - multiple repair point activities within one isolated section Unavailability of portable gas detectors Poor ventilation / failure of air blower Poor supervision / non-usage of applicable procedure for cofferdam work | Loss of Consciousness | Loss of ventilation due to Mal operation and equipment failure – leading to asphyxiation | C5 | C0 | B3 | C2 |
| | | | Injury / Fatality | C5 | C0 | B3 | C2 |
| H-16.004 – Organized Crime (Piracy & Assault) | Lack of security forces (law & order) Criminal Activities Provocative attitude Military presence, aggression, accidental/unlawful Poor community relations Community unrest | Intrusion and attack on personnel & asset Fighting, Attack on personnel, equipment/ boat seizure | Hostage taking | C5 | B3 | D1 | B3 |
| | | | Post-Traumatic Stress | C5 | B3 | D1 | B3 |
| | | | Personnel injury/fatality | C5 | B3 | D1 | B3 |

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 18 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



For Details about the Pipelines Asset Hazard Register, you can view through this [SPDC Pipeline Hazard Effects Register](#).

2.3 MAH Identification & Management

Hazards associated with Pipelines Asset activities could impact on personnel, cause damage to assets, affect the community and environment. Thus, to achieve operational success, it is therefore imperative that these hazards are evaluated and adequately managed.

The Hazards and Effects Management Process (HEMP) is the process by which Pipelines Asset team manages the hazards associated with her operations.

Table 2.3 below describes the processes involved in hazards evaluation.

Table 2.3: The Key Steps of the HEMP Process

| | |
|----------|---|
| IDENTIFY | Identify all hazards associated with facility through a comprehensive and structured process. |
| ASSESS | Assess the likelihood (how often the hazardous event could occur), the size of the consequences (e.g. how big is the fire), and the severity of the outcome (what sort of damage/harm would occur). |
| CONTROL | Determine what needs to be in place to remove the hazard from the business, or reduce the likelihood of it occurring, or reduce the size of the consequences and severity. |
| RECOVER | Provide measures that allow people to get away from the location of the hazard (e.g. lifeboats to abandon a platform) or re-establish normal operations after an incident. |

Above all, demonstration that risks have been reduced to a level that is ALARP.

Compliance to ALARP principles is demonstrated and documented through HEMP.

2.3.1 Hazard Identification (HAZID)

Definition: A hazard is anything that has the potential to cause:

- Harm to people such as ill health or injury
- Damage to assets
- Impact on Community
- Harm to the environment



The hazards associated with Pipelines Asset activities were identified through a structured HAZID workshop that drew in staff with wide range of Operations and maintenance experience using the [SPDC Pipeline Hazard Effects Register](#).

Using the skills and experience of the multi-disciplinary team, each of the hazards in the inventory is reviewed to determine whether the hazard could occur when operating the Pipelines Asset. Potential threats and consequences were also identified.

The hazards identified are recorded in a hazard register, which is the complete record of all hazards, their threats, consequences and risk ranking (discussed in part 2.2 above).

2.3.2 Risk Ranking and MAH

The classification of hazards as MAHs is determined by risk ranking using the Risk Assessment Matrix

| SEVERITY | CONSEQUENCES | | | | INCREASING LIKELIHOOD | | | | |
|----------|--------------------------------|-----------------|-----------------|-----------------|--------------------------------|--------------------------|---|---|--|
| | People | Assets | Community | Environment | A | B | C | D | E |
| | | | | | Never heard of in the Industry | Heard of in the Industry | Has happened in the Organisation or more than once per year in the Industry | Has happened at the Location or more than once per year in the Organisation | Has happened more than once per year at the Location |
| 0 | No injury or health effect | No damage | No effect | No effect | | | | | |
| 1 | Slight injury or health effect | Slight damage | Slight effect | Slight effect | | | | | |
| 2 | Minor injury or health effect | Minor damage | Minor effect | Minor effect | | | | | |
| 3 | Major injury or health effect | Moderate damage | Moderate effect | Moderate effect | | | | | |
| 4 | PTD or up to 3 fatalities | Major damage | Major effect | Major effect | | | | | |
| 5 | More than 3 fatalities | Massive damage | Massive effect | Massive effect | | | | | |


Hazards for which the Risks are within the outlined black lines shown by the arrow below typify MAH

Figure 2.1: Risk Assessment Matrix

The four colours in the application of the [RAM](#) mean the following:

Light Blue

Manage for continuous improvement, although Businesses may set lower priority for further Risk reduction.

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

| | |
|------------------|--|
| Dark Blue | Manage for continuous improvement through the effective implementation of the HSSE Management System. |
| Yellow | Identify and implement Controls and Recovery Measures to reduce Risk to As Low As Reasonably Practicable (ALARP). |
| Red | Identify and implement Controls and Recovery Measures to reduce the Risk to ALARP and provide a Documented Demonstration Of ALARP by a Bow-Tie or equivalent methodology |

The hazards in Part 2.2 Table 2.2 (MAH Register) have been risk-assessed per the following impact categories:

| | | | |
|-----------|-------------|----------|----------|
| High Risk | Medium Risk | Low Risk | Low Risk |
|-----------|-------------|----------|----------|

- P – Harm to people
- A – Asset Damage and other Consequential Business Loss
- C – Impact on Community
- E – Environmental impacts

Low Risk (Blue/Light Blue): Manage for continuous improvement

Medium Risk (Yellow): Incorporate risk reduction measures. Control to ALARP

High Risk (Red): Incorporate risk reduction measures. Control to ALARP. Tolerability of risk is to be endorsed by the Line Manager directly accountable for the Location or Organization.

Hazards within the dark/light blue areas need to be managed for continuous improvement in accordance with the HSE-MS and Company Policies. The risks posed from these hazards are managed adequately through the application of standards and HSE procedures

Hazards within the yellow area (but with consequence severity of 4 or lower) need to be controlled to ALARP; but not through this HSE Case. These are captured in the hazard register.

Major Accident Hazard: A specific hazard is classified as MAH if it is assessed as “High” risk (red area in RAM) or if it has a severity 5 consequence. For MAHs, ALARP is demonstrated through this Case by using the Bow-Tie model.

From the Pipeline Asset Risk Ranking exercise the following hazards have been classified as MAHs.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 21 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|


| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

Table 2.4: Major Accident Hazards

| ID | Hazard | Assessed in Hazard Control Sheet | Applicable Bow-Ties |
|----------|---|---|---|
| H-01.002 | Condensate | Hydrocarbons (unrefined) – Riser/ Pipelines – Oil and Gas – Flow Stations to Manifolds (delivery line), Manifolds to Terminals (Trunklines) | <ul style="list-style-type: none"> • Crude oil under Pressure /Condensate • Hydrocarbon gas |
| H-01.003 | Hydrocarbon gas | | |
| H-01.005 | Crude Oil | | |
| H-07.001 | Land transport | Dynamic Situations – Driving | <ul style="list-style-type: none"> • Driving during operations |
| H-07.002 | Water Transport | Dynamic Situations – Vessel /Marine Collision | <ul style="list-style-type: none"> • Water Transport |
| H-07.003 | Air Transport | Dynamic Situations – Helicopter Crash | <ul style="list-style-type: none"> • Air Transport |
| H-11.001 | Insufficient Oxygen in atmosphere during confined space entry (Cofferdam) | Atmosphere / Medium | <ul style="list-style-type: none"> • Insufficient Oxygen in atmosphere during confined space entry (Cofferdam) |
| H-16.004 | Armed Attack and Organized Crime | Security – Armed attack, organized crime (oil theft), kidnap. | <ul style="list-style-type: none"> • Armed attack/organized crime |

2.3.3 Application of the Bowtie

Fit for purpose Bow – ties specifying the required barriers and controls to manage the MAHs have been developed by the Pipelines Asset Team and reviewed by the relevant Technical Authorities to ascertain their robustness.

Please note that the Land/Water/Air Transport and Armed Attack/Organized Crime Bow-Ties have been adopted from the Logistics and Corporate Security HSE MS (reference Security Risk Exposure Matrix, SREM) respectively.

2.3.4 Hazard and Barrier Assessment

Hazard Control Sheets (HCS) presented in Part 2.4 below provide full details of each of the MAHs. The HCS detail the nature of the hazard, the threats and consequences from the hazards, a description of the barriers put in place, effectiveness review of the barriers and a demonstration of ALARP management of the risk.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 22 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



2.3.5 Barrier/Control Effectiveness

The application of the bow-ties concept enabled the Pipelines Asset team to identify the barriers and controls required to manage the identified threats and consequences in her operations. However, the safety of personnel at the facility greatly depends on how effectively the barriers and controls are applied on site.

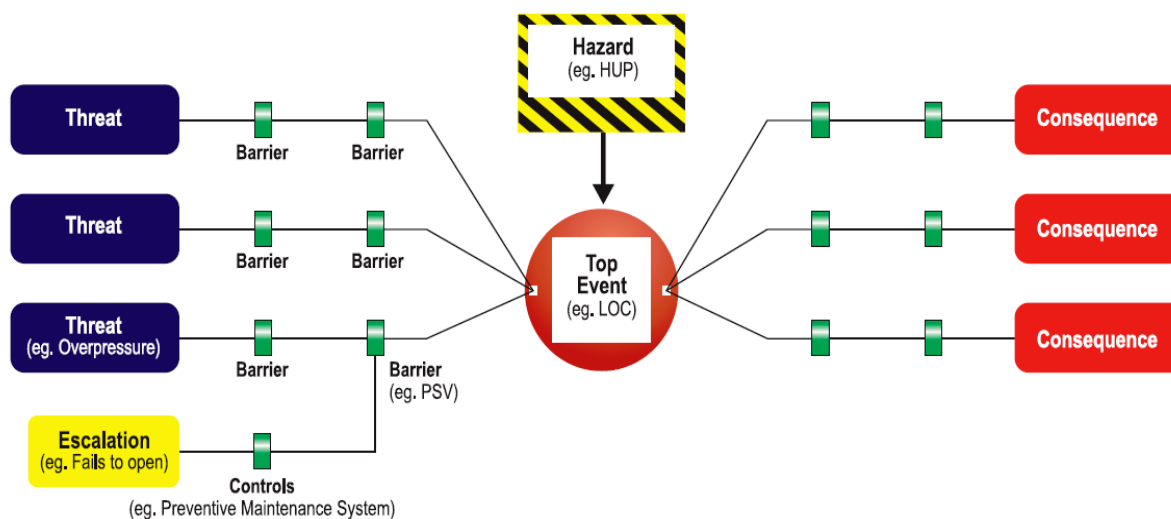


Figure 2.5: Barrier/Control Effectiveness Schematic

These controls are managed through systems, processes and tools such as Inspections, Audits, Competency Assurance, CMMS (SAP), Fountain, Issues Tracking Register, PIMS, etc.

Determining the effectiveness of the controls is important and relies on feedback from frontline Operations and Maintenance personnel as well as audit findings/reports. The ranking for controls in the Bow-Ties can be seen in Section 2.8.4

2.3.6 ALARP Risk Management for Major Hazards

A risk is ALARP if it can be demonstrated that all possible, economically viable controls to prevent the hazard from being released or limit the consequences have been implemented, and that the cost of introducing further, additional controls would be grossly disproportionate to the benefit gained in terms of risk reduction.

This part of the HSE Case considers each of the hazards in the severity 5 and high-risk zone of the matrix and discusses possible additional controls, which could be introduced to reduce the risk still further. The cost of these controls is qualitatively assessed and, if the cost is determined to massively outweigh the risk reduction achieved by introduction of the control, the risk is demonstrably ALARP. If, however, additional



controls are identified where the associated cost is not disproportionate to the benefit gained, an action is raised as remedial plan in Part 5 of the HSE Case to undertake further quantitative cost- benefit analysis.

2.3.7 Operating Envelopes

The facility has been designed to tolerate some temporary deviation from normal operations, provided that additional precautionary measures or a reduction in certain activities is undertaken. This deviation is controlled through the facility status report, management of change procedure and Manual of Permitted Operations (MOPO) (see below).

Safe operation of the facility is dependent on remaining within a defined operational envelope that has been assessed as providing a suitable level of control.

2.4 MAH Assessment Sheets

Details of the MAH assessment are shown in table 2.2 and also reflected in the [SPDC Pipeline Hazard Effects Register](#)

2.5 Bow-Tie Assessments


The Bow-Tie model provides for the assessment of Hazards in order to:

- Identify the potential Hazard release, escalation and Consequence scenarios
- Identify the controls (i.e., Barriers and Escalation Factor Controls) required to effectively manage these Hazards, (e.g. the HSE Critical Elements, HSE Critical Tasks and procedures)
- Support the ALARP demonstration
- Provide visibility and communicate the above information to those responsible for managing, or who may be affected by the Hazards
- In the event of an incident, can relate causes of incidents to the controls that failed, thus enabling improved incident learning and prevention.

The Bow-Tie XP software package facilitates implementation of this specification in SPDC.

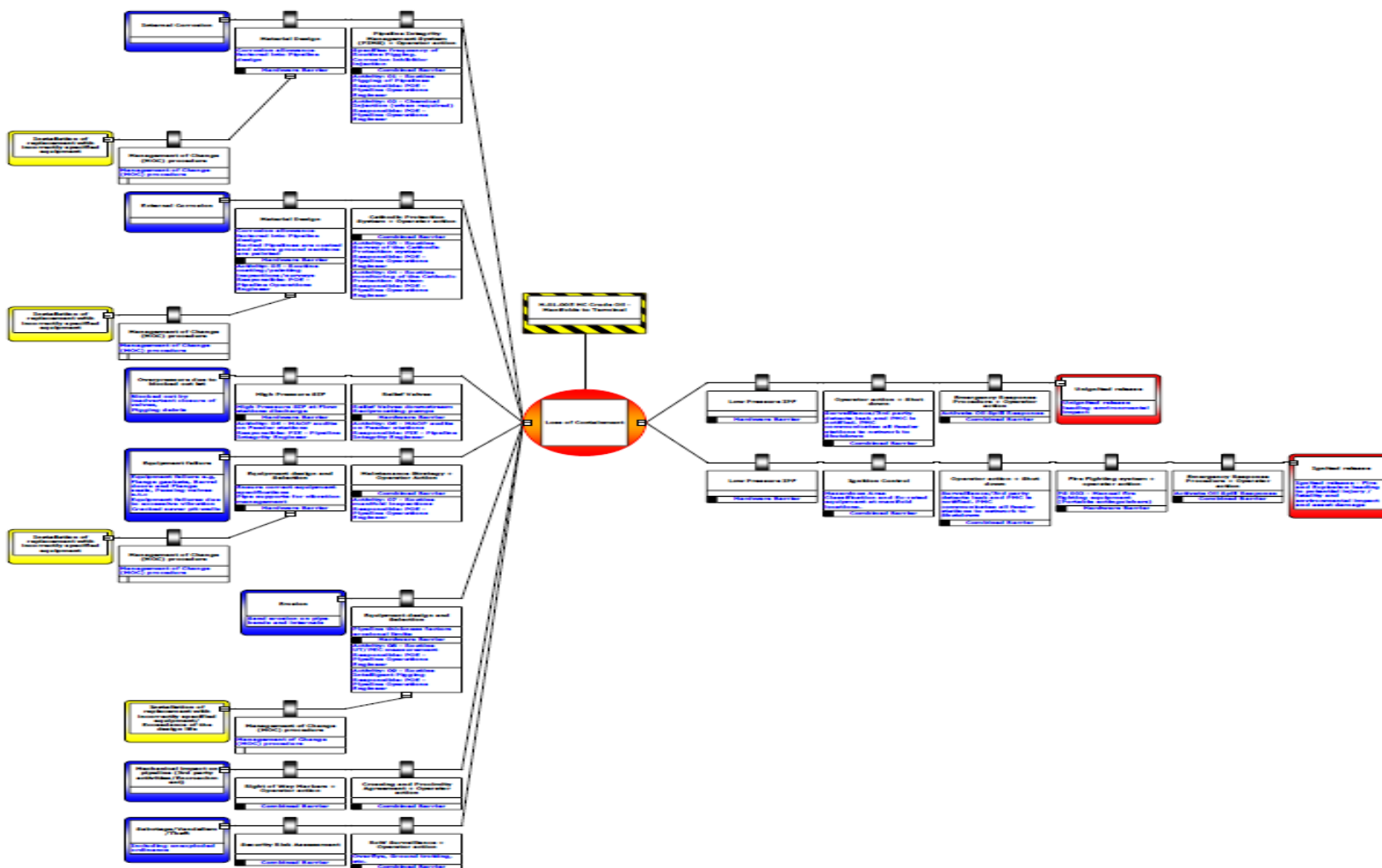
The following 8 Major Accident Hazards (MAHs) were identified as inherent in Pipeline Asset

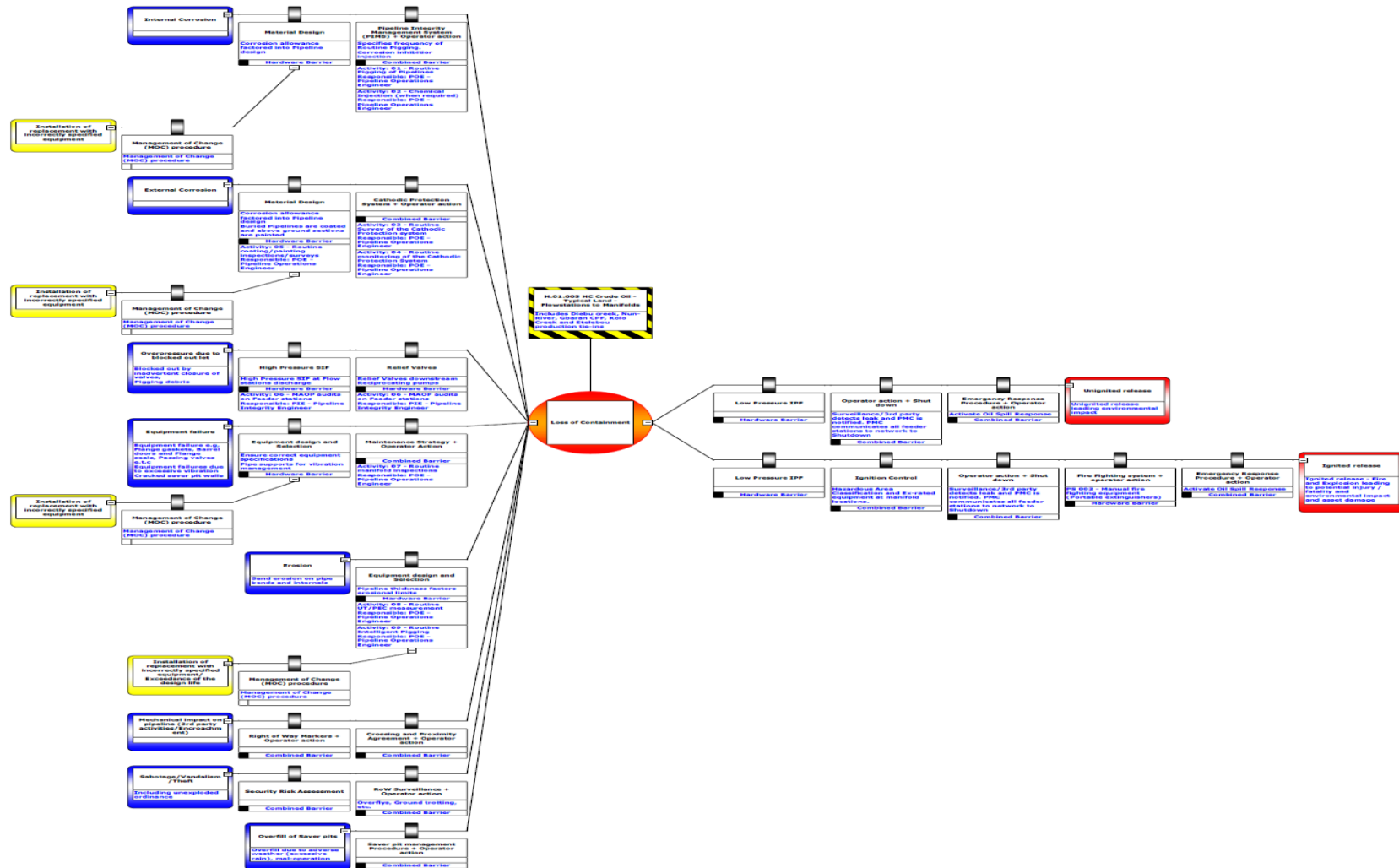
| | |
|----------|--------------------------|
| H-01.002 | Condensate |
| H-01.003 | Hydrocarbon Gas |
| H-01.005 | Crude Oil under Pressure |
| H-07.001 | On Land Transport |
| H-07.002 | Water Transportation |
| H-07.003 | Air Transport |
| H-11.001 | Oxygen Depletion |
| H-16.004 | Organised Crime |

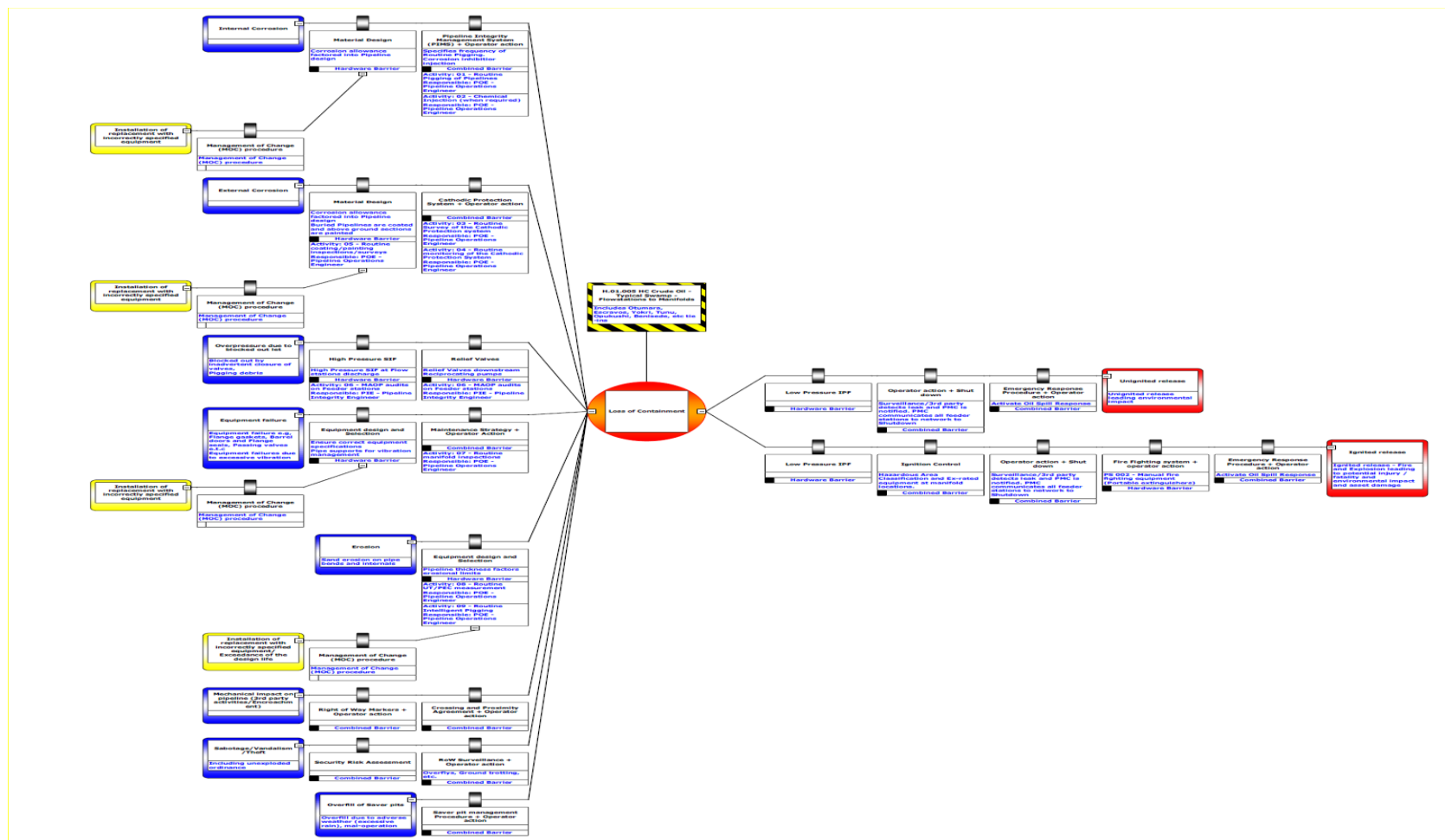
| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

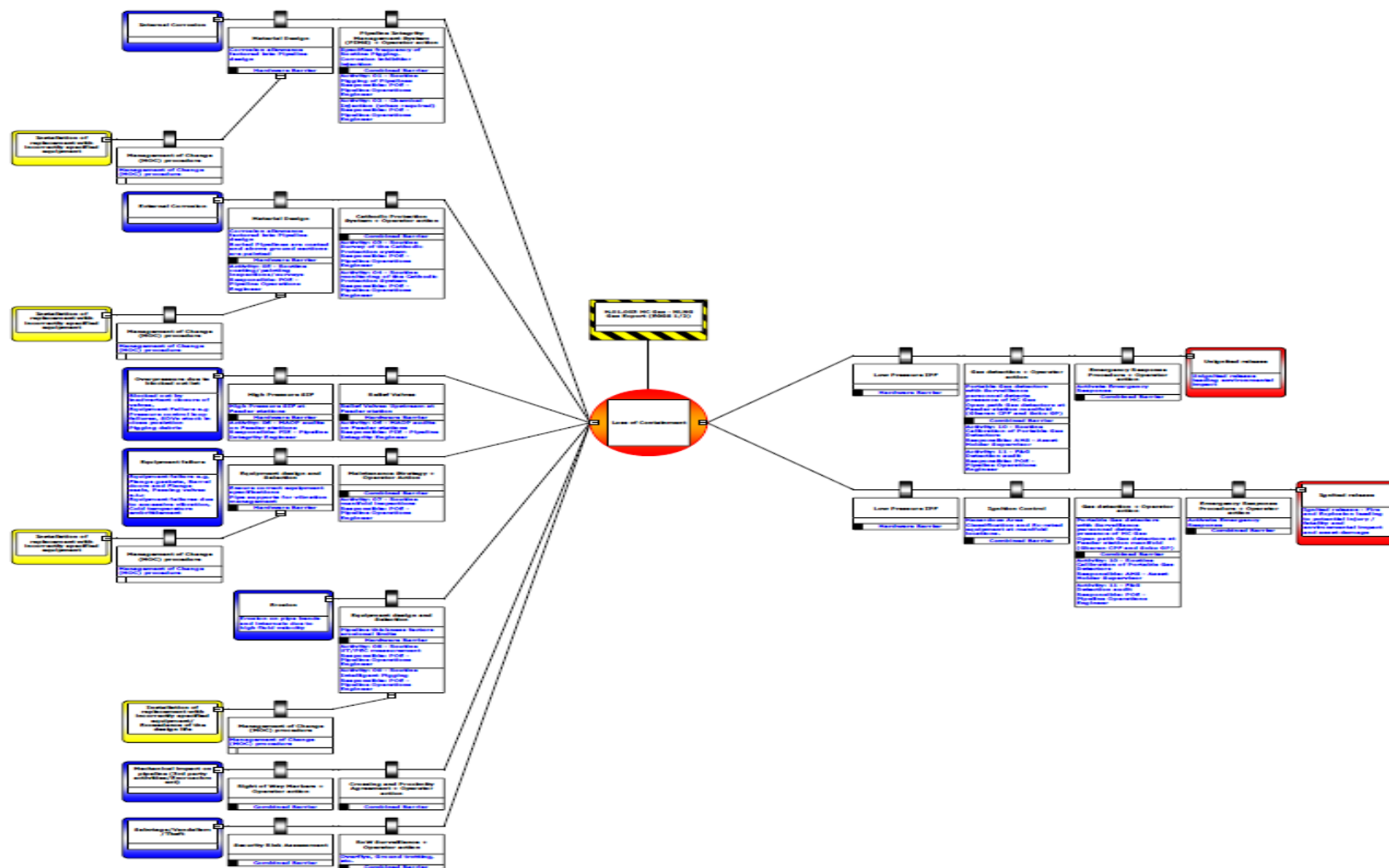
Bow-Tie assessment conducted for each of the MAHs and generated in the Bowtie XP software can be accessed through the MAH listing below and Clearer versions of the bowties can be viewed via this [Link](#):

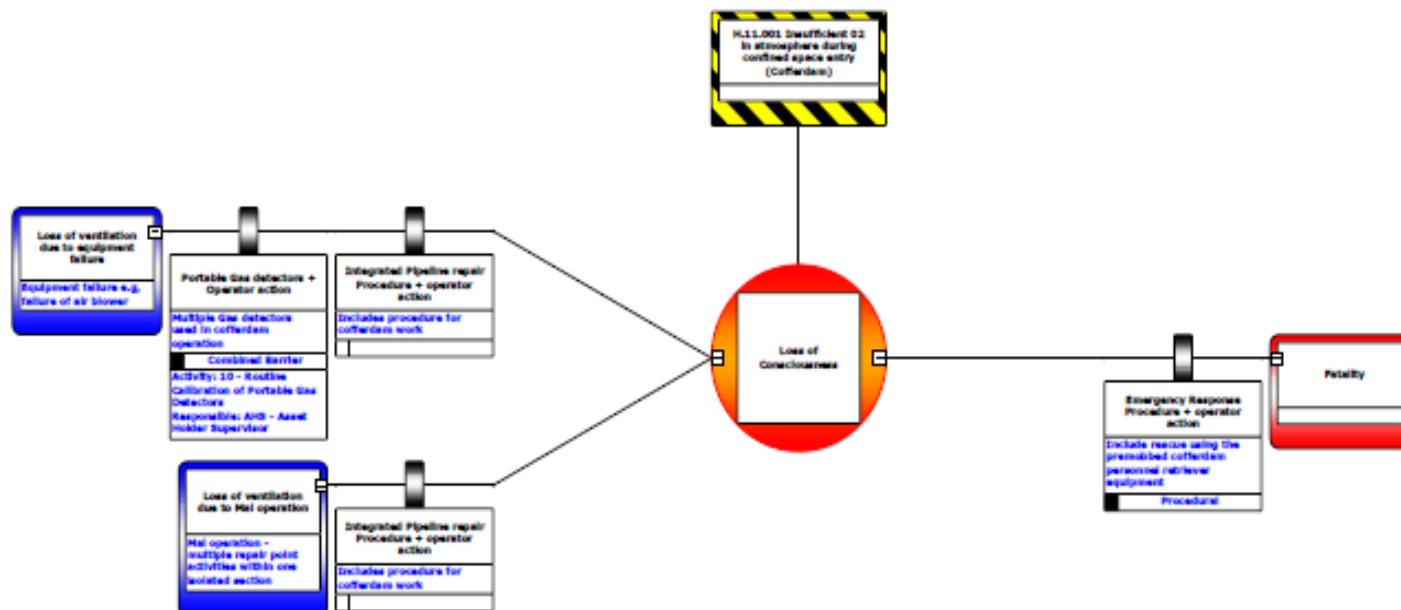
| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 25 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|











| | | |
|---|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|---|-------------------------------|-----------|

2.6 Summary of Studies and Results

Table 2.5 below lists the various HEMP, safety and risk studies undertaken for the Pipelines Asset, and which are also considered to be HSE Critical documents. The full document summary is provided via below attached links:

| Aspect | Document |
|---|--|
| EIA | The Shell Petroleum Development Company of Nigeria. (Replacement of the 650 M Nun River Crossing Section of the 10" X 18.6 Km Diebu Creek – Nun River Pipeline), Oct. 2006 |
| EGGS 1 Phase 2 Block Valve QRA Report | EGGS 1 Phase 2 Block Valve Quantitative Risk Assessment |
| Field Corrosivity Test (FCT) Campaign | FCT Campaign carried out in 2006 |
| Security Plan for FCT Campaign in PEA.PDF | Security Plan Campaign carried out for the Old PEA |
| Safety Critical Elements | Safety critical element |
| (PIMS) | Pipeline operations have deployed the Pipeline Integrity Management System (PIMS) to manage its maintenance process and Production Control |
| Kolo Creek–Soku Bulk-line HSE Case | K2S Design HSSE Case and Alarp Demonstration |
| Risk Assessment on Pipeline local isolation requirements | Integrated Pipeline Repair Procedure |
| HAZOP for Pipeline Assets | As documented in various HAZOP studies and archived |
| Pipeline Overpressure Protection | As documented PIPELINE Engineering records for MAOP guidelines |
| Risk Based Studies for Eastern Pipelines | As documented in FIT4 risk management system |
| HRA | Cooperate Pipeline HRA |
| Pipeline Asset Hardware Barrier Assessments (HBA) Report | SPDC Pipeline HBA Closeout |
| Security Risk Assessments (SRA) | Security Risk Assessment Pipeline East Security Risk Assessment Pipeline West |

It should be noted that any actions arising from these assessments/ studies are uploaded in Fountain and tracked to close out.



2.7 Risk Reduction Philosophies

2.7.1 General

All the hazards in the Asset are known and the decision type to reduce the risks to ALARP is Type A/B, based on Decision Framework (See Fig2.2). The key risk reduction philosophies are based on this premise.

2.7.2 Overpressure protection

The philosophy is to provide overpressure protection systems but reduce the frequency of the initiating events for overpressure, to reduce the demand on the protective systems.

Initiating events of high pressure include:

- Blockage in the process
- Maloperation of valves
- Spurious closure of valves
- Sabotage
- Hydrates (for gas processing systems)

2.7.3 Corrosion Management

External corrosion management is based on coating/wrapping complemented by Cathodic Protection system for buried pipelines. For internal corrosion, the default management system is regular pigging complemented by corrosion inhibition where necessary. For corrective actions a risk-based approach is adopted.

2.7.4 Fire Protection

Key fire protection measure in the manifolds is the separation distance (fire breaks) around the manifold perimeter fences to mitigate the risk of escalation and isolation of the inventory feeding the fire.

The Pipeline Right of Ways (ROWs) are kept maintained to minimize escalation of bush fire.

2.7.5 Active Fire Protection

Active fire protection systems are deployed in the pipelines manifolds, based on two types of response protection such as

- Fixed firefighting systems (e.g. extinguishers).
- Manual response by emergency response crews using mobile equipment.

Fire water hydrant systems are available for extinguishing fires in some cases such as Pipeline pigging manifold within the Producing Facilities and Receiving Terminals.

Remote manifold stations are unmanned mostly with no firefighting facilities.

2.7.6 Explosion Overpressure Protection

Pipeline Process Facilities have been designed with no specific blast resistance. However, occupied buildings (guard huts/ROW shelters) are sited where the individual risk of explosion impact is within tolerable levels and ALARP in line with PSBR-1 (Safe siting of occupied buildings)



2.7.7 Prevention of ignition

Separation between process pipelines manifolds and strong sources of ignition – flares and process facilities – are maintained to ensure that any gas will be dispersed to below the lower flammability level for releases (with a size up to 50 mm).

Hazardous areas are classified per the Institute of Petroleum's Model Code of Safe Practice IP part 15 Edition 2. Electrical equipment rated for use in Zone II hazardous areas should be installed away from Zone I or Zone 0 hazardous areas.

Instrumented Protective Systems

All safety instrumented functional systems (SIFs) are classified with the appropriate Safety Instrumented Levels (SIL).

2.7.8 Fire and gas detection

There are no fixed fire and gas detection systems at the remote manifolds and pipeline RoWs. However, some of the Pipelines pig traps located within the Producing Facilities/Receiving Terminals are covered within their fire and gas protection systems.

In general, during work activities, hand-held gas detection systems are provided to detect gas leaks that could cause harm to personnel, or on ignition, cause significant explosion impact or sizeable fires, whilst carrying out pipelines operations activities.

Prior to work commencement, gas testing is carried out to assure that there is no gas leakage.

On confirmed gas during work activity, personnel are evacuated from worksite, the equipment within the fire zone are isolated and depressurized and dependant equipment in other fire zones shutdown and isolated before work re-commence.

2.7.9 Manning

Generally, pipelines Facilities are un-manned. However, there is an arrangement for local surveillance guards who patrol the manifolds and right of ways.

Other philosophies adopted in Pipelines are as shown in the table below.

| S/N | Philosophy | Applicable MAH |
|-----|---|----------------------|
| 1 | Adherence to Preventive Maintenance & Corrective Maintenance/Management of change | All but Security |
| 2 | Strict adherence to PTW procedure and Access Control | All |
| 3 | Minimal Manning Levels/Adherence to appropriate specific work crew cycles | All |
| 4 | Optimised Job Planning | All |
| 5 | Competence Based Development | All |
| 6 | Active community engagement | Security/Hydrocarbon |



2.8 ALARP Demonstration

2.8.1 Objective

The objective of this section is to:

- Review the mitigation measures for the identified major accident hazards and propose remedial measures
- Demonstrate that the risk levels, following the implementation of the remedial actions, are ALARP

2.8.2 Means of Demonstrating ALARP

To demonstrate that all reasonably practicable measures to reduce risks have been undertaken, the appropriateness of the arrangements was assessed using the ALARP Decision Framework (Fig 2.2 below).

For all Pipeline facilities, the hazards are well understood and the issues considered for risk reduction lie in Type A of the Framework whereby codes and standards, good practice, engineering judgement are the main factors in determining whether a measure is reasonably practicable. The only exceptions are the risk reduction issues against the consequences of vapour cloud explosions which lie in Type B whereby some element of risk-based analysis dominates.

Substantial input to the process of determining ALARP is provided by using Bowties developed for identified Major Hazards in Shell Operations. The process below was followed:

- Identification of the barriers including escalation factor controls, required to reduce the risks to ALARP
- Assessment of the validity of the specified barriers and escalation factor controls
- Confirmation using good judgement that there are no further Reasonably Practicable barriers required, based on Generic bowtie barriers and escalation factor controls
- Determination of the HSE critical tasks required to design, operate and maintain the barriers
- Determination of the HSE critical positions and competencies needed to operate and maintain the barriers
- A list of remedial actions identified to provide the missing barriers or improve the effectiveness of the existing barriers

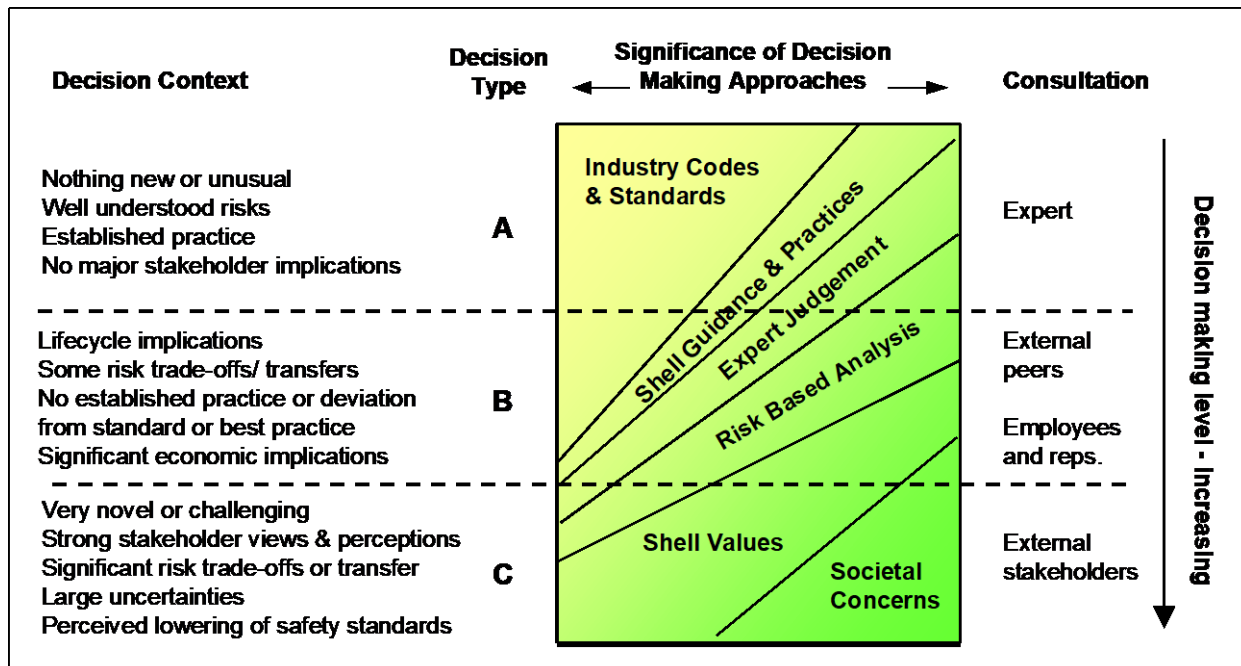


Figure 2.2 Decision Framework

2.8.3 ALARP DETERMINATION

Several HEMP studies were carried out as shown in Section 2.6 and others that may be required will be included in the remedial action plan (Part 5).

Reviews to evaluate missing barriers and effectiveness of the barriers were undertaken (see Table 4.5 below) and remedial actions arising there from were included in the remedial action plan. It is considered that following the implementation of the remedial actions, the risk levels are demonstrably at ALARP level.

2.8.4 Effectiveness of Controls:

After the identification of "Barrier" or "Recovery" measures, an evaluation of the quality of each is done as part of the ALARP assessment. The criteria used for establishing the quality rating is:

Effective – the control always works as intended.

Partially Effective – control works most of the time but there are some weakness or performance issues.

Ineffective – the control is not present, or if present its not suitable for the required function.

If a control is ranked as 'Partially Effective' or 'Ineffective' then there is a risk that the barrier it supports will fail leading to the potential for a major accident (or the inability to recover from one). To correct this weakness, a Remedial Action is raised which identifies what action needs to be undertaken to reinstate the control to full effectiveness.

The quality should be verifiable through e.g. audit of the HSE critical activity needed to maintain an effective barrier.

The following table defines ALARP Criteria based on barriers and controls

Table 4.5 ALARP Evaluation and Determination Criteria

| | OVERPRESSURE | | | | | | | | | | |
|--|---------------------------|-------------------------------|----------------------|--|--------------------|-----------------------|-----|------------------|------------------|------------------|---|
| | | | | | | | | | | | |
| | THREAT | | | | | CONSEQUENCE | | | | | |
| | MAWP | SDS | PSV | | Ignited release | Leak detection System | F&G | Ignition Control | Shut Down System | Blow down system | Explosion protection (Active /passive) |
| PIPELINES | YES | YES | NA | | | | | | | | |
| MANIFOLDS | YES | YES | YES | | Un-ignited release | Leak detection System | F&G | Shut Down System | Blow down system | Drain system | Booms/Clean up |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | INTERNAL CORROSION | | | | | | | | | | |
| | | | | | | | | | | | |
| Material Selection & Corrosion Allowance | Chemical Injection System | Pipeline Replacement Program | Corrosion Inhibitors | | | | | | | | |
| YES | YES | YES | NA | | | | | | | | |
| | | EROSION | | | | | | | | | |
| | | | | | | | | | | | |
| Material Selection & Erosion Allowance | Fluid velocity limits | Sand detection and monitoring | | | | | | | | | |
| YES | YES | N/A | | | | | | | | | |
| | EXTERNAL CORROSION | | | | | | | | | | |
| | | | | | | | | | | | |
| Material Selection | Fluid velocity limits | Cathodic Protection | Coating / Painting | | | | | | | | |
| YES | YES | YES | YES | | | | | | | | |
| | | | | | | | | | | | |
| Legend | | | | | | | | | | | |
| | Effective | | | | | | | | | | |
| | Partially effective | | | | | | | | | | |
| | Ineffective | | | | | | | | | | |

The Justification to Operate in Section 1 is based on the demonstration that Pipelines Asset meets these ALARP criteria and can be operated safely in compliance with Shell Policy and requirements.

The [ALARP Determination documented for Corporate Pipelines Asset](#) demonstrates that inherent risks associated with Major Accident Hazards (MAHs) are being managed to As Low As Reasonably Practicable (ALARP). It supports the continued operation of the facility with reviews following learning from major incidents and technological advancement.



2.9 Manual of Permitted Operations (MOPO)

The MOPO is a matrix, or set of matrices, that maps operational activities against foreseeable situations that could compromise safe operating limits; if or when they arise. It was developed by reviewing the typical range of activities performed and any threats and escalation factors identified as part of the Bow-Tie assessments that may compromise the safe operating limits of the facilities.

It identifies and differentiates between:

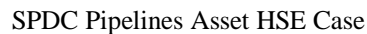
- **Allowable** – Combination of activities allowable with normal procedures
- **Not Permitted** – Activity not permitted in these circumstances and requests for deviation must be formally approved by the Activity Owner (Asset Manager)
- **Permitted** – Combination of activities provided additional assessment and controls are put in place. These additional measures are specified in a set of advisory notes prepared to assist in defining the required actions at site through the evaluation of the associated risk arising from degradation of the system or impact of the concurrent activity.

The MOPO is an information tool to assist Team Leaders, Project Engineers and line leadership during the planning and coordination of operations and activities by providing useful information on:

- The operation or activity operating envelope and safe operating limits;
- Actions to take if/when certain situations arise that could compromise the safe operations.

The Manual of Permitted Operations in Pipelines Asset is contained in the link below

 [Manual of Permitted Operations](#)




Mandatory

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|---------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 41 |
|------------------------------------|-----------------|-----------------------|----------------------------|---------------------------------|-------------|



SPDC Pipelines Asset HSE Case

Mandatory

| ER | | | | SAFETY CRITICAL ELEMENTS | | | | | | | | | | | | |
|--|---|----|----|---|---|--|--|--|---|--|--|----|--|--|--|--|
| EMERGENCY RESPONSE | | | | | | | | | | | | | | | | |
| Spill Containment (e.g. booms etc) - unavailable | | | | <div> HSE CASE MATRIX OF PERMITTED OPERATIONS (MOPO) Activities and SCEs/ER Facilities Revision 03</div> | | | | | | | | | | | | |
| Tier 1 (MHMS) Medical Response - cannot be met | | | | | | | | | | | | | | | | |
| Tier 2 (MHMS) Medical Response - cannot be met | | | | | | | | | | | | | | | | |
| Tier 3 (MHMS) Medical Response - cannot be met | | | | | | | | | | | | | | | | |
| | | | | STRUCTURAL INTEGRITY | PROCESS CONTAMINANT | IGNITION CONTROL | DETECTION SYSTEM | PROTECTION SYSTEMS | SHUTDOWN SYSTEMS | EMERGENCY RESPONSE | | | | | | |
| | | | | Topside structures SI 002 not meeting performance standard | Relief System - local unavailability - P-0007 | Certified Electrical Equipment IC 003 not meeting performance standard | Security Systems DS 002 - local unavailability | Chemical Injection Systems PS 013 not meeting performance standard | High integrity Pressure Reduction Systems (HIPPS) SD 003 not meeting performance standard | Pipeline Isolation Valve SD 005 not meeting performance standard | Communication Systems ER 004 not meeting performance standard | | | | | |
| | | | | | Containment integrity - compromised - P-0007 | Earth Bonding IC 005 not meeting performance standard | | | | | Open Hazardous Drains System ER 010 not meeting performance standard | | | | | |
| | | | | | | | | | | | Open Non-Hazardous Drains System ER 011 not meeting performance standard | | | | | |
| NORMAL ACTIVITIES | | | | | | | | | | | | | | | | |
| B1 | N | B1 | B1 | A1 Operate Process Equipment | B3 | N | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| | N | B1 | B1 | A2 Cathodic protection monitoring | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A3 Chemical injection | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A4 Crude Oil evacuation | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A5 Valve Servicing | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A6 Cathodic protection Survey | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A7 Manifold Painting | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A8 Inspection of Non-piggable Lines (UT, LRUT etc) | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A9 Gantry inspections | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A10 Pipeline Coating Survey | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A11 RV Inspection | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A12 Scrubber Inspection | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A13 Function Testing of ESD System | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A14 Crude Oil Discharge | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A15 Manifold Inspection (Riser, pig traps, valves, drain pits etc) | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A16 Process Start-up/Shutdown Operations | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A17 Sampling | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| B1 | N | B1 | B1 | A18 Piggings Operations (Routine and Intelligent) | B3 | B1 | B3 | B3 | B3 | B3 | B3 | NA | | | | |
| A | N | B1 | B1 | A19 Marine Operations | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| OTHER ACTIVITIES (incl 3rd Party) | | | | | | | | | | | | | | | | |
| B1 | N | B1 | B1 | B1 NDT/ Radiography | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B2 Auxiliary Pumping | B3 | N | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B3 Pipeline Coating repairs | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B4 Cathodic Protection Upgrade | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B5 Dig verifications | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B6 Pressure monitoring | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B7 Cofferdam Construction | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B8 Entry into cofferdam | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B9 Diving Operations (in close proximity) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B10 Remote Operated Vehicles (ROV) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B11 Crane Operation / Lifting | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B12 Test post Installation | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B13 Civil works (guard huts, concrete flooring, fencing etc) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B14 RoW survey/ boundary re-opening | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B15 Movement breaker installation/ Marker installation | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| N | N | B1 | B1 | B16 Containment & recovery | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B17 Clean up & remediation | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B18 Radiography Work | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B19 Confined Space Entry (third-party) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B20 Hotwork (grinding, welding, oxy-cutting) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B21 Coldwork | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B22 Erecting and removal of scaffolding | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B23 Mooring | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B24 Positive Isolation and Depressurisation of Process Eqpt | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B25 Pressure Testing | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B26 Site Reinstatement | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B27 Other Maintenance (Gantry, relief valves) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B28 Hook-up and Commissioning/de-commissioning (tie-ins) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| A | N | B1 | B1 | B29 Grass cutting/ Bush Clearing | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B30 Dredging Operations | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B31 Nitrogen Purging | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| B1 | N | B1 | B1 | B32 De-sludging/Desanding Operations (saver pits, drain pits) | B3 | B1 | B3 | B3 | B3 | B1 | B1 | NA | | | | |
| REF: | | | | LEGEND: | | | | | | | | | | | | |
| EP 2005-0300-SP-04 | | | | A Combination Allowable with Normal Procedures | | | | | | | | | | | | |
| SMEP Facilities MOPOs | | | | B Activity Permitted (Refer to Notes) | | | | | | | | | | | | |
| | | | | N Activity Not Permitted in These Circumstances | | | | | | | | | | | | |
| | | | | NA Non Applicable | | | | | | | | | | | | |



PART 3 SAFETY CRITICAL ELEMENTS (SCEs)

3.1 Design Specification and Operating Philosophy

Design Specification:

Pipelines Operating Procedures

HSE Reference Manuals

[HSE Reference Manuals](#)

Production Control

SPDC Production Control

[Integrated Operations Guides - IOG](#)

[Pipeline Integrity Management System Manual](#)

Maintenance Job Routine – [MJR Integrated Operational Guide](#)

[Pipeline Integrity Mgmt. Sys Procedure](#)

Engineering Control

[Design and Engineering Practices \(DEPs\)](#)

[SPDC Engineering Specification](#)

[SPDC Corporate Change Management Procedure](#)

Emergency Procedures

[SPDC Pipelines Emergency Response Procedure](#)

[SCiN Emergency Response Management Manual](#)

[SCiN Corporate Oil & Chemical Spill Emergency Response, Contingency Plan & Procedures](#)

[Medical Emergency Response Guidance Notes](#)

[SCiN Medical Emergency Procedure](#)

Security Controls

[SCiN Security Management System Manual](#)

3.2 Operating Philosophy

The overall philosophy of Pipelines Assets is managed through the application of the Pipeline Integrity Management System (PIMS) and is built on the company objective of No Harm to People, Assets, Community and Environment.

The Pipelines Asset Emergency Response Procedure and the revised JIV procedure also help to drive this. The link to PIMS manual is attached below.

[PIMS Manual](#)



3.2.1 Barriers and HSE Critical Elements & Performance Standards

The Safety Critical Elements have been identified in line with "[Management of SCEs and Performance Standards](#)" and [Safety Critical Element Management Manual](#), as an item of equipment or structure whose failure could lead to a Major Accident or whose purpose is to prevent or limit the consequences of a Major Accident. [The SCE Performance Standards](#) provide the performance criteria, which a HSE Critical System would be required to achieve when available. The following inventory presents a list of Safety Critical Elements identified from the bowtie analysis of Major Accident Hazards (MAHs) present in Pipeline Asset. The SCE identifiers below bear direct links to individual Performance Standards.

Structural Integrity

- SI 006 Topside structures

Process Containment

- PC 005 Piping Systems
- PC 006 Pipelines/Flowline
- PC 007 Relief Systems

Ignition Control

- IC 003 Certified Electrical Equipment
- IC 005 Earth Bonding

Detection System

- DS 002 Security Systems

Protection System

- PS 013 Chemical Injection Systems

Shutdown System

- SD 005 Pipeline Isolation Valves
- SD 003 High Integrity Pressure Protection Systems

Emergency Response

- ER 004 Communication Systems
- ER 010 Open Hazardous Drains Systems
- ER011 Open Non-Hazardous Drains System


3.3 Safety Critical Elements (SCEs) & Performance Standards (PSs)

3.3.1 Performance Standards

A Performance Standard is a statement of the performance required of an SCE, and which is used as a basis for managing the hazard. Each SCE described has its own Performance Standard. The Performance Standard states the overall goals of the SCE. The goals are aligned with the role that the SCE has in a Major Accident. From the goals, detailed performance criteria are developed.

For Pipelines Asset HSE Case being an Operations HSE Case, Performance Standards are defined in terms of Operational Inspection, Maintenance and Testing. Performance Standard criteria are specified in terms of four general headings.

- Functional Criteria.

| | | |
|---|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|---|-------------------------------|-----------|

- Minimum assurance task.
- Assurance measures.
- Assurance Value.

Operational Performance Standards (PS) for Pipeline operations have been prepared by compiling the requirements from the following sources:

- **Global Shell EP Performance Standards** – Shell is a mature company and general performance requirements for most SCEs have been developed over time based on internal standards (e.g. the DEPs), external standards (e.g. API/BS) and Company operating experience.
- **Specific Requirements from HEMP** – the technical HSE studies may identify performance requirements over and above generic standards that require adjustment to the PM tasks.
- **Specific Requirements from local requirements** – based on the specific hardware selected (e.g. a unique / new type of pump that requires different type of performance checks), or local legal requirements (e.g. mandatory PSV Inspection frequency) the generic performance standards may be changed.

Completed facility Performance Standards are reviewed and approved by the following people before implementation:

- Discipline Technical Authorities
- Maintenance Engineering Technical Authorities

Here is [The Performance Standards](#).

The requirements in the Performance Standards are translated into SAP Preventative Maintenance (PM) tasks which specify clearly, concisely, and realistically the nature of the tasks and the frequencies at which they are to be completed. All tasks identified in the Performance Standards for SCEs are flagged in SAP as Safety Critical tasks and are prioritized for completion.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 45 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|

Facility SCE Mapping

| MAH | | | | | | | | | SCE Identifier | Safety Critical Element | Mapping / Functional Location | |
|-----------|------------------------------------|------------|-----------------|---------------|-----------------|------------------|----------------|-------------|----------------|---|-------------------------------|--------------|
| Crude oil | Organized Crime/ Militant Activism | Condensate | Hydrocarbon gas | Air Transport | Water Transport | Oxygen Depletion | Land Transport | Consequence | SCE Identifier | Safety Critical Element | Buried | Above Ground |
| | ✓ | | | | ✓ | | ✓ | | ER 004 | Communication Systems | ✓ | ✓ |
| ✓ | ✓ | ✓ | ✓ | | | | | | DS 002 | Security Systems | ✓ | ✓ |
| ✓ | | ✓ | | | | | | | ER 010 | Open Hazardous Drains System | ✓ | ✓ |
| ✓ | | ✓ | | | | | | | ER 011 | Open Non-Hazardous Drains System | ✓ | ✓ |
| ✓ | | ✓ | ✓ | | | ✓ | | | IC 003 | Certified Electrical Equipment | ✓ | ✓ |
| ✓ | | ✓ | | | | | | | IC 005 | Earth Bonding | ✓ | ✓ |
| ✓ | | ✓ | ✓ | | | | | | PC 006 | Pipelines | ✓ | ✓ |
| ✓ | | ✓ | ✓ | | | | | | SD 005 | Pipeline Isolation Valves | ✓ | ✓ |
| ✓ | | ✓ | ✓ | | | | | | PS 013 | Chemical Injection Systems | ✓ | ✓ |
| ✓ | | ✓ | ✓ | | | | | | SD 003 | High Integrity Pressure Protection System | | ✓ |
| ✓ | | ✓ | ✓ | | | | | | SI 002 | Topside Structures | | ✓ |
| ✓ | | ✓ | ✓ | | | | | | PC 007 | Relief Systems | | ✓ |
| ✓ | | ✓ | ✓ | | | | | | PC 005 | Piping systems | ✓ | ✓ |

3.3.2 Facility SCE Features

Some features of the SCE's found in Pipelines assets and operations are described below;

Process Containment (PC) – PC006 Pipelines, PC005 Piping Systems.

A Safety Critical Pressure Vessel is one that is normally designed, constructed and installed to a recognized pressure vessel code or standard. They provide hydrocarbon and flammable fluid containment under normal operating conditions.

The typical scope of a Safety Critical Pressure Vessel is the pressure-containing envelope, which is anchored on their ability to maintain process containment through correct design and operation against threats such as fatigue, vibration, pressure and temperature failures. Failure of these equipment could cause loss of containment resulting in fire, explosion or release of dangerous substances with potential to cause death or serious injury to one or more persons and serious environmental impact.



Typically, pipeline limits are between the pig traps, and bypass isolation valves at each end of the pipeline although the critical elements may be a section of the pipeline, depending on the assessment of risk.

Shut Down Systems (SD) – SD003 High Integrity Pressure Protection Systems

(HIPPS); SD005 Pipeline Isolation Valves.

The Shutdown systems are required to provide reliable means for safely isolating and shutting down equipment, systems/areas and facilities in a controlled manner when preset limits are exceeded. This is achieved either by automatically reacting to pre-defined abnormal conditions or by manual initiation of the ESD.

The basis for selection of the ESD system is that it prevents a Major Safety and/or Environmental Accident or contributes to preventing escalation of an accident. It does this by isolating pipeline with inventory, to prevent continued loss of hydrocarbons to the environment. Two ESD systems exist within pipeline operations:

- High Integrity Pressure Protection System (HIPPS) – provides high integrity instrumented over pressurization protection for pipelines, equipment or piping systems that do not have sufficient mechanical protection for the maximum envisaged fluid pressure. They are intended to protect against over pressurization of gas transportation pipeline systems.
- Pipeline Isolation Valves to isolate a flammable or harmful pipeline inventory from the onshore or offshore Facilities or public areas. They reduce the inventory released in the event of a Major Hazard release.

Detection Systems (DS) – Security Systems [DS002]

These include all systems to prevent unauthorized access to the Facility. They are intended to reduce the likelihood of damage to people or equipment such as:

- Access control devices
- Closed Circuit Television Cameras (CCTV)s
- Detectors and alarms
- Perimeter fences

Protection Systems (PS) – Chemical Injection Systems [PS013]

The injection of chemicals into the process stream is to prevent material deterioration. Typical chemicals injected in Pipeline operations include Corrosion Inhibitors. The basis for selection of Chemical injection is that failure to inject these chemicals for an extended period could lead to deterioration of equipment, which could result in loss of containment.

Emergency Response (ER) – Communication Systems ER004

Emergency numbers are provided at the manifold guard huts. Some mobile line numbers are also provided for ease of communication.

Some Right of Way surveillance guards have cell phones to enhance communication.

The communication systems have been primarily designed as a recovery barrier for Hydrocarbon Hazards; Dynamic situation Hazards; and Security related hazards.

Emergency Response (ER) – Open Hazardous Drains System [ER010]

The Open Hazardous Drains system is safety and environmentally critical as it allows removal of

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 47 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



hydrocarbons or flammable / toxic liquids following a loss of containment. Components of the Open Hazardous Drains system are as follows: Drain Pits and Saver Pits.

Ignition Control (IC) – Certified Electrical Equipment [IC003]

Certified electrical equipment (e.g. Ex rated), are deployed for work in hazardous areas to avoid ignition of flammable gases. The selection of suitable electrical equipment is based on the hazardous area classification of the facility, in accordance with DEP 80.00.10.10.

Equipment has been engineered to provide an ignition control barrier for Hydrocarbon Hazards: H-01.002/003/005.

Ignition Control (IC) – Earth Bonding [IC005]

Earth bonding is provided to ensure that a source of ignition cannot be generated by a build-up of static energy. This is achieved through the selection of bonding equipment based upon the establishment of hazardous areas and their boundaries throughout the facility.

Structural Integrity (SI) – Topsides Structures [SI002]

Topsides or Surface Primary Structures such as steel structures carrying pipeline manifolds in the swamp are typically considered Safety Critical as failure of the structure would constitute major damage which may lead to loss of stability, or cause damage to hydrocarbon containment equipment.

3.4 Drawings & Layout

The link attached shows the [Pipelines As Built Records Inventory](#) and Network Schematics for [East](#) & [West](#) Respectively

3.5 Technical Assessment Studies

MIE has been introduced / rolled out in Pipelines Asset. This assures the integrity of our SCE and the management of the Major Accident Hazards. Pipelines Asset achieved MIE Calculative in October 2010 and achieved sustainability in September 2013 and has been sustained annually since then.

Operating Integrity (OI) has also been adopted for Pipeline Assets to ensure all operations are carried in safe manner, following the prescribed standards and guidelines. Pipeline has annually sustained the Stage Gate (SG) 5 phase.

3.6 Process Safety Requirement Study (PSR)

The Process Safety Requirements (PSR) applicable to Pipeline Assets have been identified and captured in [Pipeline HSE Case RAP Actions Activity Plan](#)

Gap analysis have been carried out by the various AIPSM work streams to ensure compliance of the Pipeline Assets to the applicable PSRs. Close out of the PSR gaps is being tracked to closeout.



PART 4 – HSSE MANAGEMENT SYSTEMS

4.1 HSE-MS and Business Model

The [HSE MS Manual](#) is a company-wide-corporate-level document, owned by SPDC management.

The HSE Case is a facility or operation-specific demonstration of the HSE MS in action required for facilities or operations with severity 5A/5B and RAM red risks. HSE Case demonstrates that HSE risks are managed to As Low As Reasonably Practicable (ALARP). Where severity 5A/5B and RAM red risks are managed by contractors, the activity would be managed via an interface document to be agreed by applicable parties.

This HSE Case is an update, to comply with the newer versions of [EP2005-0310 HSE Case](#) & [HSSE & SP Control Framework](#).

4.2 Asset Organogram

Pipeline Asset organisation is designed to provide required level and right number of personnel to adequately manage the risks associated with the hazards of operating the asset. Frontline and support resources have been made available to undertake HSE critical tasks identified to provide and maintain the barriers to manage the Major Accident Hazards (MAHs) specified in the bow-tie assessments.

The Pipeline Asset Organogram is contained in the link below:
[Pipelines Team Organization Post-Reshape](#)

4.3 Critical Manning Levels & Competency Management

4.3.1 Manning Levels

The Pipelines (Delivery/Trunk) and Manifolds' operations are continuous and generally unmanned. Community guards provide Surveillance/security services. Government Security Forces are also stationed at some high risk/vulnerable manifolds and right-of-way (RoW) sections.

Trained Surveillance Guards (mostly indigenes of the neighbouring/host communities) who provide surveillance services operate in pairs on any duty shift. In the event of any emergency or suspected unauthorised access of the Pipelines facilities, they notify their supervisor who in turn contacts the SPDC Pipelines responsible party. They are also expected to alert the Leak Prevention/Surveillance Team Lead or facility Operations Staff of any upset or leaks in the manifold/pipelines, using GSM telephones and radios. The Surveillance Guards are expected to man/work on a 24-hour basis.

Pipeline Operations crews visit the facilities on a routine/scheduled basis to carry out operational checks and/or preventive maintenance activities.

All preventive maintenance activities on the facilities are managed via SAP and are executed in line with appropriate schedules.

4.4 Critical Tasks & Reference Procedures Listing

HSSE critical tasks are tasks supporting HSSE critical activities, those established to manage hazards directly or indirectly with severity 5A/5B and RAM red rated risks in the Risk Assessment Matrix (RAM). These have been identified as activities that provide or maintain one or more controls (barriers and recovery measures) for managing the hazards. These include both direct and interface activities.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 49 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|

The following tables describe HSE Critical Tasks by Position as collated from the MAH Bowties. Personnel assigned responsibility for HSE Critical Tasks are informed of the task details and understand the significance. They can demonstrate that they have the necessary competencies to perform the task to the required standards. The communication of task details and confirmation of understanding and necessary competencies by the personnel are managed through the [Pipeline HSE Critical Tasks and Activity Sheet](#) which specifies who is responsible for the tasks, the inputs and documentation where the task is defined and how it will be verified that the task has been undertaken properly.

Figure below shows the relation of HSE-critical activities, to barriers and controls.

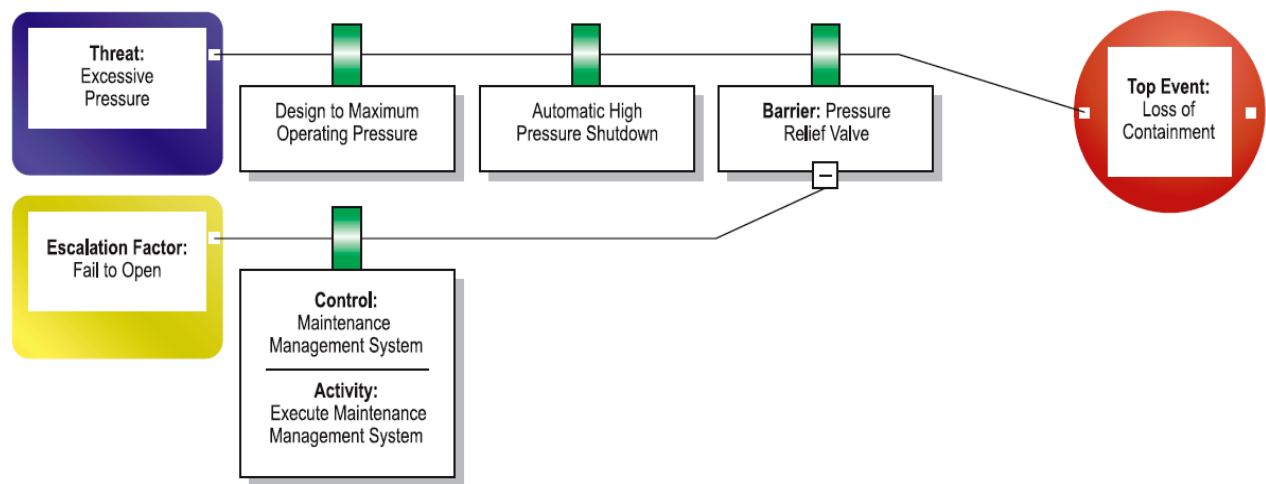


Figure 4.1 HSE Critical Activities, Barriers and Controls link

Activities can be classified into four types:

- *Design* – This specifies the necessary hardware (e.g safety critical equipment). These tasks are usually completed before the facility is operated except where modifications are made.
- *Inspection & Maintenance* – to ensure that equipment integrity is sustained in line with the performance standards.
- *Operational* – to ensure that the equipment is used within the defined limits of the controls provided and that change is managed appropriately.
- *Administrative* – covering aspects such as training and auditing etc.

**Table 4.1 HSE Critical Activities and Tasks by Responsible Person**

| Asset Manager | | | |
|----------------|---|--------------------|-------------|
| Task Code | Task Title & Description | Barrier & Controls | Hazard Code |
| EP.03.01.01.01 | Provide strong and visible leadership | | |
| EP.03.01.01.02 | Set targets proactively | | |
| EP.03.01.01.03 | Demonstrate leadership and commitment and show informed involvement in managing risks | | |
| EP.03.01.02.01 | Set risk policies and define objectives and strategies to manage the risk | | |
| EP.03.01.02.02 | Communicate policies to all employees and contractors | | |
| EP.03.01.02.03 | Ensure that the policies are readily available | | |
| EP.03.01.02.04 | Retain a record to demonstrate that employees have received this information | | |
| EP.03.01.02.05 | Inform all employees and contractors of revisions to policies | | |
| EP.03.01.03.01 | Define the organizational structure, roles, responsibilities, authorities, accountabilities and interrelations | | |
| EP.03.01.03.02 | Define and describe the business processes and assign process ownership | | |
| EP.03.01.03.03 | Define and describe the company assets and assign ownership | | |
| EP.03.01.03.04 | Assign a risk focal point | | |
| EP.03.01.03.05 | Ensure that sufficient resources are available for the effective operation and management of risks | | |
| EP.03.01.03.06 | Define and record competency levels for all critical activities | | |
| EP.03.01.03.07 | Define the communication hierarchy and information flows | | |
| EP.20.04.06 | Provide training budget. | | |
| ASS.03.01.01 | Monitor and control the use of the asset: Progress against plan, Performance targets, Quality, HSE, data and documentation. | | |
| ASS.04.01 | Analyse asset performance and integrity | | |



| Head, Pipeline Operations & Maintenance Management | | | |
|---|---|--|--|
| Task Code | Task Title & Description | Barrier & Controls | Hazard Code |
| EP.72.03.01.02 | Ensure correct, current Job competencies for tasks | - Operator Competence (+) | H-01.002, 003 |
| EP.20.02.03.01 | Deploy the right people in the right place at the right time with the right skills and motivated | - Competent & trained personnel (+) | H-01.002, H-01.003 H-17.004 |
| EP.72.03.04.01 | Examine equipment status within the operating envelope and design intent | - PS012: Process Condition Monitoring (+) | H.01.003 |
| ACT.01.07.03 EP.20.04.02.01 | Identify training needs, as appropriate for work required Support the optimum development of all staff | - Competent & trained personnel in process limits (+) - Staff training & competence in process limits (+) | H-05.003, H-17.004 |
| EP.17.03.06.02 | Access control and physical security | - DS002: Fencing of facilities (+) | H-16.004 |
| ACT.01.06.01 | Establish the work specific procedures and standards | - Policies & Procedures (+) | H-16.004 |
| EP.20.03.02.01 EP.20.30.01.02 | Operate performance, reward and benefit systems Build and enhance a performance culture | - Incentives for desired behaviour (Hearts & Minds) | H-07.001 |
| EP.17.03.05.05.03 | Administer ER equipment and resources | - Trained emergency response personnel (+) | H-01.002, H-01.003, H-05.003, H-07.003, H-08.001, H-08.005, H-09.001, H-16.004, H-16.005 |
| EP.20.30.01.03 | Promote continuous coaching | - Operator awareness/ Personnel detection of fire (+) | |
| EP.17.03.05.05.03 EP.17.03.05.05.04 EP.17.03.04.04.01 | Administer ER equipment and resources Develop ER procedure for the area Provide first line of medical services/ first aid services in locations | - ER001-07: Emergency Response Elements - ER plan, ER organ gram, ER materials, procedure, facilities, equipment e.g. first aid box, safety shower/eye wash, spill response equipment, fire extinguishers (+) | |
| EP.17.03.04.04.03 | Check and re-kit first aid boxes | | |
| EP.19.02.04 | Maintain all medical equipment facility to SPDC standards on site | - Availability of medical facilities (3 Tiers of MER: medic-on-call 24hrs, site medics & first aiders) (+) | |
| EP.17.03.04.04.02 | Provide qualified OH nurses | | |
| EP.17.03.05.05.03 | Administer ER equipment and resources | - ER004: Communications Systems (+) | H-05.003, H-07-003 |
| | | - Repair/ Replace equipment | |
| | | | |



| Operations Support | | | |
|--------------------|--------------------------------------|---|--------------------|
| Task Code | | Task Title & Description | Hazard Code |
| EP.17.03.06.02 | Access control and physical security | DS002: CCTV Provision (+) | H-01.002 |
| EP.17.03.06.02 | Access control and physical security | DS002: Fencing (+) | H-01.002 |
| EP.72.03.02.02 | | Use of Manual of Permitted Ops – work restriction (+) | H-08.005 |
| EP.72.03.02.02 | | Permit-to-work system – if safety clearance cannot be reasonably maintained in practice & there is danger, overhead lines/ transformer is made dead (+) | H-09.001 |
| EP.17.03.06.02 | Access control and physical security | Armed escort/security operatives by government for transport (+) | H-16.004 |
| EP.17.03.06.02 | Access control and physical security | DS002: Maintenance of fencing facility | H-16.004 |
| | | Personnel awareness of the hazard of open flame (+) | H-17.004 |
| | | - ER004: Communications(+) | H-01.002, H.01.003 |
| | | - ER010/ER011: Secondary Containment (+) | H-01.002 |
| | | | |

| Team Leaders / Project Engineers | | | |
|----------------------------------|--------------------------------------|--|-------------|
| Task Code | Task Title & Description | Barriers & Controls | Hazard Code |
| EP.17.03.06.02 | Access control and physical security | DS002: Access control + | H-01.002 |
| EP.72.03.02.02 | | - Job Hazard Analysis/ Permit to Work (+) | H-05.003 |
| EP.72.03.02.02 | | - MOPO – manual of permitted operations (+) | H-08.001 |
| | | - Work in thunderstorm not permitted; halt all work except where halting is assessed to be more dangerous than the violent weather (+) | H-08.001 |
| | | - PTW system (+) | H-08.001 |
| EP.20.02.03.01 | | - Clamping of leak point (+) | H-01.002 |
| | | - Repair of leak point (+) | H.01.003 |
| | | - Remediation (+) | H-01.002 |
| EP.20.02.03.01 | | - Scheduled/Preventive maintenance (+) | H-01.002 |



| | | | |
|----------------|--|---|--|
| | | - SI002: Coating / paint system (+) | H-01.002 |
| | | - SI002: Cathodic protection (+) | H-01.002 |
| | | - Scheduled/Preventive maintenance (+) | H.01.003 |
| | | - SI002: Coating / paint system (+) | H.01.003 |
| | | - SI002: Cathodic protection (+) | H.01.003 |
| | | - Non-Destructive Test/ Risk-based Inspection | H.01.003 |
| EP.20.02.03.01 | | PC001/ PC007: Valve/flange Inspection (+) | H-01.002 |
| | | PC005: Inspection of Pipings (+) | H-01.002 |
| | | - PC005: Inspection of Pipings (+) | H.01.003 |
| | | - PC001/ PC007: Valve/flange Inspection (+) | H.01.003 |
| EP.72.03.02.02 | | - Permit-to-Work System/ JHA (+) | H-09.001 |
| EP.17.06.03.03 | Communicate on security threat level | - Information to staff on security risk exposure rating (+) | H-16.004 |
| EP.17.03.06.02 | Access control and physical security | - DS002: Fence patrol & access control to prevent unauthorized access (+) | H-16.004 |
| EP.17.03.06.02 | Access control and physical security | - DS002: Guarding (hardware) (+) | H-16.004 |
| | | - Communication (+) | H-16.004 |
| | | - Operator daily check (+) | H-17.004 |
| EP.72.03.02.02 | | - Permit-to-Work System (PTW) / JHA(+) | H-17.004 |
| ACT.01.06.01 | Establish the work specific procedures & standards | - Operating procedures (+) | H-17.004 |
| | | - Supervision (+) | H-17.004 |
| | | - Toolbox talks (+) | H-17.004 |
| EP.17.03.07.08 | Post-remediation of impacted sites | - Clean-up (+) | H-01.002 |
| | | - PTW – Hot work restrictions & gas tests (+) | H-01.002, H.01.003 |
| | | - Fire break (+) | H-01.002, H.01.003, H-08.005, H-09.001, H-16.004 |
| EP.17.03.06.02 | Access control and physical security | - DS002: Access Control (+) | H-07-003 |



Table 4.2 Interface Activities

| Corporate Maintenance | | |
|-----------------------|--|-----------------------|
| Task Code | Barriers & Controls | Hazard Code |
| EP.20.02.03.01 | PC001: Pressure Control Valves – PCV (+) | H-01.002 |
| | PC003: Scheduled/Preventive maintenance (+) | H-01.002, H-01.003 |
| | Corrective/Breakdown maintenance (+) | H-01.002, H-01.003 |
| EP.17.03.06.02 | - DS002: CCTV Maintenance (+) | H-01.002 |
| | PC003: Scheduled/Preventive maintenance (+) | H-01.003 |
| | PC001: Pressure Control Valves – PCV (+) | H-01.003 |
| | - Inspection, /Technical Integrity checks (+) | H-05.003 |
| | - Maintenance (+) | H-05.003 |
| | - Testing (+) | H-05.003 |
| ACT.01.06.01 | - Job-specific procedures (+) | H-05.003 |
| | - Toolbox talks – Hazard awareness (+) | H-05.003 |
| | - Supervision/ supervisory checks (-) | H-05.003 |
| | - Adherence to requirements of General Electrical Safety and Electrical Safety Rules – IEEE & SPDC standards (+) | H-08.005 |
| | - Adherence to requirements of General Electrical Safety and Electrical Safety Rules – IEEE & SPDC (+) | H-09.001 |
| | - IC005: Inspection and maintenance of earthing and lightning protection systems (+) | H-09.001 |
| | - PC001: Alarms and Trips (+) | H-17.004 |
| | - PC001 : Pressure control (+) & PC001 : Pressure gauges (+) | H-17.004 |
| | - PC007: Relief valves (+) | H-17.004 |
| | - IC009: Maintenance/ replacement plan for flare stack/tips (+) | H-17.004 |
| | - IC008: Ignition sources control (+) | H-01.002, H-01.003 |
| | - IC003: Certified Electrical Equipment – Intrinsically safe/ explosion proof equipment (+) | H-01.002, H-01.003 |



| | | |
|--|---|---|
| | - Clamping of leak point (+) | H-01.002 |
| | - SD001: ESD System (+) | H-01.002, H-01.003, H-08.005, H-09.001, H-16.004 |
| | - SD002: Emergency depressurisation system – valves (+) | H-01.002, H-01.003 |
| | - SD006: Process emergency shutdown valves (ESDV) System (+) | H-01.002, H-01.003, H-08.005, H-09.001, H-16.004, |
| | - SD009: Utility Air System (+) | H-01.002, H-01.003, H-08.005, H-09.001, H-16.004 |
| | - DS001: Fire detection and alarm (+) | H-01.002, H-01.003, H-08.005, H-09.001, H-16.004 |
| | - IC001: HVAC (+) | H-01.002, H-01.003 |
| | - DS001: Gas detection systems (for closed systems) (+) | H.01.003 |
| | - Repair of leak point (+) | H.01.003 |
| | - Technician awareness/ Personnel detection of displacement (+) | H-05.003 |
| | - Repair/ replace damaged asset (+) | H-08.001, H-08.005, H-09.001, H-16.004 |



| DCAF/FEED | | |
|----------------|--|------------------------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | Engineering Design & specification – DEP (++) | H-01.002, H-01.003, H-05.003 |
| | - SI002: Structural certification (++) | H-05.003 |
| | - Equipment selection & specification (+) | H-05.003 |
| | - Design & Specification for facilities – DEP (+) | H-08.005 |
| | - Equipment specification (national standards) (+) | H-09.001 |
| | - Fire detection & response – design & specification (+) | H-09.001, H-16.004 |

| OR&A | | |
|----------------|--|-----------------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | Maintenance philosophy (+) | H-01.002/H-01.003 |
| | Design/ specification – DEP (+) | H-01.002/H-01.003 |
| | - Signed Approved-for-Construction (AFC) Drawings (+) | H-05.003 |
| | - Signed MFS – Min. Functional Spec (+) | H-05.003 |
| | - Equipment manual (+) | H-05.003 |
| | - Design & Specification for facilities – DEP (+) | H-08.005 |
| | - IC005: Installation of lightning arrestor (+) | H-08.005 |
| | - Equipment specification (national standards) (+) | H-09.001 |
| | - IC005: Connect permanent buildings, large and prominent masses of steelwork to earth (+) | H-09.001 |
| | - <i>Airstrips/Helipads built to standards and specifications (+)</i> | H-07-003 |
| | - IC001: Facility layout design – ventilation (+) | H-01.002, H.01.003 |
| | - Fire detection & response – design & specification (+) | H-09.001, H-16.004 |



| HSE Support | | |
|----------------|--|--|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | - Unsafe act auditing (-) | H-05.003/H-09.001 |
| | - Personnel awareness in hazard of weather (+) | H-08.001 |
| | - Warning sign – caution tag at isolation point (+) | H-09.001 |
| | - Personnel awareness of the hazard of open flame (+) | H-17.004 |
| | Alcohol and drugs policy & campaigns - | H-07.001 |
| | Journey Management Procedures/Practices+ | H-07.001 |
| | Drivers Education Programme addressing Behaviour, Attitude and DD skills - | H-07.001 |
| | DEP-5 yearly professional assessment - | H-07.001 |
| | Road Safety campaigns (posters, etc.)- | H-07.001 |
| | 2/3 yearly medicals for drivers (+) | H-07.001 |
| | Health and Fitness programs for drivers - | H-07.001 |
| | Pre-mob /Pre-start up Vehicle | H-07.001 |
| | Drivers Education Programme for bus drivers - | H-07.001 |
| | - Emergency Response Procedure (+) | H-01.002, H.01.003, H-05.003, H-08.001, H-08.005, H-09.001, H-16.004, H-07.001 H-07.003 |
| | - Emergency drills scenarios & exercises (+) | |
| | Drivers' Education Programme on graded and off-road + | H-07.001 |
| | Road Safety campaigns (posters, etc) both at SPDC & govt. Levels + | H-07.001 |
| | Journey Management Procedures + | H-07.001 |



| Security Adviser | | |
|------------------|--|---------------------------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | - Surveillance (+) | H-01.002 |
| | - Security agents (+) | H-01.002 |
| | - Security Risk Exposure Matrix – SREM (+) | H-01.002/ H-16.004, H-07-003 |
| | - Site security plan (+) | H-16.004 |
| | - DS002: Road patrol by security operatives and access control to prevent un-authorized access (+) | H-16.004 |
| | - Daily patrol (-) | H-16.004 |
| | - DS002: Fence patrol and access control to prevent un-authorized access (+) | H-16.004 |
| | - Staff training to staff on how to act in piracy & assault situations (-) | H-16.004 |
| | - Intelligence from authorities (+) | H-16.004 |
| | - DS002: Physical security – 4D principle of Deter, Delay, Deny & Detect Access (+) | H-16.004 |
| | - Patrols (+) | H-16.004 |
| | - Site security plan (+) | H-16.004 |
| | - Law enforcement (+) | H-16.004 |
| | - Information gathering & sharing (+) | H-16.004 |
| | - Liaison ; intra/ inter (+) | H-16.004 |
| | - Surveillance for deterrence | H-16.004 |
| | - Response (+) | H-16.004 |
| | - Armed protection (+) | H-16.004 |
| | Provide escorts either from govt. Or SPDC dependent on traffic reg., load | H-07.001 |
| | - Security control & checks (Govt military intervention) (+) | H-07-003 |



| SCD | | |
|----------------|---|-----------------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | - Sustainable Community Dev. Programme (+) | H-01.002 |
| | - Partner & empower community as stakeholders – CD programme (+) | H-16.004 |
| | - Appointed CLO and good community relations (+) | H-16.004 |
| | - Implementation of "Community Relations and Community Development Management – MOUs (+) | H-07-003, H-16.004 |
| | - Stakeholder management | H-16.004 |
| | - Stakeholder engagement & liaison – people management & conflict resolution training (+) | H-07-003 |

| Community Relations Officer (CRO) | | |
|-----------------------------------|--|-------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | - Regular dialogue with communities (+) | H-16.004 |
| | Awareness of Road Hazards by local communities, road safety education programs - | H-07.001 |

| Driver | | |
|-------------|---|-------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.14.zz.tt | All vehicle occupants to wear seatbelts + | H-07.001 |
| | Passengers not to distract drivers + | H-07.001 |
| | Passenger & unsafe acts feedback - | H-07.001 |



| Journey Manager | | |
|-----------------|--|--------------------|
| Task Code | Task Title & Description | Hazard Code |
| EP.20.02.03.01 | - Journey Management Plan (+) | H-08.001, H-16.004 |
| | Monitoring/Coaching + | H-07.001 |
| | Clear and well communicated rules + | H-07.001 |
| | Drivers Forum/HSE meetings + | H-07.001 |
| | Daily drivers' toolbox meeting + | H-07.001 |
| | Road Safety campaigns (posters etc) + | H-07.001 |
| | Passenger unsafe act feedback - | H-07.001 |
| | Remove vehicle keys when vehicle is parked or left unattended + | H-07.001 |
| | Maximum speed limits for different road types & signs in place to denote lower limits. + | H-07.001 |
| | - SI005: Speed Limiter requirements on all vehicle types – IVMS | H-07.001 |
| | - SI005: In Vehicle Monitoring System & Driver Merit System (+) | H-07.001 |
| | Penalties for breaking rules + | H-07.001 |
| | Air Conditioning in all vehicles + | H-07.001 |
| | Potable water available - | H-07.001 |
| | Night driving restrictions + | H-07.001 |
| | Road Safety campaigns (posters etc) - | H-07.001 |
| | Driver well rested – drive/rest and sleep/shift patterns defined and adhered to. - | H-07.001 |
| | Daily drivers' toolbox meeting + | H-07.001 |
| | - SI005: Radio- cassette player fitted & working (+) | H-07.001 |
| | Formal competence requirements defined for different driver/vehicle types ? | H-07.001 |
| | Passenger & unsafe act feedback - | H-07.001 |
| | No GSM" rules (hands-on & hands-off) + | H-07.001 |
| | Driver welfare - | H-07.001 |
| | DEP addressing Behaviour, Attitude and DD skills - | H-07.001 |
| | Clear and well communicated rules (SPDC & Govt) + | H-07.001 |
| | Drivers Forum/HSE meetings + | H-07.001 |
| | Pre-employment competence test for professional drivers + | H-07.001 |
| | RTA briefing packs feedback to all drivers - | H-07.001 |
| | - SI005: Radio- cassette player fitted & working (+) | H-07.001 |
| | Eye test prior to attending DEP course - | H-07.001 |
| | Eye Test included in Driver's re-certification course - | H-07.001 |




| | | |
|--|--|----------|
| | Drivers supervised by qualified staff and clear reporting lines defined - | H-07.001 |
| | Use of Professional drivers + | H-07.001 |
| | Stress guidance available to drivers and driver supervisors - | H-07.001 |
| | - SI005: Light Vehicles fitted with ABS brakes | H-07.001 |
| | Vehicle appropriate for task (load, journey & road conditions) - | H-07.001 |
| | Drivers with high self-esteem + | H-07.001 |
| | Formal competence requirements defined for different driver/vehicle types + | H-07.001 |
| | Driver complaint feedback mechanism - | H-07.001 |
| | Fitness to Work medical protocol every year for professional drivers (+) | H-07.001 |
| | Maximum age for drivers - | H-07.001 |
| | Driver well fed - | H-07.001 |
| | Driver well rested – drive/rest and sleep/shift patterns defined and adhered to. - | H-07.001 |
| | Use of Sunglasses in strong glare? | H-07.001 |
| | Vehicles kept clean (housekeeping) + | H-07.001 |
| | - SI005: Reversing Alarms on HGV & Buses (++) | H-07.001 |
| | Banks man/Helper for large/heavy vehicles? | H-07.001 |
| | Alcohol and drugs policy & campaigns + | H-07.001 |
| | Tyre specification and selection as per manufacturer + | H-07.001 |
| | Tyre pressure marked on wheel arches - | H-07.001 |
| | Drivers trained in correct wheel changing methods? | H-07.001 |
| | Tyre condition & pressure checked during daily checks? | H-07.001 |
| | Vehicle regular inspection and maintenance (monthly inspection) - | H-07.001 |
| | Vehicle maintained to manufacturers recommendations? | H-07.001 |
| | Vehicle defect reporting system used by drivers - | H-07.001 |
| | Vehicle daily checks by driver + | H-07.001 |
| | Monitoring/Coaching + | H-07.001 |
| | 6-monthly/Annual Vehicle inspection? | H-07.001 |
| | Vehicle specifications for vehicle & road type + | H-07.001 |
| | Vehicle appropriate for task (load, journey & road conditions) - | H-07.001 |
| | Qualified supervisor checks loading before start of journey - | H-07.001 |
| | Roof-racks only in special circumstances, weight limit imposed - | H-07.001 |
| | Monitoring/Coaching + | H-07.001 |
| | Load restrictions (traffic law) - | H-07.001 |
| | Specification for loading vehicles and securing loads? | H-07.001 |



| | | |
|--|--|----------|
| | Training and competence assurance on loading vehicles and securing loads (supervisory & rigger/driver level) - | H-07.001 |
| | Roadside checks (govt. Enforcement) + | H-07.001 |
| | Adequate load securing equipment and inspection of this material? | H-07.001 |
| | Load and vehicle checks by driver during journey + | H-07.001 |
| | Provide escorts either from govt. (location & load size dependent) + | H-07.001 |
| | - LS001: Airbags for driver and front seat passenger (+ | H-07.001 |
| | - Fire extinguisher in each vehicle (+) | H-07.001 |
| | - First Aid Kit in each Vehicle (+) | H-07.001 |
| | - LS001: Seat belts for all vehicle occupants (+) | H-07.001 |
| | - SI005: No bull bar allowed (+) | H-07.001 |
| | - Recover damaged vehicle: | H-07.001 |
| | - SI005: Vehicle towing gears | H-07.001 |
| | - Assess damage (+) | H-07.001 |
| | - Repair / replace (+) | H-07.001 |



This page is intentionally left blank

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

4.4.1 Critical Task

The HSE Critical Tasks identified in Pipeline operations and the HSE critical activity responsibility matrices are in the links below.

- [Pipeline Assets HSE Critical Tasks](#)
- [HSE Case Roles & Responsibilities](#)

4.4.2 Listing of HSE Critical Procedures


By reviewing the hazard analysis and the Bowties, the following procedures have been identified as critical.

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 65 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



Table 4.2: Critical Documents

| Title | Level | Scope | Reference |
|--|-------|--|--|
| Permit to Work System | OpCo | Specifies the application of permit to work within SCiN Operations | Permit-Work |
| Emergency Response Procedure | Asset | Provides the guidance for emergency response for Pipeline onshore facilities. | SCiN Emergency Response Management Manual SPDC Pipelines Emergency Response Procedure |
| Job Hazard Analysis Procedure | OpCo | Describes the requirements of the Job Hazard (JHA) as a HEMP tool to manage hazards and risks analysis in the execution of all work at the workplace | Managing Risk Job Hazard Analysis (JHA) |
| Management of Change (MOC): Plant Change Procedure | OpCo | Provides guidelines for managing proposed modifications to existing onshore and offshore facilities and structures to ensure that the changes are practical with added values and no additional risk, whether it involves change in process. | Corporate Change Control Procedure |
| Safe System Isolation | OpCo | Describes the requirements for “defeat” or “override” or “bypass” of an automatic control or protection system when it is required to be deliberately rendered inoperable for the purposes of start-up, testing and maintenance. | Pipeline Isolation /LOTO Procedure |
| Operating Deviations | OpCo | Stipulates hazard management requirements for continuing operations when integrity assurance activities or corrective maintenance cannot be executed | PD Operations Deviation Control |
| MOPO/ SIMOPS Procedure | Asset | Defines the standards to be applied to safely manage multiple activities being performed simultaneously at a location. | Concurrent Activities and Influences |
| Critical Handover Matrix | Asset | Identifies Critical positions that should handover and what needs to be handed over. | Handover Matrix |

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

| Title | Level | Scope | Reference |
|---------------------------------------|-------|---|---|
| Integrated Operation Guide | OpCo | Describes the requirements for "defeat" or "override" or "bypass" of an automatic control or protection system when it is required to be deliberately rendered inoperable for the purposes of start-up, testing and maintenance | IOG |
| Integrated Pipeline Repairs Procedure | Asset | Describes the repair methods and procedures, safety precaution and conditions for Pipeline repairs | Integrated Pipeline Repairs Procedure |

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|---------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 67 |
|------------------------------------|-----------------|-----------------------|----------------------------|---------------------------------|-------------|



4.4.3 Register of HSE-Critical Legislation

Federal Nigerian Legislation

- [Federal Legislation.](#)
- [State Legislation](#)
- [Nigerian Upstream Petroleum Regulatory Commission \(NUPRC\)](#)
- [NUPRC Environmental Guidelines & Standards for Petroleum Industry \(EGASPIN\) 2002](#)
- [Federal Ministry of Environment \(FMEnv\)](#)
- [Environmental Impact Assessment Sectoral Guidelines](#)
- [National Oil Spills Detection and Response Agency \(NOSDRA\)](#)
- [Nigeria Nuclear Regulatory Authority \(NNRA\)](#)
- [NNRA Act 1995v](#)
- [Oil and Gas Pipelines Regulations 1995 \[1\]](#)
- [Oil Pipelines Act \[1\]](#)
- [Nig Safety and Security of RA Source Regulation 2006](#)
- [Petroleum Act \[2\]](#)
- [Petroleum Regulations](#)
- [NAPIMS](#)
- [Oil Producers Trade Sectors\(OPTS\)](#)
- [Clean Nigeria Associate \(CNA\)](#)
- [Oil Spill Response Limited OSPL](#)

4.4.4 HSE Critical documents

HSE Policies

- [UPC HSSE&SP Policy & Commitment](#)
- [Shell Group HSSE&SP Commitment and Policy](#)

Second Tier Policies

- [Emergency Response](#)
- [Drug & Alcohol](#)
- [HIV & AIDs Prevention and Treatment](#)
- [Security](#)
- [Shell Nigeria: Flaring Policy](#)

HSE Management system

- [HSSE & SP Control Framework](#)
- [SPDC HSE Controlling Documents](#)
- [SPDC Pipeline Hazard Effects Register](#)
- [Cooperate Pipeline HRA](#)

Pipelines Specific HSE Critical Procedures

- [List of all Pipeline specific HSE procedures here](#)

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 68 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



4.5 Competency Requirements

4.5.1 Critical Task Competencies

A critical success factor in making certain that barriers remain effective is having an individual with the right competencies to undertake activities/tasks identified in the bowties. The process for achieving this in SCiN involves the three main steps highlighted below:

1. Every activity/task identified is matched to a specific position(s) in the company and this position is accountable responsible for that activity/task being done satisfactorily. This is shown on the Accountability Sheets.
2. The required competencies for a position are defined either in the position's Job Competency Profile (JCP) or through a detailed job description (JD).
3. An "assurance system" is put in place to demonstrate that the person who is working in a position has the right competency or has a plan in place to close any competency gaps. For supervisory positions (L2) competence assurance in accordance with the HSSE & SP CF. For technicians, this is covered under the International Vocational Qualification (IVQ).

There are two main groups of competency elements that make up a competency profile for a specific position:

- First, there are HSE Competencies that are specified by "Competence Assurance of HSSE Critical Positions" HSSE & SP CF.
- Secondly there are the general business competencies relevant for the job requirements (e.g. the technical skills required to be an operations team leader).


Not all competencies (even HSE ones) directly relate to the management of MAH. For example "waste and emission management" is defined HSE Competency but it is not required for any of the identified MAH.

4.5.2 Contractor HSE and Competency Management

SCiN policy requires contractors to manage HSE in line with its policy. Contractors are required to adopt HSE standards compatible with those of Shell Company.

Managing contractor HSE shall be in accordance with EP HSE Standard "Contractor HSE Management" EP 2005 0110. The basic principle of the standard is that HSE management controls are appropriate for the level of the contract HSE risk/mode, organizational relationship with the contractor and the capabilities of the contractor to manage HSE within the scope of the contract.

Competence requirements in the Pipeline Asset HSE Case currently being implemented via [Pipeline HSE Critical Task Accountability Sheet](#)

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

This Page is intentionally left blank

| | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|-----------------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are un |
|------------------------------------|-----------------|-----------------------|----------------------------|-----------------------|



4.6 HSE Accountability Packs Activity Responsibility Matrix

Based on the safety critical activities on the MAH Bowties HSSE critical accountability sheets have been developed.

The Activity Responsibility Matrix with the accountability responsibilities relative to the management of MAH's are contained in the links below:

[Pipeline HSE Critical Tasks and Activity Sheet](#) and [Pipeline HSE Critical Task Accountability](#)

4.7 Emergency Response Arrangement

Procedures are in place for Emergency Response in Pipeline Asset operations. Emergency Response provisions are available at all work locations.

A crisis is a sudden, unexpected incident that may put employees, the public, and/or the environment at immediate risk and requires rapid and responsible action in the face of external scrutiny. Pipeline Asset depends wholly on the SPDC Crisis Management Plan whose purpose is to provide an orderly and systematic approach for managing crisis.





Pipeline Asset personnel are continuously trained to fully understand the roles that they are individually and collectively expected to play. The understanding of staff roles and responsibilities is tested during drills and emergency response exercises. A drill schedule is developed as a part of the annual HSE plan and focuses on drills monitored by regulators external to SPDC. Drills are however executed on an ad hoc basis at Pipelines emergency repair work sites, if the job exceeds 3 days in duration.

In Pipeline operations, the main emergencies are related to:

- Fire and Explosion
- Security
- Spillage and
- Medical Emergency Response (MER).

Contractors who work for Pipeline operations align their emergency response plans to the Pipelines emergency response procedures, which are derived from the SPDC emergency procedures.

Emergency response procedures that are deployed in Pipeline operations are in the links below.

-  [SCiN Emergency Response Home Website](#)
-  [SCiN Medical Emergency Response Guidance](#)
-  [SCiN Emergency Response Management Manual](#)
-  [SPDC Pipelines Emergency Response Procedure](#)



4.8 Bridging Interfaces

Most major contracts in Pipelines operations are in the Mode 1 category and as such managed under the SCiN Permit to Work System. Mode 2 category contracts (as defined in [HSSE&SP Control Framework - Contractor HSE Management](#)), require an interface between the Pipelines HSE Case and the contractor HSE MS. This is provided through a set of interface or bridging documents, which detail bridging information used to clarify accountabilities, roles and responsibilities for the management of HSE-critical activities. The bridging information shall be developed as a part of the Project HSE Plan.

In addition, interface with other service providers are guided by service level agreements as contained in the link below. [HSSE&SP Control Framework - Contractor HSE Management](#).

4.9 Workforce Involvement

In developing and updating this HSE Case, there has been a number of workshops and review sessions to enable staff participate effectively, make contributions based on real work experiences and as well take ownership of the HSE Case as it pertains to applicability, suitability and implementation.

The Process Safety Team was equally engaged in the Bow-Ties development and HSE Activities to address the Remedial Action Plans. Including Safeguarding Memorandum and HAZOP studies.

4.10 Audits & Reviews/Assurance Process

The Pipelines audit programme for any particular year is guided by the SPDC Corporate Audit plan in the annual business planning cycle. The strategy adopted in Pipelines Asset HSE Audit or Assurance plan reflects the HSE risks, identified areas for increased focus as well as contractor and external audits relevant to its operations. These audits are driven in compliance with the group audit procedures.

PART 5 REMEDIAL ACTION PLAN

5.0 Remedial Action Plan

The Remedial Action Plan (RAP) below addresses the shortfalls and improvements identified whilst developing the HSE Case as shown in the Table below, and may for example, be a direct or indirect result of a missing, inadequate, or ineffective controls to manage the hazards arising from the following:

- Outstanding actions from HEMP and supporting safety and risk studies.
- Remedial actions from HSE Reviews including process safety reviews and Audits.
- Shortfalls identified in the bowtie risk assessments.
- Some shortfalls (relating to the MAHs) in the compilation of the Hazards and Effects Register.

It is the responsibility of the HSE Case Owner to ensure that these actions are satisfactorily completed. If the remedial actions are not fully and successfully implemented, then the effectiveness of the barriers in Hazard release prevention and mitigation in Pipeline Operations would be weakened.

This Plan would be updated in the Fountain Action tracking tool as action items are completed or new action items are identified.


See the [Pipeline HSE Case RAP Actions Activity Plan](#)

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 72 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|



Glossary

| | |
|--------------------|--|
| ALARP | As Low As Reasonably Practicable |
| Bbls | Barrels |
| Bbls/d | Barrels per day |
| DEP | Design Engineering Practice |
| DEP | Driver Education Program |
| NUPRC | Nigerian Upstream Petroleum Regulatory Commission |
| EAT | Environmental Aspect Tables |
| EER | Environmental Evaluation Report |
| EGASPIN | Environmental Guideline and Standards for Petroleum Industry |
| EIA | Environmental Impact Assessment |
| EMS | Environmental Management System |
| EP | Exploration and Production |
| EPBM v4 | Exploration and Production Business Model, version 4 |
| ERT | Emergency Response Team |
| ESD | Emergency Shut Down |
| ESI | Environmental Sensitivity Index |
| FEPA | Federal Environmental Protection Authority |
| FME _{env} | Federal Ministry of Environment |
| HAZID | Hazard Identification |
| HAZOP | Hazard and Operability Review |
| HEMP | Hazard and Effects Management Process |
| HIR | Hazard Identification Report |
| HRA | Health Risk Assessment |
| HER | Hazard & Effects Register |
| HSE | Health, Safety and Environment |
| HSE MS | Health, Safety and Environment Management System |
| IOG | Integrated Operations Guide |
| ISO | International Organisation for Standardisation |
| JHA | Job Hazard Analysis |
| N/A | Not Applicable |
| RAP | Remedial Action Plan |

| | | |
|--|-------------------------------|-----------|
|  | SPDC Pipelines Asset HSE Case | Mandatory |
|--|-------------------------------|-----------|

| | | | | | |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|
| Doc. No.: SPDC-2021-10-00000051 | Revision: 08 | Date December 2021 | Custodian: SPDC-UPC/G/U | Printed copies are uncontrolled | Page: 74 |
|------------------------------------|-----------------|-----------------------|----------------------------|------------------------------------|-------------|